New York and New Jersey Harbor Anchorages

Final General Reevaluation Report and Environmental Assessment

US Army Corps of Engineers ®

THE PORT AUTHORITY OF NY & NJ

Norfolk District
803 Front Street
Norfolk, VA 23510

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The Port Authority of NY& NJ
4 World Trade Center
New York, NY 10007

Cooperating agencies: U.S. Environmental Protection Agency, National Oceanographic and Atmospheric Administration/National Marine Fisheries Service, U.S. Coast Guard, NY Division of Historic Preservation, NY State Department of Environmental Conservation Department

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Leverage scientific, economic, and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.

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COVER SHEET

New York and New Jersey Harbor Anchorages
General Reevaluation Report and Environmental Assessment

LEAD AGENCY: Department of the Army
U.S. Army Corps of Engineers, Norfolk District

COOPERATING AGENCIES: U.S. Environmental Protection Agency, National Oceanographic and Atmospheric Administration/National Marine Fisheries Service, U.S. Coast Guard, NY Division of Historic Preservation, NY State Department of Environmental Conservation Department

ABSTRACT:

The New York and New Jersey Harbor Anchorages Study Area includes the harbor anchorages and dredged material disposal sites. Alternative plans combined multiple structural and nonstructural measures to improve the efficiency of the existing navigation system. Currently, larger vessels calling on the port exceed the maximum dimensions of the anchorages (-47 ft. MLLW and length of 1100 ft.) and are unable to fully utilize the anchorages in the event of channel closures (i.e. weather (visibility or high wind)). This results in navigation inefficiencies as ships are required to transit back to the ocean. These inefficiencies are projected to continue in the future as vessel sizes are expected to increase. The Recommend Plan (also referred to as the Action Plan and/or Preferred Alternative is the National Economic Development (NED) Plan which includes:

- Deepening the Gravesend Anchorage to a required depth of -50 feet (MLLW);
- Widening the Gravesend Anchorage to 3,000 feet and associated modifications of the Approach Area;
- Maximum designed swing area up to 3,600 feet.

The Preferred Alternative includes construction and maintenance of these features. Dredged material placement/disposal will occur at the Historic Area Remediation Site (HARS). The project construction is anticipated to be completed by 2025 (or earlier depending on funding capability) and following construction, anchorage depth would be maintained at the authorized depth going forward.

EXECUTIVE SUMMARY

The results of engineering, economic, environmental, and real estate investigations performed for this General Reevaluation Study (GRR), a continuation of a prior (2000) Feasibility Study (FS), are being used to determine if improvements to the constructed federal project are warranted and if necessary, seek additional authorization where not already granted for navigation system improvements at New York and New Jersey Harbor Anchorages (Figure 1). The Port Authority of NY and New Jersey (PANYNJ) requested the re-evaluation of the original project (USACE 2000) which was authorized under Section 435 of the Water Resources Development Act (WRDA) of 1996 (Public Law 104-303).

This authorization led to the 2000 Corps Feasibility Study (FS) which led to deepening of the federal channels to an average depth of 50 feet. The 2000 study did not address improvements to harbor anchorages. The original authorization included authority to conduct a comprehensive study of the navigational needs at the Port of New York and New Jersey. The prior FS and current GRR study tiered off the prior FS is being conducted under Section 216 of the Flood Control Act of 1970 (Public Law 91-611), which authorizes the review of completed projects in the interest of navigation and related purposes to determine the feasibility of additional navigational and anchorage needs for further port improvement.

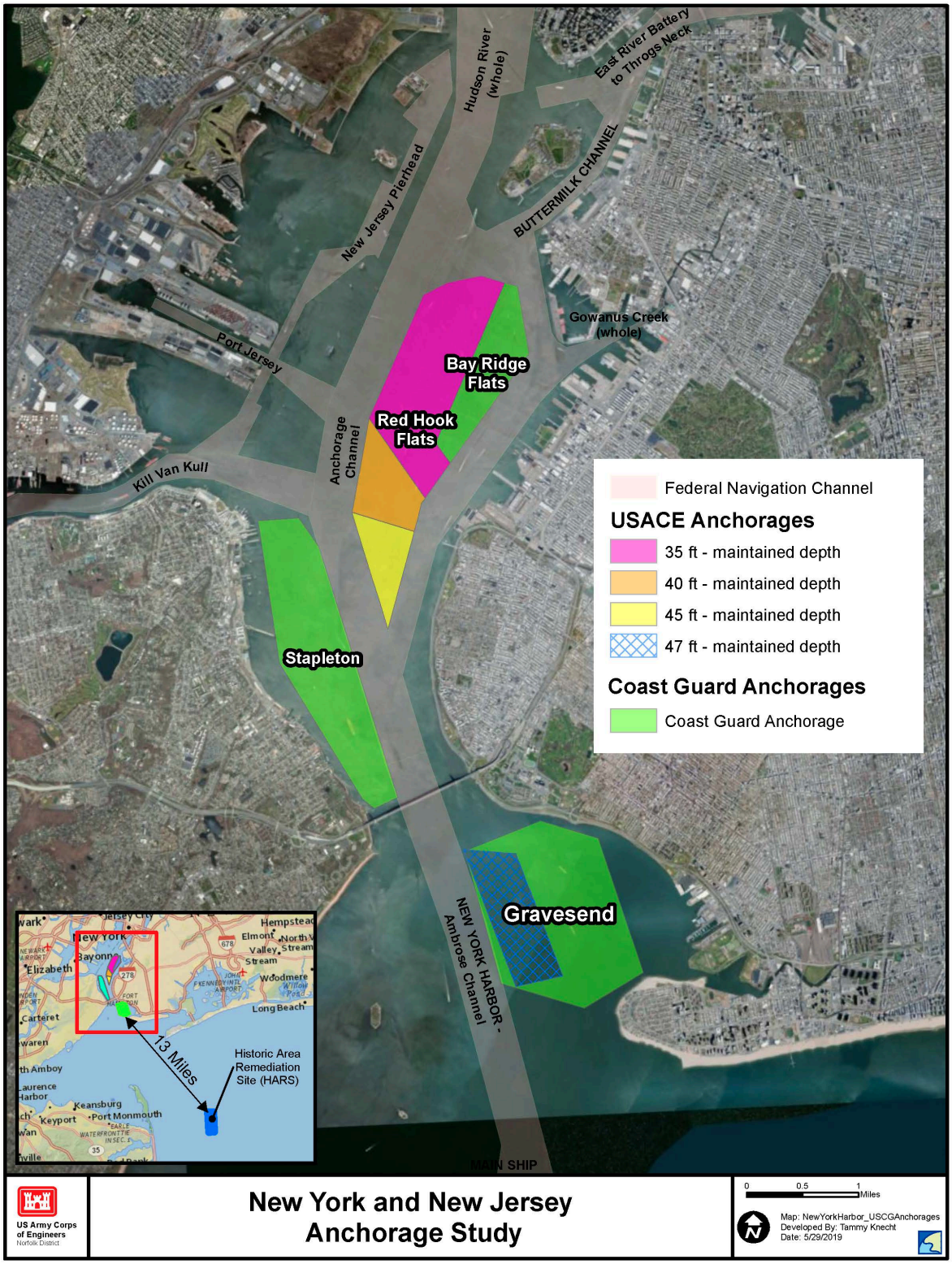

Figure 1: New York and New Jersey Anchorages

DESCRIPTION OF REPORT

This General Reevaluation Report (GRR) and Environmental Assessment (EA) documents the Feasibility Study process and presents the results of investigations and analyses conducted to evaluate modifications to the existing federal navigation system to improve its ability to efficiently serve the current and future vessel fleet and process the forecasted cargo volumes. It presents: (1) a survey of existing and future conditions; (2) an evaluation of related problems and opportunities; (3) development of potential alternatives; (4) a comparison of costs, benefits, adverse impacts, and feasibility of those alternatives; and (5) identification of a National Economic Development (NED) Plan and Recommended Plan (RP).

PURPOSE AND NEED

The purpose of this investigation is to examine if modification to the Federal anchorages will improve navigation conditions for deep draft ships using the port now and in the future and provide transportation cost savings. Currently, larger vessels calling on the port exceed the maximum dimensions of the anchorages (-47 ft. MLLW and length of 1100 ft.) and are unable to fully utilize the anchorages in the event of channel closures (i.e. weather visibility or high wind). This results in navigation inefficiencies as ships are required to re-transit back to the ocean. These inefficiencies are projected to continue in the future as vessel sizes are expected to increase.

ALTERNATIVES AND RECOMMENDED PLAN

Utilizing the USACE Planning Process as specified in ER 1105-2-100, plan formulation was conducted with a focus on achieving the federal objective of water and related land resources project planning, which is to contribute to the NED consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements. Plan formulation also considers all effects, beneficial or adverse, to each of the four evaluation accounts identified in the Principles and Guidelines (1983), which are NED, Environmental Quality, Regional Economic Development, and Other Social Effects.

Alternative plans combining multiple structural and nonstructural measures to improve the safety and efficiency of the navigation system were considered to determine whether the federal government should participate in implementing navigation improvements and to determine which alternative maximizes NED while minimizing environmental impact. The expected returns to the NED benefits are calculated. NED benefits are generated by addressing inefficiencies in the existing transportation system to lower transportation costs. Net benefits are calculated by subtracting the total cost to construct and maintain the improvements over a 50-year study period from the total transportation cost savings that would be generated by the proposed improvements over that period. The NED Plan is the alternative that reasonably maximizes net NED benefits while remaining consistent with the federal objective of protecting the nation’s environment. Where two cost-effective plans produce similar net benefits, the less costly plan is identified as the NED plan, even though the level of outputs may be less. The NED Plan is the Recommended Plan for implementation.

In this study, multiple alternatives were developed that generated annual net economic benefits. After careful consideration, the USACE identified the environmentally acceptable alternative that reasonably maximizes project benefits and includes:

- Deepening the Gravesend Anchorage to a required depth of -50 feet (MLLW);
- Widening the Gravesend Anchorage to 3,000 ft. and associated modifications of the Approach Area;
- Maximum designed swing area up to 3,600 ft.

The RP includes construction of this features. No increases in operations and maintenance are anticipated. The RP will create a 3,000 ft. diameter anchorage that can accommodate a 3,600 ft. diameter template for larger vessels whereby the channel will be utilized while the vessel swings during tidal shifts. Dredged material placement/disposal will occur at the Historic Area Remediation Site (HARS), and/or other upland disposal sites for this project (if needed). Portions of the dredged area may be suitable for beneficial use projects and beneficial use projects would be coordinated separately from this project. General operation and use of the HARS would continue with or without implementation of the RP. The project construction is anticipated to be complete in approximately 2025 (or earlier depending on funding capability) and following construction, anchorage depth and width would be maintained over the 50 year lifecycle of the project (Figure 2).

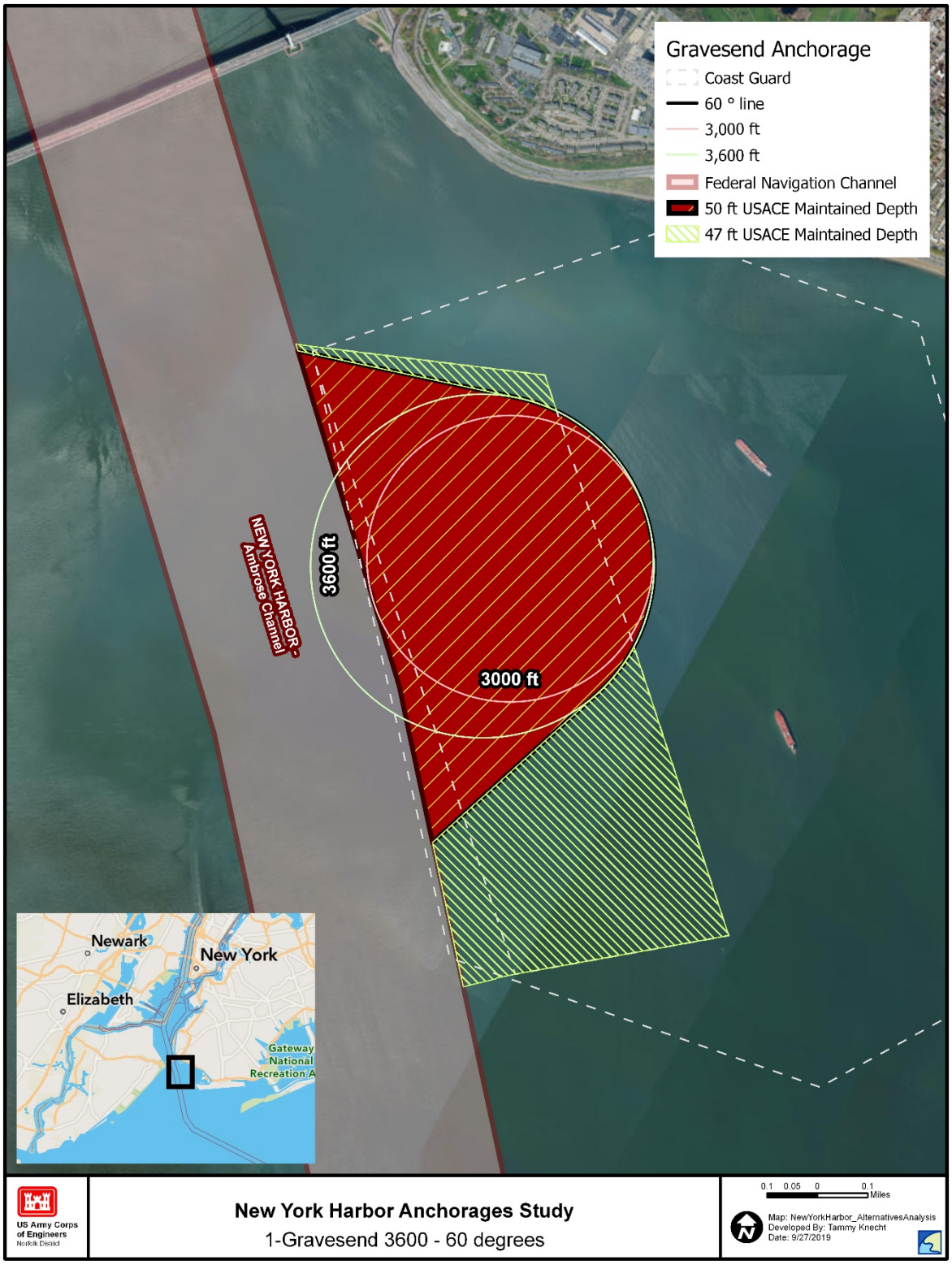

Figure 2: Gravesend Anchorage, Recommended Plan

COSTS AND BENEFITS

Based on existing and projected future vessel traffic, vessel fleet mix, and liner services currently associated with use of the harbor, one general design containership vessel was selected. The vessel mix was allocated over time to provide benefit calculations using the HarborSym economic analysis model. The characteristics of the design vessel was used to develop channel dimension and alignment needs. Further refinement of the dimensions and alignment is expected through application of ship simulations prior to developing final designs. The dimensions of the design vessel is described as follows:

- General Design Vessel:
    a. 1,200 foot length
    b. 158 foot beam
    c. 50.0 foot draft
    d. 13,000 - 14,000 TEUs

The projected traffic allocated between the time-modified distributions of containerships has provided average annual net benefits of $171 thousand for the RP (the NED Plan). The RP maximized annual net benefits and maintained a BCR of 1.2. The estimated project first costs are $25.2 million and economic investment costs are $25.3 million (FY 20 Cost). The entire project is economically justified. Table 1 provides a summary of the federal and non-federal costs and Table 2 provides the annualized benefits and costs for the Recommended Plan in FY 20 Cost. The benefits are attributable to transportation cost savings through the use of existing ships, the use of larger vessels, and delay reductions.

Table 1: Federal and Non-Federal Costs (FY 20 Costs)

	Total Cost	Federal	Non-Federal
Mob and Demobilization	$5,100,000	$3,825,000	$1,275,000
Dredging Cost	$13,754,000	$10,315,500	$3,438,500
Environmental Mitigation	$ -	$ -	$ -
Monitoring	$ -	$ -	$ -
Construction Management	$1,104,000	$828,000	$276,000
Preliminary Engineering & Design	$1,656,000	$1,242,000	$414,000
Contingency (16.8%)	$3,636,000	$2,727,000	$909,000
Total Construction of GNF	$25,250,000	$18,937,500	$6,312,500
Lands & Damages	$-	$-	$-
Total Project First Costs	**$25,250,000**	**$18,937,500**	**$6,312,500**
Relocating Aids to Navigation	$-	$-	$-
10% GNF Non-Federal	$-	($2,525,000)	$2,525,000
Total Cost	**$25,250,000**	**$16,412,500**	**$8,837,500**

Table 2: Costs and Benefits (FY20 Costs)

Equivalent Annual Benefits and Costs FY2020 Costs & Price Levels 50-Year Period of Analysis / 2.75 % Discount Rate	
Project Costs (rounded)	$25,250,000
Interest During Construction	$86,000
Total Economic Investment	$25,336,000
AAEQ Costs	$938,000
Economic Investment	
Increased O&M Costs	$0
Total AAEQ Costs	$938,000
AAEQ Benefits	$1,148,000
Transportation Cost Savings	
Total AAEQ benefits	$1,148,000
Net AAEQ Benefits	$210,000
Benefit-Cost Ratio (at 2.75%)	1.2

ENVIRONMENTAL IMPACTS AND MITIGATION

The possible consequences of the RP were considered in terms of probable environmental impact, social well-being, and economic factors. Informal Section 7 consultation with the National Marine Fisheries Service (NMFS) pursuant to the Endangered Species Act (ESA), is completed (NMFS). Coordination with United States Fish and Wildlife Service (FWS) is complete. A FWCAR was received on 3 March 2020. A Coastal Zone Management Act Consistency Determination was concurred with by the New York State Department of State on 23 August 2019. A water quality certification support letter from NYSDEC was received on 19 February 2020.

NMFS signed the Greater Atlantic Regional Fisheries Office (GARFO) Verification Form on 17 May 2019, therefore, pursuant to the ESA, NMFS concurred with our “Not Likely to Adversely Affect” determination with respect to Federally-listed threatened and endangered species. Impacts to all threatened and endangered species and any designated Critical Habitat are not anticipated to be “significant,” as defined by the significance thresholds in Council on Environmental Quality’s Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 Code of Federal Regulations 1500-1508), as amended.

Consultation with NMFS, pursuant to both the Marine Mammal Protection Act (MMPA) and the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) have been completed. Pursuant to the MSFCMA, an Essential Fish Habitat Assessment was prepared for all Federally-managed species and provided to NMFS along with the Draft Report/Environmental Assessment. Best Management Practices and standard USACE protocols would be implemented

for the protection of listed sea turtle and whale species, Atlantic and shortnose sturgeon, and any other protected species to reduce any potential negative impacts of the project.

There is no anticipated required compensatory mitigation with implementation of the Recommended Plan. All mitigation, in terms of avoidance and minimization measures, has been incorporated into the development of the proposed project. Best Management Practices have been incorporated in order to protect the environment and minimize impacts during construction, and operation and maintenance cycles.

There would be no significant economic, recreation, aesthetic, or social well-being impacts, either adverse or unavoidable, as a result of the proposed action. This project would be expected to have a positive impact on the economy of the New York City region and areas served by the Port. In addition, a Programmatic Agreement was coordinated and was signed by USACE on 5 December 2019 and the New York State Historic Preservation Office (SHPO) on 3 February 2020 to address any potential cultural resource impacts anticipated during project implementation.

There would be no significant impacts anticipated to benthic resources, wetlands, and water quality. The benthic resources impacted are common to the area, and the proposed dredging footprint is very small relative to the undredged areas surrounding it. The surrounding area will provide new recruits to the dredged anchorage such that recovery is expected to occur within a few years. Therefore, such impacts to the benthos are considered temporary, minor and not significant. The nearest wetlands from the open water dredging site in Gravesend Bay are over one mile away and, therefore, the proposed dredging should have no effect on wetlands in the area. All impacts would be anticipated to be temporary and negligible to minor in nature. Total Suspended Solids and turbidity in the water column resulting from dredging and material placement/disposal would quickly return to ambient conditions after construction or maintenance operations due to the primarily sand nature of the sediments to be dredged, resulting in only temporary, minor and not significant impacts to water quality.

The Historic Area Remediation Site (HARS) is an authorized ocean disposal area designated by the Environmental Protection Agency (USEPA) for dredged material placement if the material meets USEPA and USACE criteria for disposal at the site. U.S. Army Corps of Engineers has permitting authority under Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) for use of the sites to place appropriate material. In the past, dredged material from these locations has met Ocean Dumping Criteria, as set forth under 40 CFR 227. Upland sites able to contain and process contaminated sediments will be used in the event dredged material is too contaminated to meet criteria for placement at HARS.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAEQ	Average Annual Equivalent
ACHP	Advisory Council on Historic Preservation
ADCIRC	Advanced Circulation Model
APA	Administrative Process Act
APE	Area of Potential Effect
APP	Accident Prevention Plan
ASA	Assistant Secretary of the Army
BAZ	Biologically Active Zone
BCR	Benefit-to-cost ratio
BFE	Base Flood Elevation
CAA	Clean Air Act
CEDEP	Cost Engineering Dredge Estimating Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
CFS	Cubic feet per second
CRA	Cost Risk Analysis
CSRM	Coastal Storm Risk Management
CWA	Clean Water Act
CY	Cubic Yards
CZMA	Coastal Zone Management Act
DO	Dissolved Oxygen
DoD	Department of Defense
DMMP	Dredged Material Management Plan
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
ESI	Environmental Sensitivity Index

EQ	Environmental Quality
FC	Fecal Coliform
FEIS	Final Environmental Impact Statement
FA	Focus Area
FONSI	Finding of No Significant Impact
FCSA	Federal Cost Share Agreement
FWOP	Future Without Project
GARFO	Greater Atlantic Regional Fisheries Office
GDM	General Design Memorandum
GIS	Geographic Information System
GRR	General Reevaluation Report
GSP	Gross State Product
GTC	Global Container Terminals
H & H	Hydrology and Hydraulics
HZ	Hertz
HARS	Historic Area Remediation Site
IPCC	Intergovernmental Panel on Climate Change
IBI	Index of Biological Integrity
LERRs	Lands, Easements, Rights-of-Way, and Relocations
LFA	Load Factor Analysis
LOA	Length overall
LPC	Limiting Permissible Concentration
MEC/UXO	Munitions of Explosive Concern/Unexploded Ordinance
MBTA	Migratory Bird Treaty Act
MCY	Million Cubic Yards
MEC	Munitions and Explosives of Concern
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MOTBY	Military Ocean Terminal at Bayonne
MPRSA	Marine Protection, Research and Sanctuaries Act
MSA	Metropolitan Statistical Area
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MSI	Maritime Strategies International Ltd.
MS4s	Municipal Separate Storm Sewer Systems

MXSLLD	Maximum Summer Load Line Drafts
NAAQS	National Ambient Air Quality Standards
NAA/FWOP	No Adverse Affect, Future Without Project
NACCS	North Atlantic Coast Comprehensive Study
NAD	North Atlantic Division
NAVD	North American Vertical Datum
NED	National Economic Development Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NNBF	Natural and Nature Based Features
NOAA	National Oceanographic and Atmospheric Administration
NPL	National Priorities List
NRHP	National Register of Historic Places
NS-PIER-VI	Lamberts Point Coal Terminal
NWI	National Wetlands Inventory Project
NYSDEC	New York State Department of Environmental Conservation
NOx	Nitrogen Oxide
ODMDS	Ocean Dredged Material Disposal Site
OESS	Ordnance and Explosives Safety Specialist
OSE	Other Social Effects
OSH	Occupational Health and Safety
O&M	Operations and Maintenance
P&G	Principles and Guidelines
PONYNJ	Port of New York and New Jersey
PANYNJ	Port Authority of New York and New Jersey
PAHs	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated Biphenyls
PDT	Project Delivery Team
PED	Pre-construction, Engineering and Design
PMT	Portsmouth Marine Terminal
PNTC	Port Newark Container Terminal
PPE	Personal Protective Equipment
PPT	Parts per Thousand
PPX3	Post Panamax Generation 3 Vessels

RCRA	Resource Conservation and Recovery Act
RECONS	USACE online Regional Economic System
RED	Regional Economic Development
ROI	Region of Influence
RONA	Record of Non-applicability
RP	Recommended Plan
RSLR	Relative Sea Level Rise
SAV	Submerged Aquatic Vegetation
SHPO	State Historic Preservation Office/Officer
SLC	Sea Level Change
SMMP	Site Management and Monitoring Plan
TBPS	Terabytes per second
TES	Threatened and Endangered Species
TEU	Twentyfoot Equivalent Unit
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
RP	Tentatively Selected Plan
USACE	United States Army USACE of Engineers
USEPA	United States Environmental Protection Agency
FWS	United States Fish and Wildlife Service
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
USN	United States Navy
VOX	Volatile Organic Carbon
VTS	Vessel Traffic System
WCSC	Waterborne Commerce Statistics Center
WRDA	Water Resources Development Act

1 STUDY INFORMATION

1.1 Introduction

This New York and New Jersey Harbor Anchorages, Integrated General Reevaluation Report (GRR) and Environmental Assessment (EA) documents the U.S. Army Corps of Engineers (USACE) feasibility study planning process for evaluation and recommendation of anchorage improvements for the New York and New Jersey Harbor Federal navigation project. It also documents implementation of the National Environmental Policy Act (NEPA) in the planning process.

The Port of New York and New Jersey (PONYNJ) is the largest container port on the east cost of the United States and the third largest in the nation and largest refined petroleum product port in the nation. The Port has six container terminals that receive vessels from all of the world's major ocean carriers serving nearly every region of the world.

The New York and New Jersey Harbor Federal Navigation Project consists of a network of channels extending from the Atlantic Ocean into the PONYNJ. The project includes a system of USACE anchorages with depths ranging from -35 to -47 ft. (Figure 1-1). The Federal project anchorages, Red Hook Flats and Gravesend Bay, support normal Port operations including lightering, bunkering/refueling, waiting areas, emergency "bailout" areas, and U.S. Coast Guard inspections.

Recently, the Federal navigation channels near the anchorages were deepened to -50 feet mean lower low water (MLLW). These improvements were authorized in the Water Resources Development Act (WRDA) 2000. However, Red Hook Flats and Gravesend Bay, were not part of the authorized improvement project and are at the depths authorized in the 1965 Rivers and Harbor Act.

The Port Authority of New York & New Jersey requested a study to consider the feasibility of improving the anchorage areas to make them more suitable for the increasing size and number of deep draft vessels including widening of the existing areas, deepening greater portions of the anchorages, possible new configurations within existing anchorages.

1.2 Study Authority

This study is authorized under Section 216 of the Flood Control Act of 1970 (Public Law 91-611), which supports investigation efforts for the modification of existing projects, as follows:

"The Secretary of the Army, acting through the Chief of Engineers, to review the operation of projects for which construction has been completed and which were constructed in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to recommend to Congress on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."

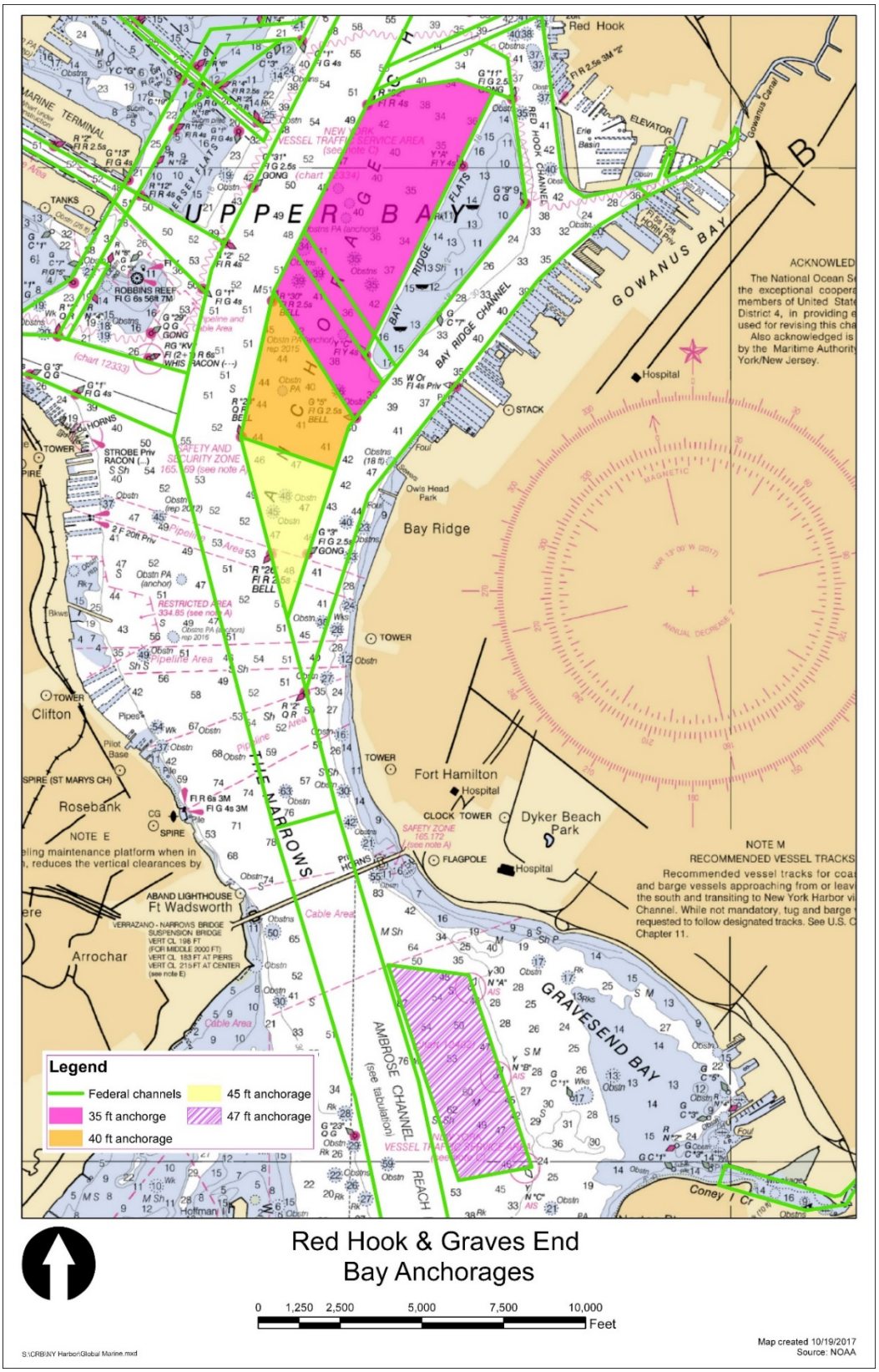


Figure 1-1: Federal Navigation Project Anchorages

1.3 Non-Federal Sponsorship

The non-Federal sponsor for this study is the Port Authority of New York and New Jersey (PANYNJ). The PANYNJ, as the non-Federal sponsor, entered into a feasibility cost sharing agreement with USACE on May 12, 2017 for this study.

1.4 Cooperating Agencies

U.S. Environmental Protection Agency, National Oceanographic and Atmospheric Administration/National Marine Fisheries Service, U.S. Coast Guard, NY Division of Historic Preservation, NY State Department of Environmental Conservation Department are cooperating agencies for this project.

1.5 Study Purpose and Need for Improvement Project

The purpose of this investigation is to examine if modification to the Federal anchorages will improve navigation conditions for deep draft ships using the port now and in the future and provide transportation cost savings. Currently, larger vessels calling on the port exceed the maximum dimensions of the anchorages (-47 ft. MLLW and length of 1100 ft.) and are unable to fully utilize the anchorages in the event of channel closures (i.e. weather visibility or high wind). This results in navigation inefficiencies as ships are required to re-transit back to the ocean. These inefficiencies are projected to continue in the future as vessel sizes are expected to increase.

1.6 Study Area

The New York and New Jersey Harbor is located along the northern portion of the Atlantic Seaboard, approximately 270 miles north of Norfolk, Virginia and 200 miles south of Boston, Massachusetts. There are two USACE constructed and maintained anchorage areas in the harbor. One is located in Gravesend Bay in the Lower Bay, and the other in Red Hook Flats, in the Upper Bay, New York. The upper and lower bays are separated visually by the Verrazzano-Narrows Bridge connecting Brooklyn and Staten Island. There are additional anchorages within the harbor that are authorized by the U.S. Coast Guard for use but none of these are maintained by USACE. Figure 1-2 shows the location of the New York and New Jersey Harbor Anchorages project. The Federal navigation channels are shown for reference but are not evaluated for improvement in this study. (Note that within the same footprint as USACE maintained anchorage at Gravesend is a much larger Coast Guard designated (but not Federally-maintained) anchorage.)

Throughout this study various levels of investigation will occur. The study will focus within the Area of Potential Effect (APE) which is here defined as the anchorage areas within New York Harbor. The APE includes the Upper Bay and Gravesend Bay areas (see Figure 1-2). Various portions of this study will also reference areas outside the APE to provide a better understanding of how the project relates entire harbor at various scales of analysis.

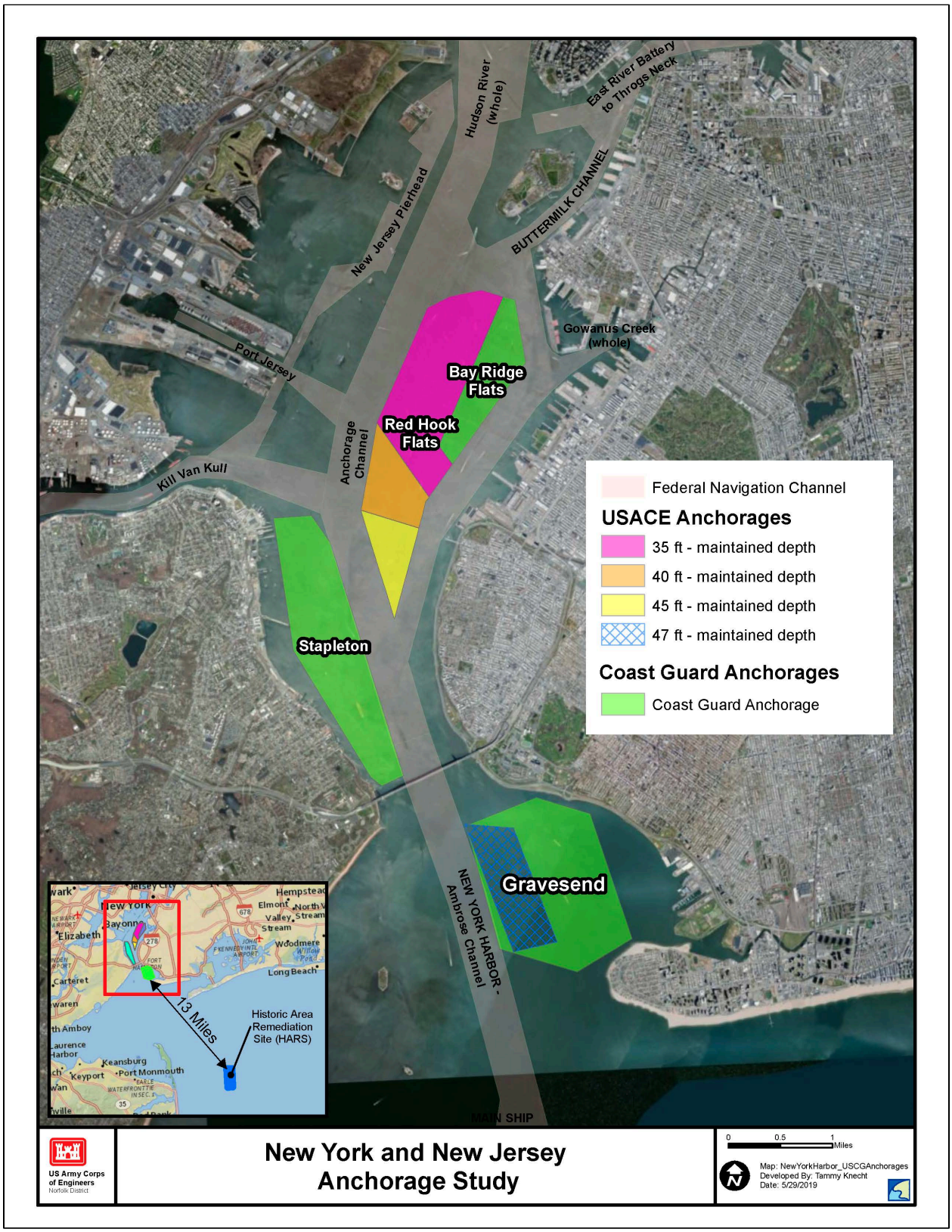


Figure 1-2: Location Map

1.7 Existing Project

The anchorages at Gravesend Bay and Red Hook Flats are integral to the Harbor's waterborne commerce network. The Red Hook Flats and Gravesend Anchorages provide navigation support to six container terminals:

- Port Newark Container Terminal
- Global Container Terminals Bayonne, New Jersey
- Maher Container Terminal
- APM Terminals
- Global Container Terminals, New York
- Red Hook Container Terminal.

Four Terminals are located in New Jersey and two Terminals are located in New York, of which four Terminals are accessed via the Kill Van Kull Channel. The anchorages are used by vessels as they wait for berthing availability, weather or transiting closures of the Kill Van Kull Channel, favorable tides, and for bunkering and lightering. In addition to commerce, the Gravesend anchorage is often utilized for the required U.S. Coast Guard inspections that must occur for some vessels prior to entering the PONYNJ. Current users include various sizes of container vessels, tankers, and bulk carriers, as well as tug and barges, articulated tugs and barges, and ferries.

The dimensions of the existing Federally authorized and constructed New York and New Jersey Harbor Anchorages are provided in Table 1-1.

Table 1-1: Existing Authorized and Constructed Anchorage Dimensions

		Anchorage Depth	**Anchorage Width**
Planning Segment	**Sub area**	**Authorized/ Constructed (ft. MLLW)**	**Authorized/ Constructed (ft.)**
Red Hook Flats	Southern area	-45/-45	3,335 approx.
	Middle area	-40/-40	3,335 approx.
	Northern area	-35/-35	3,335 approx.
Gravesend Bay		-47/-47	2,255 approx.

1.7.1 Construction History

The Red Hook Flats anchorage was first authorized in 1935 to depths of -40 and -30 ft., MLLW. Later in 1965, Red Hook Flats was authorized to its current depth and Gravesend was authorized to its current depth and configuration. In addition, Red Hook Flats was also re-aligned 200 yards to the west to better align the shipping channels adjacent to it.

1.8 Prior Reports and Studies

Numerous studies and reports have been conducted on the New York and New Jersey Harbor Anchorages project, a summary list is provided here, a subset of a much larger list of documents available and produced as part of the PONYNJ Harbor Deepening Project. A detailed list of these reports, as well as a historical summary of the Federally authorized anchorages in the harbor, can be found in the 2000 New York and New Jersey Harbor Navigation Study (USACE 2000).

Additional studies, reports, and authorizations, including those since 2000, are listed below:

- Environmental Assessment Effect of the NY/NJ Harbor Deepening Project on the Remedial Investigation/Feasibility Study of the Newark bay Study Area. (In House Document dated June 2007, 1 volume)
- Beneficial Uses of Dredged Material for Habitat Creation, Enhancement, and Restoration in New York New Jersey Harbor (USACE 2001)
- Environmental Assessment on Consolidated Implementation of the New York and New Jersey Harbor Deepening Project (USACE 2004)
- Final Environmental Assessment, Elimination of “High Spot C” Obstruction to Navigation within the New York Bight Navigational Precautionary Area – Ambrose Channel (USACE 2012)
- US Army Corps of Engineers (USACE). 2015. Migratory Finfish Survey Summary Report. New York and New Jersey Harbor Deepening Project. New York District.
- Dredge Plume Dynamics in New York/New Jersey Harbor. Summary of suspended sediment plume surveys performed during harbor deepening. (USACE 2015)
- Final essential fish habitat assessment, knowledge gained during the harbor deepening project, summary report. (USACE 2013)
- Aquatic Biological Survey Report. (USACE 2012)
- Benthic Recovery Report, Arthur Kill Channel (USACE 2017)

1.9 Federal Policy and Procedure

Identification of project-specific planning criteria used in USACE project planning is guided by the Principles and Guidelines (P&G) of 1983, the Planning Guidance Notebook, ER 1105-2-100 (22 Apr 2000), and NEPA of 1969, the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508); and Procedures for Implementing NEPA, ER 200-2-2 (4 Mar 1988).

USACE project planning follows the six-step process first described in the P&G and further elaborated in the Planning Guidance Notebook, ER 1105-2-100 (April 2000). Although presented in series, these steps are applied in an iterative process, which focuses emphasis on succeeding steps. Steps in the plan formulation process include:

1. The specific problems and opportunities to be addressed in the study are identified, and the causes of the problems are discussed and documented. Planning goals are set, objectives are established, and constraints are identified.
2. Existing and future without project conditions are identified, analyzed, and forecasted. The existing condition resources, problems, and opportunities critical to plan formulation, impact assessment, and evaluation are characterized and documented.
3. The study team formulates alternative plans that address the planning objectives. A range of alternative plans are identified at the beginning of the planning process and screened and refined in subsequent iterations throughout the planning process.
4. Alternative project plans are evaluated for effectiveness, efficiency, completeness, and acceptability. The impacts of alternative plans will be evaluated using the system of accounts framework which includes National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE) as specified in the P&G and ER 1105-2-100.
5. Alternative plans will be compared. Contributions to NED will be used to prioritize and rank alternatives. The public involvement program will be used to obtain public input to the alternative identification and evaluation process.
6. A plan will be selected for recommendation and a justification for plan selection will be prepared.

1.10 Overview of General Reevaluation Report/Environmental Assessment

The New York and New Jersey Harbor Federal navigation project is currently undergoing two general reevaluation (GRR) studies. This report covers the anchorages and is referred to as the New York and New Jersey Harbor Anchorages Integrated Feasibility Report and Environmental Assessment (EA). A second study of New York and New Jersey Harbor channels initiated in July 2019 and will be covered in a future separate document.

The purpose of the GRR is to identify the plan that reasonably maximizes national economic development benefits while being technically feasible and environmentally sustainable, and recommend a plan for future action.

The purposes of the EA are:

- Evaluate a reasonable range of project alternatives;
- Identify and analyze the environmental impacts of the alternatives;
- Incorporate environmental concerns into the decision making process.

The components of the New York and New Jersey Harbor Federal Navigation project that are being studied as part of this GRR/EA include but are not limited to:

- Improving Red Hook Flats Anchorage to a required depth of approximately -50 ft MLLW;
- Widening Red Hook Flats Anchorage to approximately 3,600 ft. and associated modifications of the approach area;
- Improving Gravesend Anchorage to a required depth of approximately -50 ft.MLLW;

- Widening Gravesend Anchorage to approximately 3,600 ft. and associated modifications of the approach area.

1.11 NEPA Scoping and Public, Resource Agency, and Tribal Coordination

- A Federal Register Notice of Intent to prepare an EIS on this study was published on 1 November 2018. However, as environmental impacts proved to be less than originally anticipated, a withdrawal notice was published in the Federal Register on 21 May 2019 to inform the public of our intent to publish an EA instead of an EIS.
- A NEPA public scoping meeting was held on 8 November 2018 and all pertinent Federal and state agencies were invited as well as the public.
- The U.S. Coast Guard, NOAA, Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (NYSDEC) agreed to be cooperating agencies.
- Interagency planning meetings were held on 10 January 2019 and on 14 February 2019 and all pertinent Federal and state agencies were invited to participate.
- Correspondence describing the proposed action and inviting consultation was sent to four Federally recognized tribes (Delaware Nation, Delaware Tribe, Shinnecock Nation, and Stockbridge Munsee Community).
- Correspondence describing the proposed action and inviting consultation was sent to the New York Division for Historic Preservation State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation. The SHPO is a cooperating agency.
- Correspondence describing the proposed action and inviting consultation was sent to the New York City Landmarks Commission and the Naval History and Heritage Command.

1.12 Report Organization

This report serves as the USACE decision support document for the recommended navigation improvements and as the EA to meet NEPA requirements for the proposed action. It is also formatted to facilitate review and processing by the Assistant Secretary of the Army for Civil Works (ASA (CW)) to provide a report with recommendations to Congress. The remainder of the report is organized as follows:

Section 2: Existing Conditions/Affected Environment
Section 3: Future without Project Economic and Navigation Conditions
Section 4: Plan Formulation
Section 5: Recommended Plan/Proposed Action
Section 6: Environmental Consequences
Section 7: Summary of Best Management Practices/Mitigation Measures
Section 8: Environmental Compliance
Section 9: List of Agencies and Persons Consulted
Section 10: Recommendations
Section 11: Finding of No Significant Impact (FONSI)
Section 12: References
Appendices

2 EXISTING CONDITIONS/AFFECTED ENVIRONMENT

2.1 Navigation Features

The improved navigation area (Figure 2-1) includes the main navigation channels and associated anchorages in the PONYNJ that support the container terminals. Deepening the main channels began in 2004, first providing -50 ft. water access to the container terminals by deepening Ambrose Channel from deep water in the Atlantic Ocean to the Verrazzano-Narrows Bridge, the Anchorage Channel from the Verrazzano-Narrows Bridge to its confluence with the Port Jersey Channel, the Kill Van Kull Channel, the main Newark Bay Channel to Port Elizabeth and the Port Elizabeth and South Elizabeth tributary channels, the Arthur Kill Channel adjacent to the New York Container Terminal, and the Port Jersey Channel.

The final contract for the -50 ft. channels involved the removal of material in five separate utility corridors and other shoals in the Anchorage and Port Jersey Channels, and sequenced with the completion of the abandonment of two New York City Department of Environmental Protection (NYC DEP) water supply siphons within the Anchorage Channel as a new line was relocated deeper under the channel. This relocation by The Port Authority of New York and New Jersey (PANYNJ) and the New York City Economic Development Corporation were severely impacted and delayed by impacts due to Hurricane Sandy (2012). The utility corridor deepening contract was awarded in December 2015 and completed in September 2016 as the water siphons were relocated and the old siphon lines abandoned.

An additional navigation construction contract was completed in 2016 in the Arthur Kill Channel, deepening the channel to the Phillips 66 Refinery to a depth of -40 ft. MLLW from the previous -35 ft. channel depth. Anchorages were not deepened during this main channel deepening and the depth within the anchorages varies considerably, with most allowing only limited use by large container vessels due to lack of depth and/or size.

A detailed discussion on navigation features is provided within Chapter 3 as part of the study's consideration of the future without project conditions.

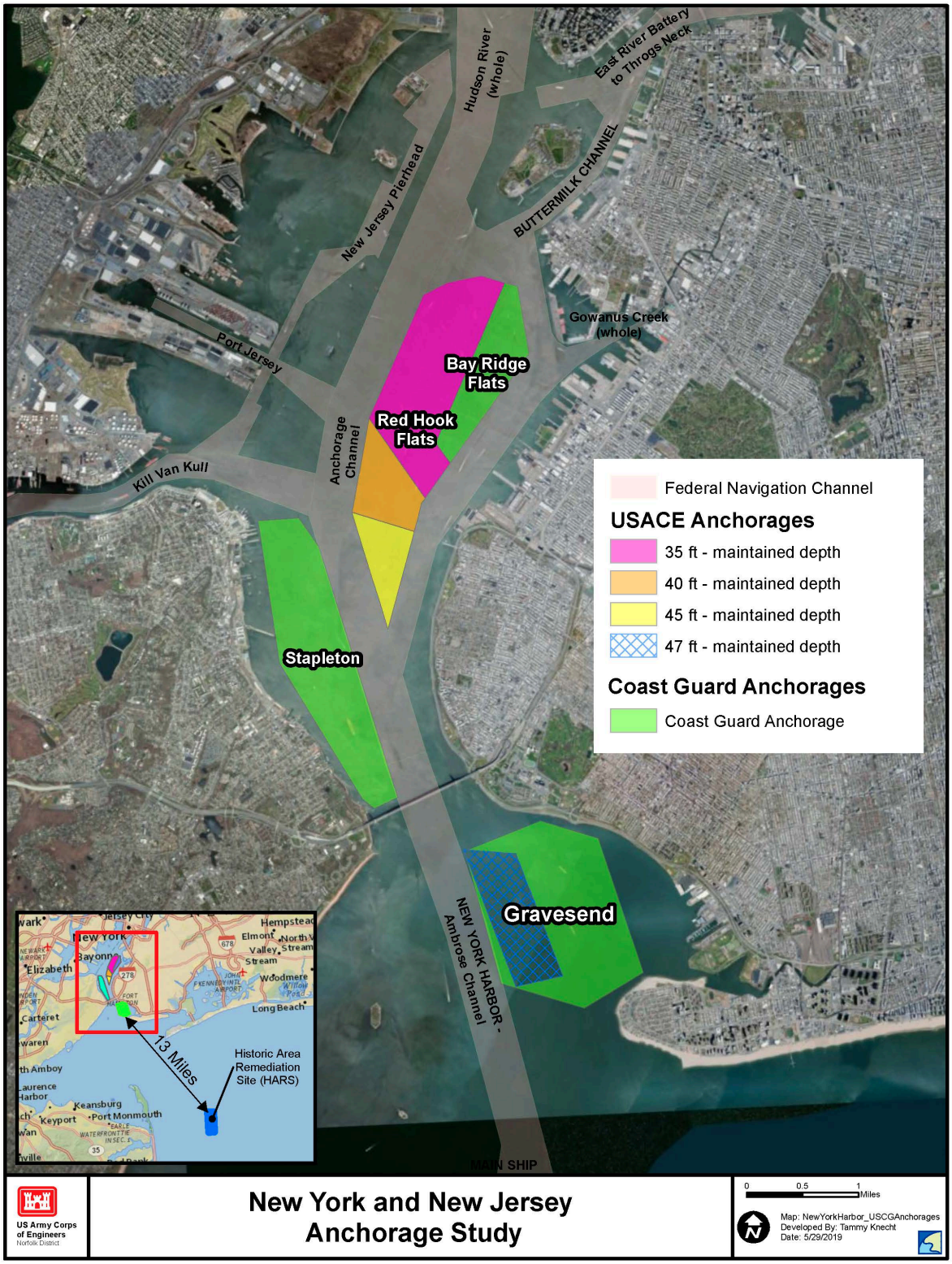


Figure 2-1: Current Navigation Channels with Associated Anchorages

2.2 Existing Economic Conditions

2.2.1 Local Economy

New York City has a population of over eight million people in five boroughs, each of which is also a county in New York State (see list below). Famous as a port of entry for immigrants, more than three million of New York City's population was born outside of the United States. Median income in the boroughs ranges from $34,388 to $72,589. (Additional detailed socioeconomic information is provided later in Section 3.11.)

Table 2-1: New York Boroughs, Population, and Income

Borough	New York City Population 2013 American Community Survey		Median household incomes, U.S. Census Bureau 2019
Manhattan	New York County	1,605,272	$64,971
Queens	Queens County	2,256,400	$62,000
Brooklyn	Kings County	2,539,789	$46,085.
Bronx	Bronx County	1,397,315	$34,388
Staten Island	Richmond County	470,223	$72,589
NYC Total		8,268,999	

2.2.2 Environmental Justice

The majority of local environmental justice populations (EJ) live in the Bronx, which is considerably northeast of the project area and should not be impacted by the proposed dredging. There are potential EJ populations in Kings County, which includes the region of New York City closest to the proposed dredging in Gravesend Bay. These EJ populations lie along the shore of the neighborhood of Gravesend and in front of Fort Hamilton, both of which are along shorelines closest to the proposed dredging. Due to the distance of these neighborhoods, the nature of the project (open water dredging), it is not expected that there will be any impacts to these neighborhoods. If any of the citizens in these neighborhoods work for local dredging companies, it is possible there could be a small economic benefit to these neighborhoods due to short-term increased employment during the dredging. Other impacts, such as to local air quality, will be analyzed in subsequent sections of this report.

2.3 Affected Environment

This section describes the existing environmental conditions found within the region of influence (ROI) and area of potential effect (APE). For the proposed project, the ROI is primarily the area to be dredged in Gravesend Anchorage, as well as waters used by dredging vessels and associated support vessels to move the dredged material. For a few resources, such as air, the ROI is larger due to the fact that emissions impact the local region, including citizens of New York City. Noise is another with a larger ROI, as underwater noise can travel for quite some distance underwater and therefore has the potential to impact waters outside the immediate dredging footprint and transport lanes to move the material. The ROI for each resource, unless otherwise defined, is considered the footprint to be dredged and associated transport lanes to move the dredged material. This section has been prepared in accordance with the NEPA and the CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations (CFR) 1500-1508), regulations.

The topics in this section are structured to mirror the topics presented in Section 6, Environmental Consequences of the Alternatives, where the “future without project” and “future with project” alternatives are evaluated and compared.

Dredged material placement sites are not addressed in this document. For both existing and future either with or without implementation of an action alternative, dredged material placement/disposal is planned to be placed at the Historic Area Remediation Site (HARS). The HARS is an area offshore of Sandy Hook, New Jersey, which had been used extensively for disposal of dredged and other materials, derived from the New York/New Jersey Harbor and surrounding areas, since the late 1800's. Between 1976 and 1995, this area, known as the New York Bight Dredged Material Disposal Site, and also known as the Mud Dump Site, received on average about 6 million cubic yards of material each year from federal and private maintenance dredging and from harbor deepening activities (Massa and others,1996). In September 1997 the Mud Dump Site (MDS) was closed as an official ocean disposal site by the U.S. Environmental Protection Agency and the MDS and surrounding areas were designated as the Historic Area Remediation Site (HARS). The HARS is subdivided into a Primary Remediation Area (PRA, subdivided into 9 cells), a Buffer Zone, and a No-Discharge Zone. The sea floor of the HARS, approximately 9 square nautical miles in area, is being remediated by placing at least a one-meter thick cap of Category I (clean) dredged material on top of the existing surface sediments that exhibit varying degrees of contamination (http://www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/hars.htm). Category I sediments have no potential short or long-term impacts and are acceptable for unrestricted ocean disposal (EPA, 1996)). About 1.1 million cubic yards of dredged material for remediation was placed in the HARS in 1999, and 2.5 million cubic yards in 2000. Disposal at HARS is covered under prior NEPA (USEPA 1997) and other management documents (USEPA and USACE 2010, (see https://www.nan.usace.army.mil/Missions/Navigation/Historic-Area-Remediation-Site-HARS/) and therefore does not need to be addressed in this document. Any material placed there from the proposed project at Gravesend Anchorage will need to meet Category 1 requirements for placement at HARS.

Existing upland dredged material disposal sites will be used, if future suitability testing of the material during pre-construction engineering and design (PED) determines that the dredged material does not meet disposal criteria for HARS. Upland disposal sites have associated management plans, permits, and necessary environmental documentation and therefore, do not need to be addressed in this document. If upland sites are used, the USACE will need to pay

required fees for disposal of the dredged material as solid waste per 6 NYCRR Part 360 Solid Waste Management Facilities Regulations, or in compliance with the regulations guiding the remediation of Brownfields sites, but no further environmental analysis of such sites is needed prior to their use. There are a number of upland sites in the region that could be used, some may require additional treatment of the material before they can accept it to reduce the chances of further contamination. Hazelton mines, UTEX A380 Development, and NL Industries are among the largest sites in the region.

2.4 Geology, Physiography, and Topography

The Lower Bay of the Hudson-Raritan Estuary, opens into the New York Bight region, a shallow expanse of oceanic waters between Long Island and the New Jersey Coast. The area is in the Coastal Plain, a region of flat, low-lying land adjacent to the sea coast and is underlain by bedrock that is typically covered by a layer of unconsolidated sediments that varies in thickness.

Coastal plain deposits form a seaward-thickening wedge of poorly consolidated sediments, dating from the Cretaceous, Tertiary, and Quaternary ages which dip gently to the east (seaward) and uncomfortably overlie older rock units. Surficial deposits are either glacial or postglacial, deposited before or after the last glaciation, respectively. No economically significant mineral deposits are mapped in the study area. However, commercial sand mining periodically occurs in the Ambrose Channel in the Lower Bay and other locations in the Harbor.

The topography of the Coastal Plain is a terraced landscape that stair-steps down to the coast and to the major rivers, which includes New York City and Long Island (Figure 2-4). The Bronx and Manhattan lie on the eastern edge of the Newark Basin, a block of the Earth's crust that sank downward during the Triassic period which consists of mostly metamorphic rock. South of these areas, the underlying stone consists of terminal moraine (till) and along the current shoreline, the outwash plain sediments underlie surface soils. The coastal lowland sub-province is a low-relief region along the lower Hudson River, its tributaries, and surrounding waters of New York Bay at topographic elevations between zero and 409.8 ft. (Todt Hill on Staten Island, the highest point in the City) with the City averaging 33 ft. above mean sea level.

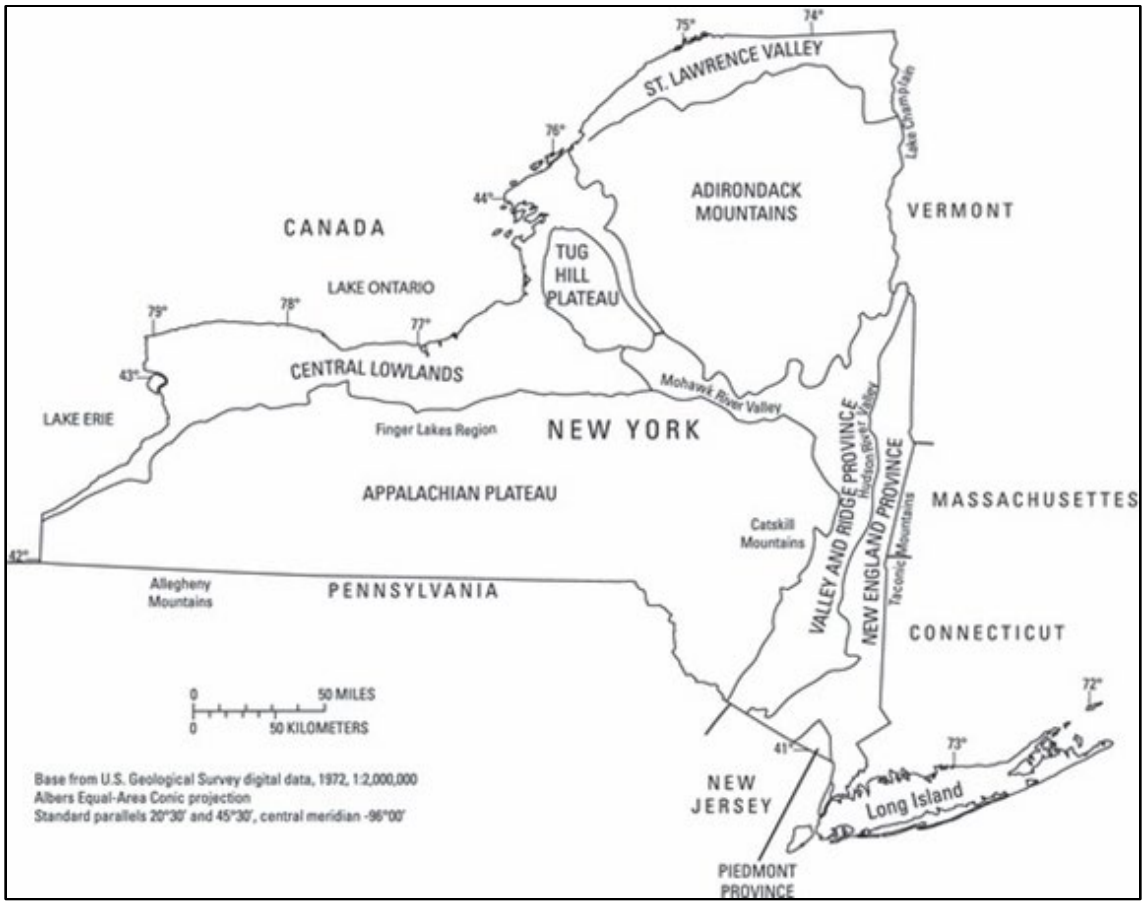


Figure 2-4: Physiographic Map of New York State

The New York Coastal Plain is underlain by a thick wedge of sedimentary rock that increases in thickness from very thin at its beginning near the Fall Line, where the coastal plain meets the Piedmont to the northwest of New York City. On the Long Island Platform, this layer of sediments is approximately 4 miles thick and thickens as it extends outward into the ocean to more than 7.5 miles thick, under the outermost edge of the continental shelf in the Atlantic Ocean. This wedge rests on an eroded surface of Precambrian to early Mesozoic rock.

The landforms surrounding the project area are comprised primarily of geologically recent (Pleistocene and Holocene) sediments, primarily fine sands, silts, gravel, and (glacial till) with surface soils consisting of mostly greenbelt loam, fine sandy loams, coarse sands, and disturbed urban soils (USDA, 2019).

The subaqueous terrain of the project area is of similar material, with sand, (gravelly to silty) being the sediments found within the potential dredging area at Gravesend Bay Anchorage. Figure 2-5 illustrates the dominant bottom types in the project ROI of Gravesend Anchorage, the potential impact area of dredging.

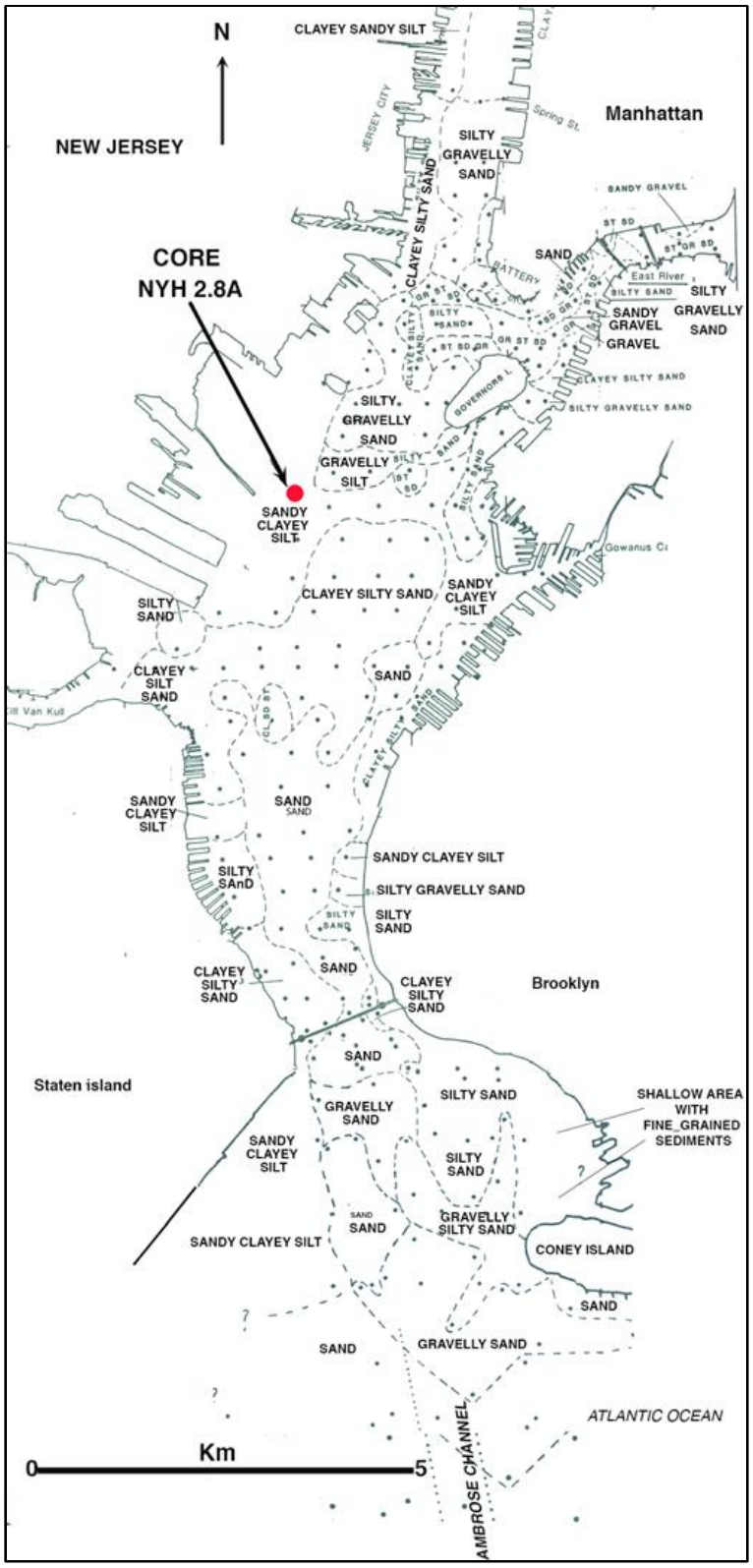


Figure 2-5: Bottom types in the project ROI (Coch, 2016)

Earthquakes of significant magnitude are unlikely occurrences for the eastern United States, which is not very seismically active as few plate boundaries occur here. However, earthquakes affecting New York City have occurred, the greatest being a magnitude 5 earthquake in 1884. Approximately 30 earthquakes of magnitude 3 or greater have occurred in the wider New York region from 1924-2006 (USGS, 2019). Few have caused significant damage in the city, the most recent earthquake that did (minor damage to buildings in Brooklyn was noted) occurred in 2011 and was centered in northern Virginia. The ROI includes areas transited by dredging vessels/equipment and areas of navigation Channel and Anchorages.

2.5 Hydrology and General Bathymetry

Hydrologic features of the ROI include New York Bay and the Kill Van Kull tidal strait.

The Hudson River, which is the headwaters of New York Bay though outside the project ROI, is 315 miles long, flowing primarily north-south through eastern New York State, draining into New York Harbor (also called New York Bay) between New York City and Jersey City. The Bay drains into the Atlantic Ocean. It has a watershed of 13,000 square miles, covering much of New York and portions of other nearby states. It has no tributaries in the project ROI, the Mohawk River is a major tributary well to the North of the project ROI (Figure 2-6).

Figure 2-6: Hudson River watershed Hydrology

Due to the size and freshwater input of the Hudson River, the discharge of water from the lower Hudson River to Upper New York Bay is considerable, averaging 22,000 cubic ft. per second (cfs) (McCrone, 1966) but can be as low as 3,400 cfs (USACE, 2004).

The East River is not actually a river (Figure 2-7), but an estuarine tidal strait that connects Long Island Sound with Upper New York Bay. It does not support container vessel traffic.

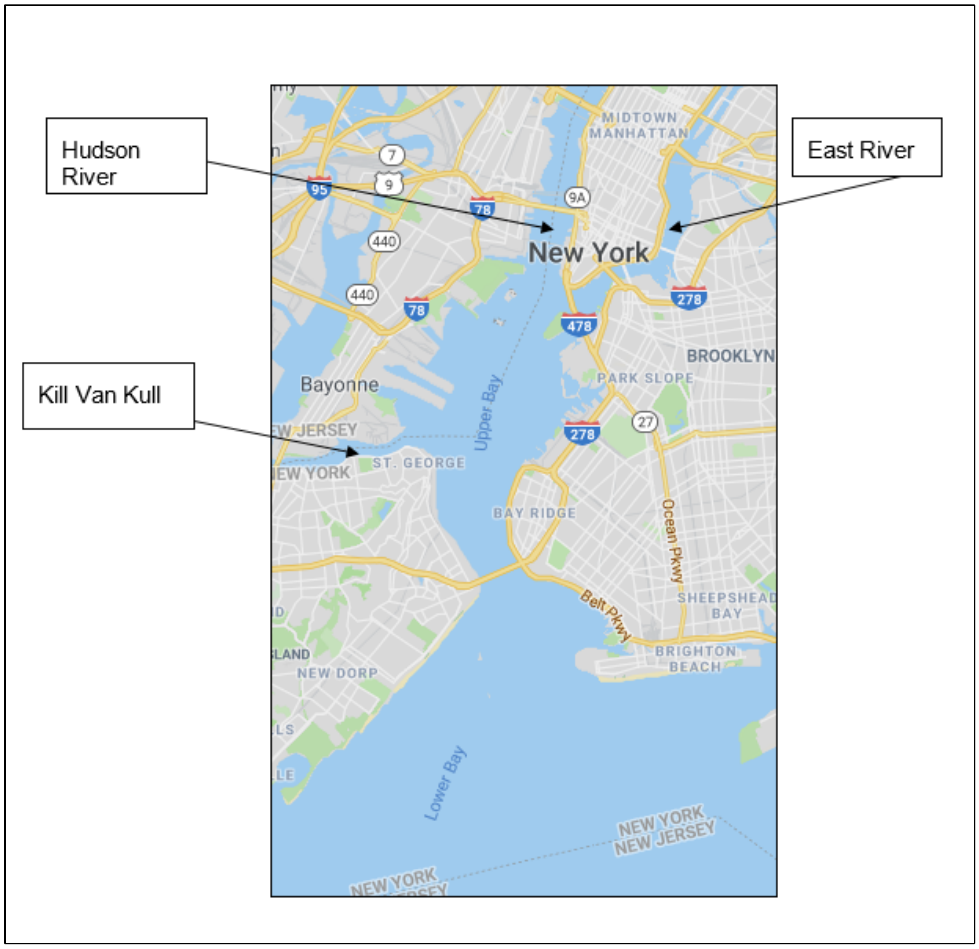


Figure 2-7: Hudson River, East River, Kill Van Kull

The Kill Van Kull is a tidal strait, between Staten Island, New York, and Bayonne, New Jersey, connecting Newark Bay with Upper New York Bay. It is a major shipping channel (depth,-50 ft MLLW) and supports large container vessels. Similarly, the channel that runs most directly through the main stem of the lower Hudson River and Upper Bay, the anchorage channel is at -50 ft. MLLW.

The anchorages adjacent to these channels vary in depth. Gravesend Bay is at -47 ft, MLLW and Red Hook Flats varies from -35 to -45 ft., MLLW.

2.6 Tidal Processes and Salinity

The project ROI for this resource, the Lower New York Bay, is a tidal estuary, with two high and two low tides each day. Within the project ROI, the tidal range is, approximately six feet. The incoming tide is strong enough such that the river runs north for six hours and then runs south for six hours as the tide goes out. Tides are noted as far North as the Troy Dam, 150 miles upriver from the Bay and also the furthest upriver ocean-going vessels are able to navigate.

At the port at Albany, which is approximately 135 miles North of New York and New Jersey Harbor, the tidal range is 4.7 ft. with a velocity averaging 2.3 ft./second, though this is higher in surface waters of the main channel, approaching 2 knots (3.4 ft./second).

The salt front, which is the leading edge of incoming diluted sea water (0.1 parts per thousand (ppt.)), is usually south of the Tappan Zee Bridge, but it can extend as far north as Poughkeepsie during droughts. The typical salinities of surface waters are as follows: oligohaline (0.0 – 0.5 ppt.) from Newburgh-Poughkeepsie and North, oligohaline (0.5 – 5.0 ppt.) from Newbergh-Poughkeepsie to Peekskill, and mesohaline (5.0 -18.0 ppt.) downriver of Peekskill (McCrone, 1966).

The saltier water typically lies below the upper layer of fresh water as a salt wedge, though some mixing occurs during higher spring tides and high freshwater flows. Due to this, local waters in the project ROI are typically stratified to some degree with local ROI waters ranging from mesohaline to polyhaline (18-30 ppt.), with an average surface water salinity of 25.4 ppt. and a bottom salinity of 29.4 ppt (USACE, 2004). The spring freshet, which results from melting snow throughout the Hudson River watershed, reduces salinities from these averages in the spring.

2.7 Hazardous, Toxic, and Radioactive Waste

Hazardous and/or toxic wastes, classified by the Resource Conservation and Recovery Act (RCRA), are materials that may pose a potential hazard to human health or the environment due to quantity, concentration, chemical characteristics, or physical characteristics. This applies to discarded or spent materials that are listed in 40 CFR 261.31-.34 and/or that exhibit one or more of the following characteristics: ignitable, corrosive, reactive, or toxic. Radioactive waste is the radioactive by-products from the operation of a nuclear reactor or from the reprocessing of depleted nuclear fuel; however, there is no history of radioactive waste deposited in the ROI. Therefore, radioactive waste is dismissed from further discussion.

Local, known sources of contaminated sediments are well known. A search of EPA superfund site has shown one superfund site in New York and New Jersey Harbor, the Diamond Alkali Superfund site. The nearest site outside the local area is in Brooklyn, the Gowanus Canal, and does connect to the Hudson-Raritan estuary region. “The Gowanus Canal was built in the 19th Century by dredging a tidal creek and wetlands to allow industrial access to Gowanus Bay. After completion in the 1860s, the canal became a busy industrial waterway, home to heavy industries including manufactured gas plants (MGP), coal yards, cement makers, tanneries, chemical plants, and oil refineries. It was also the repository of untreated industrial wastes, raw sewage and runoff. The canal consists of contaminated sediments with no identified source(s) due to the complexity and overlap of potential sources. Sediments are contaminated with polycyclic aromatic hydrocarbons, polychlorinated biphenyls, pesticides, metals, and volatile organic contaminants.” (EPA superfund site, url: https://semspub.epa.gov/work/02/363172.pdf)

The Hudson River is itself heavily contaminated with polychlorinated biphenyls (PCB's) and has been subject of large-scale cleanup efforts to reduce the level of contamination. Due to its long history of urbanization, industrial pollution, historically inadequate water treatment, former military operations, industrial pollution, and urbanization, the Hudson River was formerly considered one of the most polluted waterways in the United States in terms of water quality and bottom sediment composition. General Electric (GE) was one of the main polluters, discharging PCB's into the Hudson River from 1947-1977, causing a wide range of negative impacts to wildlife and anyone who drank the water in certain stretches of the River or consumed the fish from the Hudson River. Other factories contributed to this pollution, including General Motors, whose wastewater was contaminated with lead, and other factories that used and disposed of PCB's into the Hudson River. However, an aggressive clean-up program that included contaminated sediment removal and remediation has significantly improved water quality in the modern-day Hudson River. The first attempt to clean up the upper Hudson River was the removal of 180,000 cubic yards (140,000 m3) of contaminated river sediments near Fort Edward in 1977–78. In 1984, the EPA declared a 200-mile (320 km) stretch of the river, from Hudson Falls to New York City, to be a Superfund site requiring cleanup, with the removal of 5.25 million cubic yards of contaminated sediments recommended for removal from approximately 40 hot spots of major PCB contamination. Numerous contaminated material removal projects have been conducted at various PCB hot spots in the Hudson River, with over 3 million cubic yards of PCB contaminated bottom sediments being removed to date. Details on where the dredged sites are located can be seen at this link: https://www3.epa.gov/hudson/pdf/Phase2_Overview-2015.pdf. All of these sites are North of Troy, New York, well out of the project ROI.

The Diamond Alkali site along the lower Passaic River/Newark Bay, could also be a source of local contamination in sediments and waters of the Gravesend Anchorage. The main contaminants of concern at the Diamond Alkali site are dioxin, PCBs, metals, polycyclic hydrocarbons (PAH), and pesticides. New Jersey prohibits consumption of fish or shellfish from the lower Passaic River and Newark Bay. The Newark Bay study area is of greatest concern, due to the Kill Van Kull and Arthur Kill connecting Newark Bay and New York Bay waters and allowing for potential transport of contaminants from the Diamond Alkali site into New York Bay. Remediation efforts at the Diamond Alkali site began in the year 2000 and are ongoing. Due to the potential for contaminant transport from the Diamond Alkali site to Gravesend Anchorage, it is considered within the ROI for this resource.

2.7.1 Dredged Material

The ROI includes the areas of the anchorage to be dredged, as well as the adjacent Ambrose Channel and areas transited by dredging vessels/equipment. The ROI includes areas outside of the dredging footprint where potential contaminants could be spread by suspension and movements of sediments and also the water itself. The geographic extent of impacts is dependent upon factors such as the type of dredging equipment, the dredging depth, and environmental conditions such as wind and currents (USACE, 2015).

Potential contaminant pathways are identified through testing and evaluation of dredged material. Ocean dredged material placement is regulated under Section 103 of the Marine Protection Resources and Sanctuaries Act of 1972, Public Law 92-532 (MPRSA). For the purposes of this document, current MPSRA reports and existing marine sediment sampling data will be used. Past testing history of MPRSA is located in Appendix E. Most of this data is from the navigation channels. Direct sampling of Gravesend anchorage is limited, but there has

been sampling done as well as limited dredging. The last dredging of significance prior to the proposed project recommended in this GRR occurred in 1978, and removed a shoal area 1.26 million cubic yards of material, prior work occurred in 1977 (0.19 million cubic yards), 1973 (2.32 million cubic yards, and 1972 (1.53 million cubic yards). The site has not been dredged otherwise. The most recent sampling of the site for both sediment type and contamination was done in 1994. During this study, the majority of the site was determined to consist of sand sediments (93.5% sand, 3% silt and 3.5% clay), with a small portion at the north end consisting of considerably more silt (31%) and clay (25%) and less sand (45%) than the rest of Gravesend Anchorage. Contaminants were noted at low levels, and included metals, DDT and various related chlorinated pesticide compounds, PCBs and PAHs. All contaminants in the majority, high sand portion of Gravesend were found at low levels and met criteria for open ocean disposal including in the HARS, and additional sampling was recommended for the small area with a higher clay and silt component, as PCB and PAH levels were higher there and may not be suitable for disposal in the HARS. Further testing during PED would be required to make this determination if this region of Gravesend is dredged, but this portion is to the North of the proposed dredging footprint. However, it is still recommended that additional sampling during PED of the dredging footprint be done prior to dredging to confirm it is still suitable for disposal at the HARS.

2.8 Water Quality

The ROI for this resource includes the areas of navigation channel dredged, areas transited by dredging vessels/equipment, and any potential sites where dredged material dewatering may occur. The ROI also includes areas outside of the dredging footprint in Gravesend Anchorage where water quality impacts such as increased levels of Total Suspended Solids, turbidity, and potentially nutrient fluctuations may occur due to the proposed dredging. Such areas could potentially include the Lower New York Bay, the Kill Van Kull straight and the East River. The geographic extent of water quality impacts is dependent upon factors such as the type of dredging equipment, the dredging depth, and environmental conditions such as wind and currents (USACE, 2015).

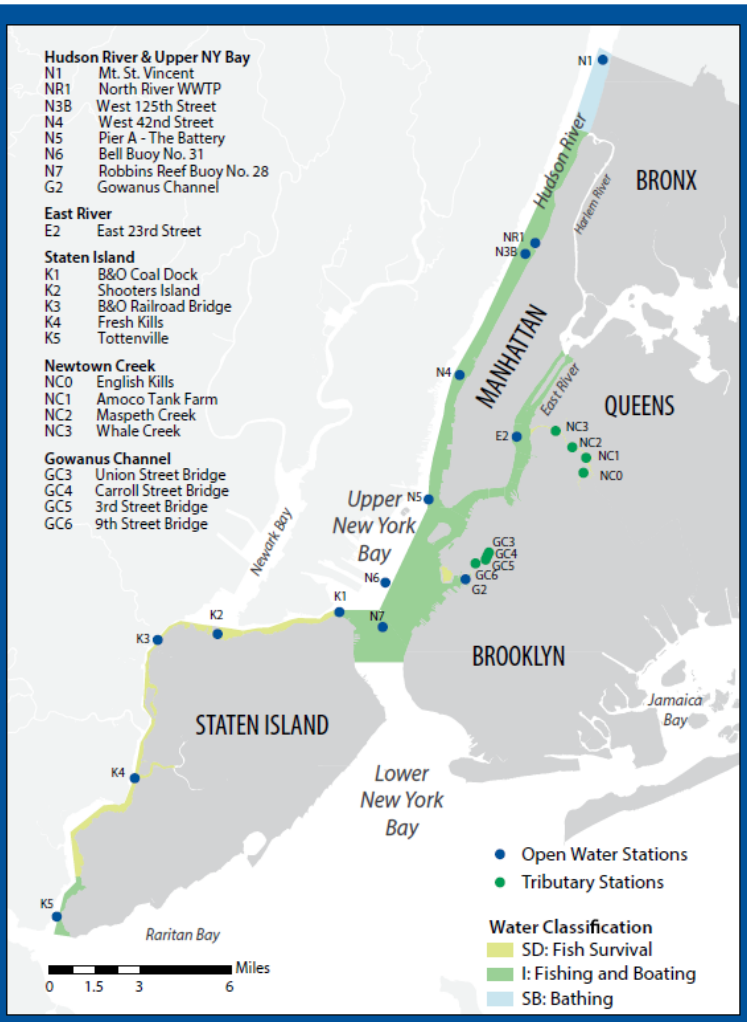
Due to its long history of urbanization, industrial pollution, historically inadequate water treatment, former military operations, industrial pollution, and urbanization, the Hudson River was formerly considered one of the most polluted waterways in the United States in terms of water quality and bottom sediment composition. GE was one of the main polluters, discharging PCB's into the Hudson River from 1947-1977, causing a wide range of negative impacts to wildlife and anyone who drank the water in certain stretches of the River or consumed the fish from the Hudson River. Other factories contributed to this pollution, including General Motors, whose wastewater was contaminated with lead, and other factories that used and disposed of PCB's into the Hudson River. However, an aggressive clean-up program that included contaminated sediment removal and remediation has significantly improved water quality in the modern-day Hudson River.

The following table and figures illustrate basic water quality standards in New York Harbor, compiled from annual water quality reports by NYSDEC (2017) (Table 2-2) (Figures 2-8 & 2-9).

One of the largest such efforts to clean up environmental contaminants was done by GE under EPA guidance, dredging 40 miles of the Hudson River, from Fort Edward to the Troy Dam (far upriver and out of the project ROI) of sediments contaminated with PCB's.

Table 2-2: Common Water Use and NYSDEC Standards for Saline Waters

Class	Best Usage of Waters	Fecal Coliform	Dissolved Oxygen (never less than)	Enterococcus
SA	Shellfishing and all other recreational use	No standard	5.0 mg/L	N/A
SB	Bathing and other recreational use	Monthly geometric mean less than or equal to 200 cells/100 mL from 5 or more samples	5.0 mg/L	(monthly geometric mean) - < 35 Cells / 100mL (single sample) - Max 104 Cells / 100mL
I	Fishing and Boating	Monthly geometric mean less than or equal to 2,000 cells/100 mL from 5 or more samples	4.0 mg/L	N/A
SD	Fish survival	No standard	3.0 mg/L	N/A



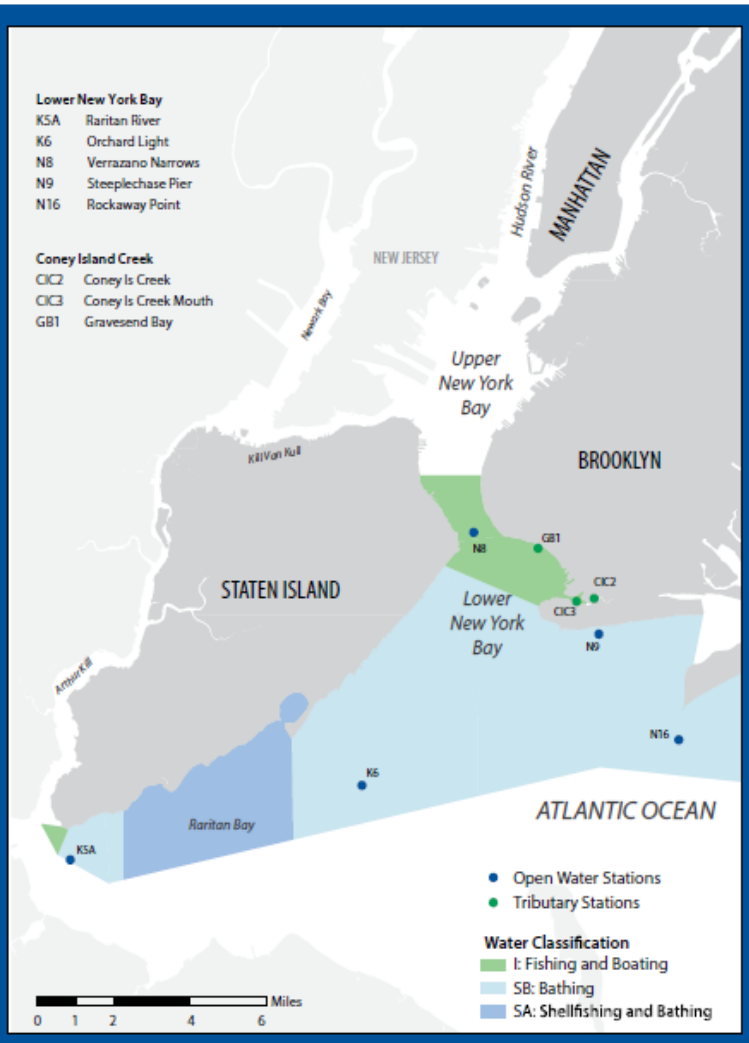
The Inner Harbor is defined as the area including: the Hudson River from the NYC-Westchester line, through the Battery to the Verrazano Narrows; the Lower East River to the Battery; and the Kill Van Kull-Arthur Kill system.

This area contains 22 Harbor Survey monitoring stations that have been grouped together due to common water uses and functions as well as similarities in point-source loadings. Waters of the Inner Harbor are often continuous, through connecting branches or straits, and cover a large and diverse geographic expanse.

Most of the Inner Harbor Area, excluding the Kills, is classified by NYSDEC as I, for uses such as fishing or boating. Most of the area in the Kills is classified for fish survival only (SD), with the exception of the far southern reach of Arthur Kill, which is designated as Class I. The Hudson River, from North of Spuyten Duyvil to Westchester County, is designated for bathing (SB).

Figure 2-8: Inner Harbor Water Quality

LOWER NEW YORK BAY – RARITAN BAY WATER QUALITY



The Lower NY Bay–Raritan Bay (LNYB-RB) vicinity represents the most oceanic portion of the Harbor Survey Program. This area of 100 square miles is represented by eight Harbor Survey monitoring stations and is composed mostly of open shallow waters, partially confined by Brooklyn's Coney Island to the north, Staten Island to the north- west, and New Jersey's Middlesex and Monmouth counties and Sandy Hook to the south. The remainder of its eastern boundary is open to Rockaway Inlet and the greater Atlantic Ocean.

This area of 100 square miles is represented by eight Harbor Survey monitoring stations and has mostly open shallow waters. Two wastewater treatment plants, Oakwood Beach and Owls Head, directly discharge into Lower New York Bay and Raritan Bay, but the region's interconnection with other parts of the harbor and to the open water of the Atlantic Ocean also influence its water quality.

Figure 2-9: Lower New York Bay-Raritan Bay Water Quality

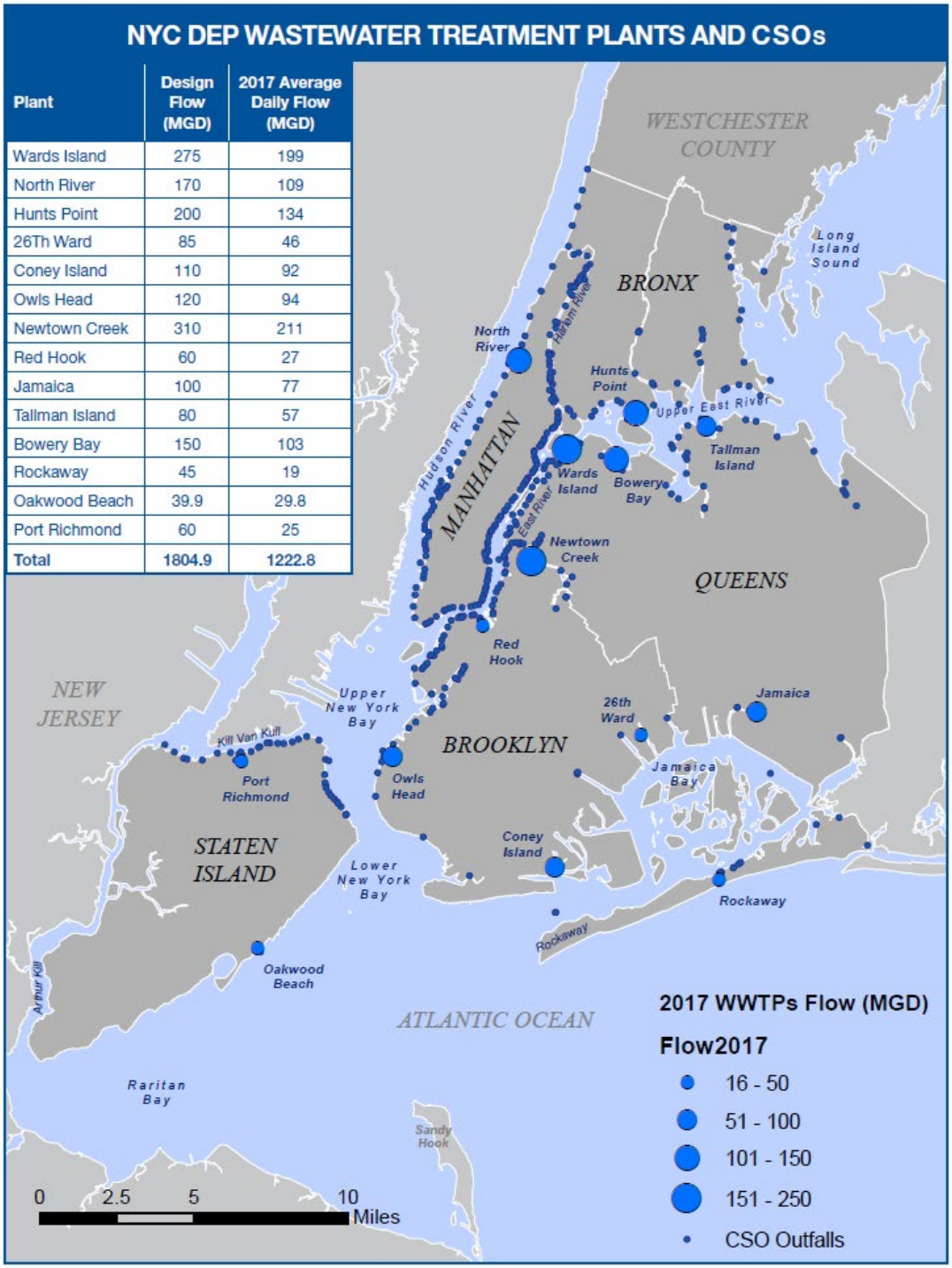
In addition to the annual New York Harbor Water Quality Report, an annual State of New York Water Quality Assessment 305(b)/303(d) Integrated Report summarizes findings and makes recommendations for a list of impaired waters by the New York Department of Environmental Conservation (NYDEC). Every two years (the most recent dates July 2017), a List of Impaired Waters is developed to describe segments of streams, lakes, and estuaries within the state that exhibit violations of water quality standards. In order to maintain the water quality standard, NYDEC creates TMDLs (Total Maximum Daily Loads) on a tributary level that indicate the total pollutants that a water body can assimilate and still meet water quality standards.

The determination whether the State's waters support their applicable designated uses as mandated by Section 305(b) of the Clean Water Act is made by NYDEC and reported annually

to USEPA based on monitoring data. There are six designated uses that may be applied to surface waters: aquatic life, fish consumption, shellfishing, recreation, public water supply, and wildlife. New York's water quality standards define the water quality needed to support each of these uses by establishing the numeric criteria for comparison of physical and chemical data. If a water body contains more of a pollutant than is allowed by the water quality standards, it will not support one or more of its designated uses. Such waters are considered to have an "impaired" quality. An "impairment" refers to an individual parameter or characteristic that violates a water quality standard. A water body fails to support a designated use when it has one or more impairments.

The lower Hudson River, along with Upper and Lower New York Bay, also has a TMDL, due to PCBs and other toxins in contaminated river bottom sediments, and is considered impaired and can be used for the following: class I (fishing and boating) and SB (bathing and other recreational use, only north of the Harlem River) in the project ROI. The East River also has a TMDL due to PCB contamination and is listed as I in the local project area. The Kill Van Kull has a TMDL for floatables as well as PCB's, Dioxin, and other toxins, likely due to urban runoff and storm activity for floatables and due to prior bottom sediment contamination with PCB's and other toxins, and is class SD (fish survival), with no recreational boating, fishing, or bathing in its waters recommended. Other than the Kill Van Kull, there are no restrictions on eating fish caught in the most of the local ROI, with numerous restrictions on fish consumption, mainly due to PCB's, extending north of the NYC Battery (https://www.health.ny.gov/publications/2794.pdf).

Today, the project ROI, which includes waters of Lower New York Bay, receives point and non-point source loadings from its 13,390 square mile drainage area, where approximately five million people live, including a portion of New York City's residents. Numerous local point sources, including both sewage treatment plants and combined sewer overflows (CSO) flow into either the Hudson River, Upper New York Bay, the Kill Van Kull or East River, all of which flow into the waters of the ROI. Figure 2-10 illustrates this trend.



Plant	Design Flow (MGD)	2017 Average Daily Flow (MGD)
Wards Island	275	199
North River	170	109
Hunts Point	200	134
26Th Ward	85	46
Coney Island	110	92
Owls Head	120	94
Newtown Creek	310	211
Red Hook	60	27
Jamaica	100	77
Tallman Island	80	57
Bowery Bay	150	103
Rockaway	45	19
Oakwood Beach	39.9	29.8
Port Richmond	60	25
Total	**1804.9**	**1222.8**

Figure 2-10: NYC DEP Wastewater Treatment Plants and CSOs

Bacterial levels in local ROI waters vary considerably, generally peaking in the warmest water temperatures, which typically occur in late summer. General trends in ROI waters have been a decline in fecal coliform (FC) levels over time due to improvements in sewage treatment and better treatment and control of stormwater during major storm events. For the most recent year data is available (2017) FC levels averaged 25 cells/100mL in waters of the lower Hudson and

Upper New York Bay, a level low enough to permit swimming. Figure 2-11 illustrates the decline in bacterial levels over time in local waters.

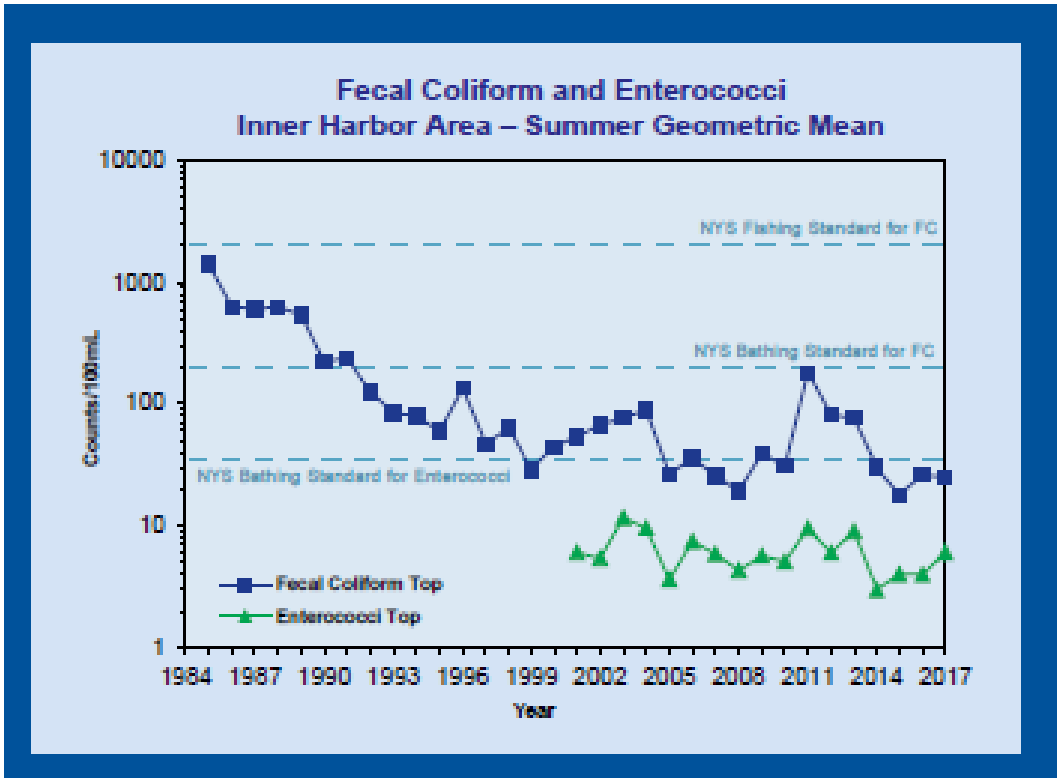


Figure 2-11: Inner Harbor Fecal Coliform and Enterococci

Dissolved Oxygen (DO) is considered one of the most important and commonly employed indicators of a water body's ability to support healthy aquatic life. Adequate concentrations of DO are necessary for fish and other aquatic life and can often times be less than ideal (five milligrams/liter and up), especially in deep channel areas and during the summer, when stratification coupled with active decomposition of organic material in bottom waters occurs. This, generally, does not occur in the New York and New Jersey Harbor navigation channel, due to the considerable mixing and large incoming tidal flow from New York Harbor and the New York Bight. DO levels are typically lowest in the summer, when temperatures are highest, which also allows for the highest rates of decomposition and metabolic rates for organic material and living organisms in the water. Local ROI waters have, with few exceptions, exceeded the 5.0 mg/L standard, which is the minimum DO needed to ensure all estuarine life, including sensitive species such as sturgeon, have an adequate oxygen supply. Figure 2-12 illustrates the general trend in improving DO in local ROI waters.

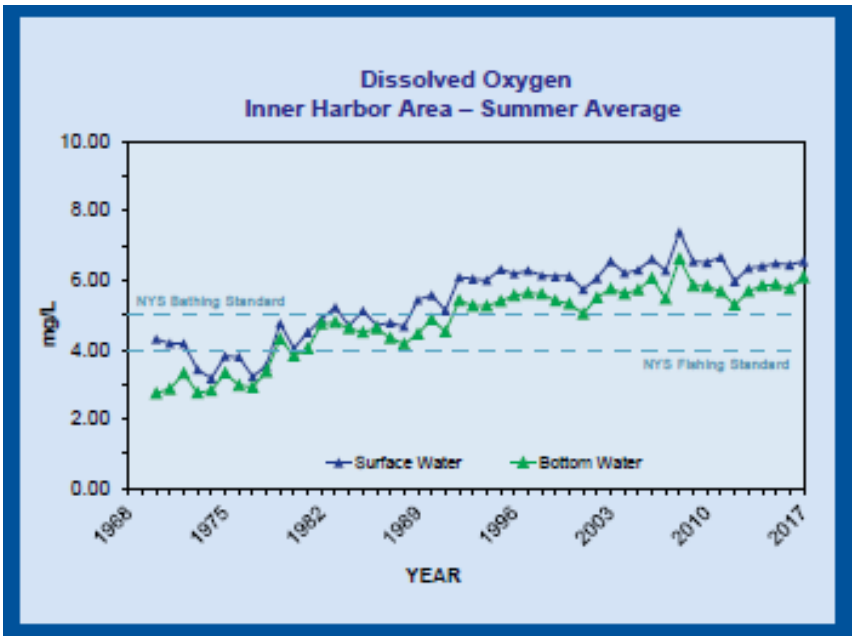


Figure 2-12: Inner Harbor Dissolved Oxygen

While water quality in the project ROI has been very low in the past, an active program to improve it that involved removal of contamination as well as improvements in water treatment and control of stormwater runoff have resulted in significant improvements in recent years, a trend likely to continue based on projected improvements to water treatment infrastructure as well as stormwater control (NYSDEC, 2017). New York City relies on drinking water supplied by the Delaware and Catskill systems (97% of NYC water is from here) west of the Hudson River and the Croton system (3%, from the Croton River which is connected to the Hudson River) just north of the City. No potable water supplies, Outstanding State Resource Waters, or Wild and Scenic Rivers are located in the vicinity of the project. Additionally, no designated sole source aquifers or wellhead protection areas are present in the project area.

Significant water quality modeling efforts have been undertaken to assess various activities, including channel deepening, in waters of the project ROI. The most recent (USACE, 2017) assessed water quality changes as a result of navigation channel deepening, a project to dredge most major navigation channels from 45 to 50 ft. deep (the Ambrose Channel would be deepened to 53 ft.). The results of the model indicated minor changes to water quality as a result of the proposed project. Other, earlier studies were done (USACE, 2007; 2002; 1999) and generally agreed with the 2017 findings in that channel deepening and activities associated with it, such as dredge plumes, do not result in significant alterations to local ROI water quality.

2.9 Vegetation, Wetlands, and Submerged Aquatic Vegetation

2.9.1 Affected Environment

The ROI includes the areas of navigation channel to be dredged, areas transited by dredging vessels/equipment, and adjacent shorelines to Gravesend Anchorage.

2.9.2 Upland Vegetation

The project is located within a highly industrialized and urbanized area in New York Harbor, bordering Staten Island and Jersey City on the West, and New York City on the East, with extensive harbor facilities on either shore. Upland vegetation is primarily confined to two parks, Ocean Breeze, Calvert Vaux parks. Other areas that have small amounts of upland vegetation include thin strips along the Verrazzano-Narrows Bridge on either side of it, running north and south for approximately one mile, and on Fort Wadsworth, which has limited forested uplands on its facility grounds. Riparian vegetation can be found upslope of fringing wetlands along the Verrazzano-Narrows Bridge and within the three parks. Upland dredged material disposal sites, if used, may also have upland vegetation located on them as mowed grassland or along their fringes, which may be riparian scrub/shrub habitat. The great majority (>95%) of the land is developed in the project ROI, similar to the total developed to forest acreage (10,542) of New York City (205,000 acres).

However, because the ROI is composed of subaqueous bottom, no upland vegetation occurs within the ROI. No impacts to upland vegetation are expected and it will not be further discussed in this document.

2.9.3 Wetlands

Wetlands are defined by the Clean Water Act regulations as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.” (USEPA, 2016).

Consulting the US Fish and Wildlife Service wetlands mapper, (https://www.fws.gov/wetlands/data/mapper.html) the most extensive wetlands near, but not in, the project ROI are the Jersey Flats, located near the former Military Ocean Terminal at Bayonne (MOTBY) with the associated Port Jersey Peninsula, and the South Beach Wetlands with the adjacent Ocean Breeze Last Chance Pond Parks. Smaller wetlands are located in the Dyker Beach Park. Throughout the ROI area, there are numerous small marsh areas scattered amid shipwrecks and abandoned docks; this acreage is very limited. Almost all of these wetlands are either palustrine forested or emergent freshwater, indicating they are not directly linked to the Bay. If they were, they would be estuarine wetlands due to the salinity of the Bay waters. There are also various fringing beaches and mudflats, which are estuarine and directly linked to Bay waters, scattered throughout (E2USN) the area, but these are not vegetated and therefore do not meet the definition of a jurisdictional wetland.

The New York Harbor is an estuary subject to daily tides. Estuary environments can be altered with the combined stress of inundation, desiccation, and changes in salinity. These conditions limit the types of vegetation that can survive within the area, and the plant communities within this dynamic ecosystem have evolved the capacity to thrive in the ever-changing environment (Perry et al., 2001). The very extensive development, since colonial times, has resulted in the fill and development of almost all of the wetlands, fresh or estuarine, within the bounds of New York City. Over the course of many years of development and industry, shorelines have been built up, bulkheaded, or were filled to facilitate development; and large industrial and military deep water access piers and marine terminals have been constructed. Google aerial photography (2016) of the shorelines adjacent to the ROI suggests that the shorelines are at least 95 percent developed, with remnant fringing unconsolidated shoreline habitat along the

southern end of the shorelines adjacent to the project ROI on both the eastern and western shore near the Gravesend Anchorage providing the most extensive shoreline not fully developed. Due to the fact that the project ROI consists of offshore waters of Gravesend Anchorage, and any waters used by vessels to transport dredged material, no impacts to wetlands are expected and wetlands are dismissed from further consideration in this document.

2.10 Benthic Fauna

Benthic communities have varied roles in the estuarine ecosystem. New York Harbor once had a vibrant benthic community, but major environmental degradation due to the development of New York City, heavy industry, and all of the associated pollution from both as well as overfishing of local stocks of shellfish affected benthic populations. Supporting evidence is provided by historical accounts of New York's oyster industry. Before 1900, oysters were found throughout much of the lower estuary and north to Ossining, New York, including Newark Bay, Arthur Kill, Kill Van Kull, Jamaica Bay, Raritan Bay, and the New Jersey shore of the Hudson. By the turn of the century, the shellfish industry was limited to waters south of the Narrows; by 1920 it largely had disappeared from harbor waters (Kirby, 2004; Franz 1982). Filter feeders such as clams, oysters, and sponges clarify and clean the waters of the bay through their biological processes, removing particulate matter and potentially toxic materials, providing for a healthy marine environment. Today's remnant population, located primarily on sub-tidal rip-rap and other hard structure rather than natural oyster reefs, which have been eliminated from the ROI, provides few such ecological services. However, there is an active and growing oyster restoration program to return oysters to New York Bay by constructing new reefs and stocking live oysters (Billion Oyster Project, 2019) and several small restoration reefs are present in the ROI at this time, along with remnant oyster populations attached to hard structures, such as rip-rap and concrete pilings. Benthic primary and secondary consumers, as well as detritivores, pass the energy of primary producers (phytoplankton) to higher levels of the food web. Many benthic species are prey for economically important species such as the blue crab (*Callinectes sapidus*), striped bass (*Morone saxatilis*), winter flounder (*Pseudopleuronectes americanus*), bluefish (*Pomatomus saltatrix*), and summer flounder (*Paralichthys dentatus*) (Limburg et al., 2006).

The benthic communities of the lower New York Harbor include an array of fauna that play important roles in the food web (USACE, 2006; Cerrato et al. 1989). The lower New York Bay benthic community includes epifauna (organisms that live attached to surfaces on the river bottom) such as oysters (*Crassostrea virginica*) and barnacles, which need hard structure, along with the following organisms that can be found on sand bottom such as blue mussels (*Mytilus edulis*), sponges, sea squirts, seas stars, and infauna that burrow into bottom sediments and are characterized by worms (primarily polychaetes (typically the most numerous organism in the ROI (USACE, 2006, 1999, 1989) and nemotodes), clams (the most numerous in the project ROI is the dwarf surf clam, (*Mulinia lateralis*), and other tunneling organisms such as tube worms. The USACE 1989 survey indicated few organisms in the project ROI besides polychates, but the more recent surveys (USACE 1999, 2006, 2011, 2013a, 2013b, 2017) indicated that significant ecological recovery has taken place since the 1980s, with a much wider variety of species being found today compared to earlier decades. The benthic community in the project ROI is, in some areas low in biomass and diversity due to sediment contamination and sediment composition (less sand and more clay and/or silt) with no reef or hard bottom habitat either, with areas dominated by higher percentage sand sediments holding much greater species numbers, biomass and diversity (USACE, 2006). Due to the nature of this substrate, the biologically active zone (BAZ), where living organisms can be found, is deeper than silt and mud sediment types,

whose BAZ is typically only a few cm deep. The project ROI, which is mostly sand based sediments, has a BAZ ranging from 13.7-16.4 cm (Diaz, 2005). Most of the potential dredging areas are more dominated by sandy sediments with little contamination, being a higher energy area with strong currents that inhibit the settlement of clay and silt sediments but rather transport then further down-bay towards the ocean. The benthic community in the areas proposed for dredging is dominated by polychaetes, amphipods and blue mussels. The most recent monitoring of the channels in the project ROI (USACE, 2006) revealed an average of 43 taxa, consisting of 52 percent polychaetes, 20 percent arthropods and 24 percent mollusks with an average of 2,511 organisms/m^2. Catches were dominated by blue mussels, amphipods and polychaetes. The organisms that colonize this type of benthic habitat are typically a limited suite of small, mostly opportunistic species with a short life cycle, that are adapted to bottom environments with frequent disturbance, due to storms and tidal action, both of which temporarily disturb sand bottom. Such areas tend to recover quickly from disturbances, in as short a time of approximately six months to two years. Blue mussels, who typically have strong annual recruitment such that disturbed or damaged beds recover quickly, can take up to five years for full recovery depending on remaining population size outside of the disturbed area, which influences local recruitment as planktonic mussel larvae are easily transported from an active mussel bed to new areas for settlement (Mainwaring et al., 2014). The project ROI for benthic resources is the impact area, Gravesend Anchorage.

2.10.1 Submerged Aquatic Vegetation (SAV, Seagrasses)

Two species of seagrasses, which are rooted, flowing plants that produce seeds adapted to growing completely submerged under water, could potentially be found in the shallow waters shoreward of the project ROI, eelgrass (*Zostera marina*) and widgeongrass (*Ruppia maritima*). SAV survival depends on water clarity and the amount of sunlight available. Submerged Aquatic Vegetation provides food and shelter for diverse communities of waterfowl, fish, shellfish, and invertebrates and it also produces oxygen, a very important function in the estuarine environment. Other ecological benefits of SAV include the ability to filter and trap sediment, and absorb nutrients like nitrogen and phosphorus. Current SAV populations in New York estuarine waters and associated restoration efforts are located in Long Island Sound, Peconic Estuary, and the South Shore Estuary (https://www.dec.ny.gov/docs/fish_marine_pdf/finalseagrassreport.pdf). There are currently no SAV in the project ROI. SAV requirements for water quality and clarity are not currently being met in New York Harbor, barring significant improvement of these waters it is highly improbably that SAV will recolonize the shallow nearshore waters shoreward of the project ROI, even if restoration were attempted. No impacts to SAV are expected and no further discussion of SAV is needed.

2.11 Plankton Community

Plankton are free-floating organisms found in freshwater and marine ecosystems that are largely transported by wind and currents, though some zooplankton have limited swimming abilities. Phytoplankton (microalgae) are tiny, single-celled organisms. Phytoplankton are primary producers because they generate food and oxygen in the New York Bay and its surrounding tributaries by a process called photosynthesis. To perform photosynthesis, phytoplankton need the energy of sunlight and they are typically found in the upper reaches of the water column. There are hundreds of species of phytoplankton in the lower New York Bay, the project ROI for this resource, but typically, the most abundant phytoplankton in the project ROI and its nearby waters are diatoms, with pico-nanoplankton and dinoflagellates found in

lower amounts but typically present (Li et al., 2018; Marshall and Cohn, 1987) Dinoflagellates are known to periodically bloom in great numbers in New York Harbor (Mahoney and McLaughlin, 1979) as toxic red or brown tides. Such tides are often caused by eutrophication, the addition of excess nutrients, often from human origin, to local waters in the form of dissolved nitrogen (N) and phosphorus (P), which stimulate plant growth.

The abundance of phytoplankton in the waters of the project ROI is seasonal with the highest abundance occurring during the spring when the highest concentration of nutrients flow into the lower Hudson/upper New York Bay and eventually into lower New York Bay, the ROI, from melting snow and rain events. The New York Estuary is the most nitrogen-loaded estuary in the world. More than half of that nitrogen is from wastewater. Nutrient pollution can cause algal blooms that can reduce oxygen levels in local waters. However, this rarely results in dead zones in ROI waters due to the high flushing rate of waters of the ROI (Billion Oyster Project, 2017). During a bloom, phytoplankton may accrue so densely in the water column that sunlight availability for other photosynthetic organisms is diminished. After a bloom, phytoplankton sink to the benthos; this can produce anoxic conditions, which can cause mortality of fish and other benthic organisms. Certain species, when they bloom in large numbers, cause “brown tides” which are a form of Harmful Algal Bloom (HAB), especially in waters of Long Island Sound. Locally, HAB’s are caused by blooms of dinoflagellates of the species *Alexandrium. Alexandrium* spp. produce toxins that bioaccumulate in shellfish, particularly mollusks, rendering them dangerous to eat as cooking does not remove or destroy the toxins. At such times, no consumption of shellfish is recommended as sickness or death could occur (NYSDEC, 2019).

Zooplankton are the mostly microscopic, free-floating animal life and they are the most abundant animals found in the lower New York Bay. Zooplankton form a crucial link in the food chain between the primary producers and higher levels of the food chain. Zooplankton consists of primary consumers (those that eat phytoplankton) and secondary consumers (larger zooplankton that consume the secondary consumers). Zooplankton are then consumed by fishes and some filter feeding benthos, which are subsequently prey for larger fishes and wildlife (Reshetiloff, 1997). Meroplankton, another abundant element in estuarine water, consists of the eggs and larvae of many fish and benthic invertebrate species.

Copepods are tiny crustaceans that are approximately one millimeter long and are the most abundant zooplankton in the lower Hudson and New York Bay and its surrounding waters, though polychaete larvae and other invertebrate larvae can be very abundant seasonally (Berg and Levitan, 1985). Larval fish and shellfish, which include commercial and recreational fisheries species and species of restoration and management concern, comprise an important component of the zooplankton community. For example, oyster, blue crab, blue mussel, and finfish larvae such as summer flounder compose the majority of the local zooplankton community seasonally.

Protozoa are single-celled zooplankton that consume bacteria and decaying plant and animal matter. Bacteria also play a crucial role in the bay and surrounding tributaries because they break down decaying plant and animal matter and provide nutrients in the food chain for higher level organisms. Comb-jellies and jellyfish are larger zooplankton that are visible to the naked eye and have some swimming capability, however, their location is largely driven by tides and currents and therefore, they are still considered zooplankton.

All fish within the lower New York Bay and its surrounding tributaries depend, whether directly or indirectly, on zooplankton because of its critical role in the food chain. Some fish such as

anchovies, herring, and shad (once a suite of fish species of great commercial importance locally) solely feed on zooplankton throughout their entire life cycle. Other fish species depend on plankton for a portion of their lifecycle either directly during their own larval phase or indirectly through the food chain, such as sturgeon. The ROI for plankton are waters above the proposed dredging area, waters that could be impacted by traverse of dredging vessels, and waters impacted by dredging plumes.

2.12 Fishery and Essential Fish Habitat

The ROI includes waters transited by dredging vessels/equipment, and areas of the anchorage dredged.

One of the countries larger estuaries, the Hudson-Raritan historically supported numerous commercial fisheries, and while commercial fishing still takes place in project ROI waters, it is quite limited in species fished and total poundage caught, compared to historic levels. Additionally, commercial fishing is limited to New York Bay waters, no commercial fishing currently takes place in the Hudson River due to either low stock levels and/or PCB contamination. The last commercial fishery in the Hudson was for shad, but a ban on shad fishing was placed in 2010. Most fishing in ROI waters is recreational at this time, though it is permissible to conduct limited commercial fishing above the Tappan Zee Bridge by permit. Over 200 fish species can be found in project ROI waters (Daniels et al., 2005). These species include both resident, year-round inhabitants and a number of migratory (anadromous) fish such as the striped bass (*Morone saxitalis*), Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*) among others, that spawn in freshwater but live as adults in estuarine/oceanic waters, and one species, the American eel (*Anguilla rostrata*), which is catadromous, living as adults in estuarine and fresh water but spawning in oceanic waters. There are 49 species in the project ROI that are primarily marine (Daniels et al., 2005). The USACE has also been collecting data on numerous fish species, with an emphasis on migratory fish, as part of an extensive monitoring program (USACE, 2000-2015) related to the navigation channel deepening project (USACE, 1999).

The fish species in the New York Harbor/Hudson River Region fall into two categories: resident and migratory. Resident fishes tend to be smaller than migratory species and are often found in shallow water, where they feed on a variety of invertebrates. Resident species include, but are not limited to the bay anchovy (*Anchoa mitchilli*), Atlantic silverside (Menidia menidia) killifish (Cyprinodontidae), blennies (Bleniidae), skilletfish (Gobiesox stumosus), gobies (Gobiidae), pipefish (Syngnathus spp.), lined seahorse (Hippocampus erectus), striped sea robin (*Prionotus evolans*), and oyster toadfish (Opsanus tau). Tomcod (*Microgadus tomcod)* can also be found in low numbers, it was once an important anadromous species in the local area (Berg and Levitan, 1985).

Total number of fish collected from mid-water trawls during each year of migratory finfish Sampling (USACE 2015) (Table 2-3).

Table 2-3: Total fish caught during USACE fish monitoring.

Target Species	Scientific Name	2006	2011	2012	2013	Total
Alewife	*Alosa pseudoharengus*	1,061	4,276	492	252	6,081
American shad	*Alosa sapidissima*	40	259	55	18	372
Atlantic menhaden	*Brevoortia tyrannus*	1,153	29	270	16	1,468
Blueback herring	*Alosa aestivalis*	1,213	6,578	31,576	4,008	43,375
Striped bass	*Morone saxatilis*	1	34	3	0	38
EFH Species	**Scientific Name**	**2006**	**2011**	**2012**	**2013**	**Total**
Atlantic butterfish	*Peprilus triacanthus*	322	135	89	82	628
Atlantic cod	*Gadus morhua*	0	0	0	2	2
Atlantic herring	*Clupea harengus*	618	116	3,853	1,421	6,008
Black sea bass	*Centropristis striata*	0	1	0	1	2
Bluefish	*Pomatomus saltatrix*	29	72	20	86	207
Pollock	*Pollachius virens*	0	1	0	1	2
Red hake	*Urophycis chuss*	0	2	0	0	2
Scup	*Stenotomus chrysops*	0	1	0	0	1
Silver hake	*Merluccius bilinearis*	0	180	2	0	182
Spanish mackerel	*Scomberomorus spp.*	2	0	0	0	2
Windowpane	*Scopthalmus aquosus*	0	5	0	0	5
Winter flounder	*Pseudopleuronectes americanus*	1	0	1	0	2

Other Species	Scientific Name	2006	2011	2012	2013	Total
American eel	*Anguilla rostrata*	0	4	0	1	5
American sandlance	*Ammodytes americanus*	4	0	1	17	22
Atlantic croaker	*Micropogonias undulatus*	0	15	1	0	16
Atlantic cutlassfish	*Trichiurus lepturus*	1	0	0	0	1
Atlantic moonfish	*Selene setapinnis*	10	58	3	4	75
Atlantic silverside	*Menidia menidia*	9	6	15	50	80
Atlantic thread herring	*Opisthonema oglinum*	0	1	98	0	99
Atlantic tomcod	*Microgadus tomcod*	0	14	5	0	19
Bay anchovy	*Anchoa mitchilli*	24,791	57,229	82,785	27,380	192,185
Blue runner	*Caranx crysos*	0	0	2	0	2
Boxfishes	*Ostraciidae*	1	0	0	0	1
Conger eel	*Conger oceanicus*	0	1	1	0	2
Feather blenny	*Hypsoblennius hentzi*	0	0	1	0	1
Fourbeard rockling	*Enchelyopus cimbrius*	1	0	0	0	1
Gizzard shad	*Dorosoma cepedianum*	0	267	0	0	267
Grubby	*Myoxocephalus aenaeus*	1	0	0	0	1
Hickory shad	*Alosa mediocris*	5	0	0	0	5
Inland silverside	*Menidia beryllina*	0	0	18	0	18

Lined seahorse	*Hippocampus erectus*	9	19	11	3	42
Lookdown	*Selene vomer*	2	0	0	0	2
Naked goby	*Gobiosoma bosc*	0	2	0	0	2
Northern pipefish	*Syngnathus fuscus*	4	3	5	6	18
Northern puffer	*Sphoeroides maculatus*	0	0	3	0	3
Northern searobin	*Prionotus carolinus*	0	1	0	1	2
Northern stargazer	*Astroscopus guttatus*	7	0	10	0	17
Oyster toadfish	*Opsanus tau*	0	5	0	0	5
Pinfish	*Lagodon rhomboides*	0	3	0	0	3
Silver perch	*Bairdiella chrysoura*	0	9	0	0	9
Skilletfish	*Gobiesox strumosus*	0	0	2	0	2
Smallmouth flounder	*Etropus microstomus*	0	10	0	0	10
Spotfin butterflyfish	*Chaetodon ocellatus*	0	0	0	1	1
Spotted hake	*Urophycis regia*	10	52	9	145	216
Striped anchovy	*Anchoa hepsetus*	33	125	1,493	89	1,740
Striped cusk-eel	*Ophidion marginatum*	0	1	0	0	1
Striped searobin	*Prionotus evolans*	1	1	1	4	7
Threespine stickleback	*Gasterosteus aculeatus*	0	0	1	0	1
Weakfish	*Cynoscion regalis*	0	57	8	0	65
White mullet	*Mugil curema*	0	0	59	0	59
White perch	*Morone americana*	0	40	6	2	48

Almost a dozen anadromous species utilize the NY/NJ Harbor during some part of their annual migration for spawning in freshwater (Waldman 2006). These species include the Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), striped bass (*Morone saxatilis*), hickory shad (*Alosa mediocris*), rainbow smelt (*Osmerus mordax*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and American shad (*Alosa sapidissima*). All of these species spawn in waters further upriver of project ROI waters, and all of them use project ROI waters as a migratory pathway to these spawning grounds. Adults and juveniles of these species can also be found foraging within project ROI waters outside of the spring spawning season, though most do not overwinter in these waters.

Common migratory anadromous species were examined for their presence and numbers during the most recent migratory fish survey conducted (USACE, 2015). Five species of particular interest were the alewife, American shad, Atlantic menhaden, Blueback herring and striped bass, which can be considered Hudson River anadromous species due to their long history of spawning there (Berg and Levitan, 1985). Other species that spawn in estuarine project ROI waters include the weakfish, scup, Atlantic tomcod (*Microgadus tomcod*), and winter flounder (Berg and Levitan, 1985).

Unlike most locally spawning species, the eggs of the winter flounder clump together in masses on the bottom rather than float. In the Lower Bay (LB), these habitats were primarily nonchannel and characterized by more sandy substrates, averaging 96.5 percent sand, 2.3 percent silt/clay, 0.2 percent total organic carbon (TOC), and shallower water (average depths of 5.3 m) compared to LB non-channel stations without ES1 and ES2 eggs (50.2 percent sand, 42.0 percent silt/clay, 2.1 percent TOC, and 7.9 m depths). Occurrences of all stages of eggs in

channels were associated with strong tides and severe cold winter water temperatures. These conditions increase the probability of egg transport from shallow spawning sites through increased vertical mixing (strong tides) and delayed development that prolongs the risk of displacement (cold temperatures) (Wilber et al., 2013). American eel (*Anguilla rostrata*), a catadromous fish, also uses project ROI waters during its spawning migration out to sea.

Hedgepeth et al. (Priest, 1981) concluded that temperature is the major factor determining the winter distribution of fishes, while food availability is the major factor controlling the summer distribution of fishes. The observations of Hedgepeth et al. (Priest, 1981) determined that dredging operations in the project area will have a greater effect on juvenile and forage fishes, which tend to remain in an estuarine river for longer periods of time with a resulting greater potential exposure to contaminants due to resuspension, if any are present, during dredging operations than foraging adults that move in and out of an estuarine tidal river more frequently.

2.12.1 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act, as amended October 11, 1996, defines the term "essential fish habitat" as the “waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” The act applies to Federally managed species, and requires Federal agencies to identify and describe EFH for fisheries that may be impacted by a potential project. Using the National Oceanic and Atmospheric Administration (NOAA) 2016 Guide to Essential Fish Habitat Designations in the Northeastern United States, and the Essential Fish Habitat Mapper (NOAA, 2019), EFH for 16 species was identified to potentially occur within the ROI. Winter flounder, a species of particular interest due to the fact that it spawns locally and its eggs are demersal, have been monitored by the USACE to assess dredging activities on their reproduction (USACE, 2000-2011, 2013). Refer to the EFH Assessment (Appendix E) for more information regarding EFH in the ROI and anticipated effects to EFH in the ROI.

2.13 Wildlife

The geographic extent of water quality impacts is dependent upon factors such as the type of dredging equipment, the dredging depth, and environmental conditions such as wind and currents (USACE, 2015). For the purpose of the following discussion, wildlife consists of amphibians, birds, mammal species (excluding marine mammals), and reptiles. There are no amphibians in the estuarine waters of the project ROI. Marine mammals, sea turtles, and migratory birds are described in Section 2.14, Special Status Species.

2.14 Special Status Species

The ROI (or Action Area as it is referred to for threatened and endangered species per 50 CFR 402.02) is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” (The terms ROI and Action Area are used interchangeably when referring to Federally listed species in the Environmental Assessment.) The ROI consists of the areas transited by dredging vessels/equipment and the areas of anchorages under consideration for deepening. The ROI includes the area of anticipated circulation patterns shifts and potential water quality impacts. The geographic extent of water quality impacts is dependent upon factors such as the type of dredging equipment, the dredging depth, and environmental conditions such as wind and currents (USACE 2015). The ROI includes the range of noise impacts as they pertain to special status species.

This section provides a summary of the special status species that are known or have the potential to occur in the Action Area. The following references were consulted for compilation of the special status species that have the potential to occur in the Action Area that is provided in Table 2-4:

- Information, Planning and Consultation System (IPaC) search conducted within the Action Area (U.S. Fish and Wildlife Service (FWS) 2019);
- National Oceanographic and Atmospheric Administration, National Marine Fisheries Service (NMFS) (2019) Section 7 Mapper, url: https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=1bc332edc5204e03b250ac11f9914a27
- Large Whale Strike Database (Jensen and Silber 2003).

Table 2-4: Federally listed species known or with the potential to occur in the project ROI

Common Name	Scientific Name	Federal Status	Critical Habitat in ROI (Y/N)
Atlantic Sturgeon	*Acipenser oxyrhynchus*	Endangered	N
Shortnose Sturgeon	*Acipenser brevirostrum*	Endangered	N
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	N
Loggerhead Sea Turtle	*Caretta*	Endangered	N
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	N
Green Sea Turtle	*Chelonia mydas*	Endangered	N
North Atlantic Right Whale	*Eubalaena glacialis*	Endangered	N
Fin Whale	*Balaenoptera physalus*	Endangered	N
Piping Plover	*Charadrius melodus*	Threatened	N
Red Knot	*Calidris canutus rufa*	Threatened	N
Roseate Term	*Sterna dougallii*	Endangered	N
Seabeach Amaranth	*Amaranthus pumilus*	Threatened	N

DPS = Distinct Population Segment; E = Endangered; T = Threatened; Y = Yes; N = No; P = Proposed; ^Species status is reported as it pertains to the DPS/Action Area; *Critical Habitat not located in Action Area

2.14.1 Federally Threatened and Endangered Species and Designated Critical Habitat

Animals and plants listed as endangered or threatened are protected under the Endangered Species Act of 1973, as amended (ESA). According to the ESA, an “endangered species” is defined as any plant or animal species in danger of extinction throughout all or a substantial portion of its range. A “threatened species” is any species likely to become an endangered species in the foreseeable future throughout all or a substantial part of its range. “Proposed Species” are animal or plant species proposed in the Federal Register to be listed under Section

4 of the ESA. “Candidate species” are species for which the FWS and NMFS have sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA. Critical habitat is designated per 50 CFR parts 17 or 226 and defines those habitats that are essential for the conservation of a Federally threatened or endangered species and that may require special management and protection.

Relevant consultation correspondence and a copy of any species lists received are provided in Appendix E. There are no candidate species known or with the potential to occur in the project ROI. The closest critical habitat is for the Atlantic sturgeon, the local distinct population segment, which is a relatively isolated sub-population (New York Bight DPS) (Figure 2-13), whose critical habitat includes the Hudson River. The critical habitat begins approximately 2.5 miles upriver of the project ROI, assuming the most upriver anchorage was deepened.

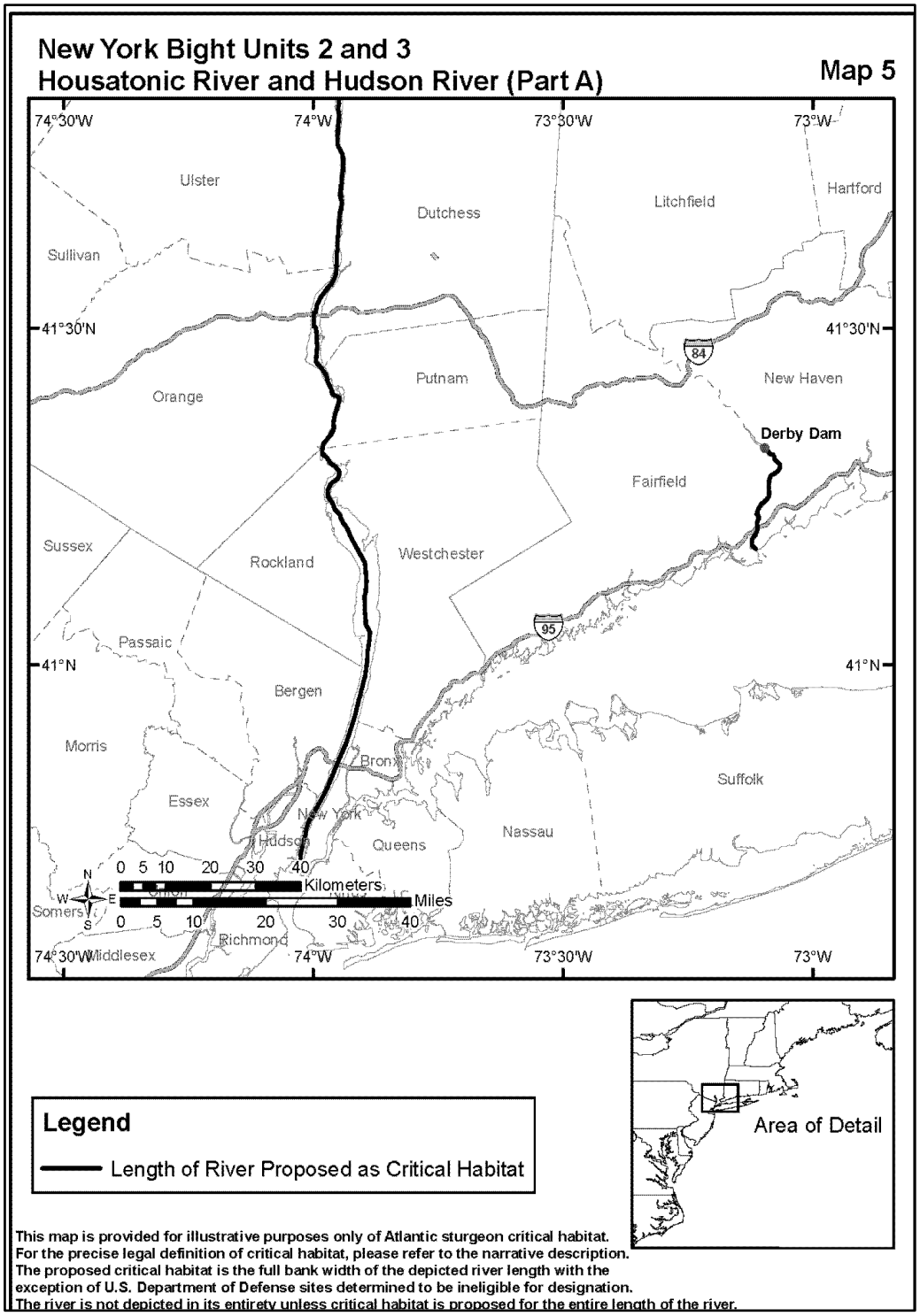


Figure 2-13: New York Bights Units 2 and 3 Critical Habitat

Both the Atlantic and shortnose sturgeon (*Acipenser brevirostrum*) migrate through waters of the Hudson River and New York Bay to reach spawning waters in freshwater reaches of the Hudson River, with the Hudson River population of shortnose sturgeon being one of the healthiest remaining populations of this species (Woodland and Secor, 2007). Shortnose sturgeon are, however, transient in upper New York Harbor waters and likely only to be found there during their migrations to spawning grounds and are not known to occur in lower New York Harbor. Atlantic sturgeon do migrate through waters of lower New York Bay, both adults and juveniles have the potential to be found in waters of Gravesend Anchorage and adjacent channels and waters. The local juvenile population aggregates in the spring and fall near Breezy Point, known as the Rockaway Aggregation. This population experiences the highest by catch rate during otter trawling fishery seasons (Dunton, 2014).

Based on our review of the survey and NOAA stranding data (Jensen and Silber, 2003), there are two records of finback (fin) whale strikes with mortality in New York Harbor and one from Manhattan.

Green sea turtles feed primarily on sea grass, and can be found foraging in sea grass beds on the eastern side of Long Island as well as in open pelagic waters and are highly unlikely to be found in the local project area. Therefore, there would be “no effect” to the green sea turtle and this species is dismissed from further analysis. Leatherback, Kemp’s Ridely and loggerhead sea turtles could potentially be found transiting waters of Gravesend Anchorage and adjacent waters transited by dredging vessels. A Biological Opinion was issued on sea turtles and sturgeon by NMFS in 2012 relative to the New York Harbor Deepening Project; it did not include detailed analysis on the shortnose sturgeon or Hawksbill sea turtle due to their determination on these two species of “Not Likely to Adversely Affect” due to their extremely low probability of being found in the area and impacted by the proposed dredged. Only the Ambrose Channel, which is adjacent to Gravesend Anchorage, was considered suitable sea turtle habitat. The seabeach amaranth, due to the offshore nature of the project, as well as the current distribution of this species on Long Island along the southern shore, will not be impacted by the proposed dredging, therefore, there would be “no affect” to the seabeach amaranth and this species is dismissed from further analysis.

Please note that all of the species listed in Table 2-4 are also state listed in the New York State (DEC) with the same status level as described for the Federal listing. There are no state listed species outside of the same Federally listed species to be found in the local project ROI.

2.14.2 Marine Mammals

The Marine Mammal Protection Act of 1972, as amended (MMPA) prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. In reference to the MMPA, a marine mammal is a species found in the U.S. that is classified into one of the following four distinct groups: cetaceans (whales, dolphins, and porpoises), pinnipeds (seals, sea lions, and walruses), sirenians (manatees and dugongs), and marine fissipeds (polar bears and sea otters). Only cetaceans, pinnipeds, and sirenians (a single migratory manatee, named “Ilya” has been spotted several times in recent years) have the potential to occur in the ROI. All marine mammals in the U.S. are protected under the MMPA.

The MMPA prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal

products into the U.S. The term “take” per the MMPA is defined as harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal. For most activities “harassment” refers to the act of pursuit, torment, or annoyance which:

- Can injure a marine mammal or a marine mammal stock in the wild which is referred to as Level A Harassment; or
- Has the potential to disturb a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns that include but are not limited to the following: migration, breathing, nursing, breeding, feeding, or sheltering which is referred to as Level B Harassment.

Table 2-5 provides a comprehensive listing of marine mammals documented to occur throughout the coastal waters of New York. The humpback whale, West Indies Distinct Population Segment, the only humpback whale population segment that occurs in New York, is no longer Federally listed but is still protected under the MMPA and has been recently returning in numbers to New York Harbor waters.

Table 2-5: Marine Mammals of New York Bight Waters

Taxonomic Category/Common Name	**Scientific Names**
Baleen Whales	
Blue whale	*Balaanoptera musculus*
Fin whale	*Balanoptera physalus*
Humpback whale	*Megaptera novaeangliae*
Minke whale	*Balaenoptera acutorostrata*
Northern right whale	*Eubalena glacialis*
Sei whale	*Balaenoptera borealis*
Delphinids	
Atlantic white-sided dolphin	*Lagenorhynchus acutus*
Bottlenose dolphin	*Tursiops truncatus*
Common dolphin	*Delphinus delphis*
Long-finned pilot whale	*Globicephala melas*
Other toothed whales	
Cuvier's beaked whale	*Ziphius cavirostris*
Harbor porpoise	*Phocoena phocoena*
Sperm whale	*Physeter macrocephalus*
Pinnipeds	
Grey seal	*Halichoerus grypus*
Harbor seal	*Phoca vitulina*

2.14.3 Bald Eagles Protected under the American Bald and Golden Eagle Act of 1972

Previously listed as Federally endangered, the bald eagle (*Haliaeetus leucocephalus*) has made a remarkable comeback and is no longer Federally listed. It is currently protected under the American Bald and Golden Eagle Act, and the Migratory Bird Treaty Act (MBTA). Bald eagles breed throughout much of Canada and Alaska, in addition to scattered sites across the lower 48 states, from California to the southeastern U.S. coast and Florida. Wintering habitat covers most of the contiguous U.S., with some year-round distribution in the northwest. Northern birds return to breeding grounds as soon as weather and food availability permit, generally between January and March.

A large raptor, the bald eagle has a wingspread of about seven ft.. Adults have a dark brown body and wings, white head and tail, and a yellow beak. Juveniles are mostly brown with white mottling on the body, tail, and undersides of wings. Bald eagles typically breed and winter in forested areas adjacent to large bodies of water. However, such areas must have an adequate food base, perching areas, and nesting sites. Throughout its range, it selects large, super-canopy roost trees that are open and accessible. Nests are constructed from an array of sticks placed in an interwoven pattern. Other materials added as fillers may include grasses, mosses, and even corn stalks. Nests are massive; often exceeding several thousand kilograms in weight.

The FWS National Bald Eagle Management Guidelines (2007) are used to assess potential effects to nesting bald eagles and provides management guidelines to avoid impacts to nesting bald eagles (FWS, 2007). To avoid disturbing bald eagles, a nest buffer is recommended between the human activity and the nest where applicable. Human impacts are considered detrimental to nesting success within the primary buffer and within the secondary buffer, human impacts are thought to impact the quality of the primary nest buffer. The primary buffer is a distance of 330 ft. from the nest and the secondary buffer is a distance of 660 ft. from the nest. Human activities that are considered detrimental to breeding activities (e.g. development, logging, use of toxic chemicals, etc.) are to be limited within the primary buffer and those that could impact the integrity of the primary buffer are restricted within a secondary buffer (e.g. developments, roadways, etc.). Per the management guidelines, a nest buffer of 2,640 ft. is recommended from the nest for loud, disturbing noises such as those caused by blasting and other loud, intermittent noises.

No bald eagle nests currently exist within the ROI. The ROI is not located in a Bald Eagle Concentration Area. The closest known nesting location for bald eagles is on Long Island, and recent sightings indicate there is a nest on Staten Island (New York Times, 2016).

2.14.4 Species Protected under the Migratory Bird Treaty Act and EO13186

The Migratory Bird Treaty Act (MBTA) and Executive Order 13186 (EO) requires agencies to protect and conserve migratory birds and their habitats. Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the FWS.

Migratory birds nest throughout North America, some as far north as the Arctic. In late summer and fall, they migrate south for the winter. Some winter in the southern United States, Mexico, the Caribbean or Central America while others go as far as South America. Each spring they return north to their breeding grounds. Many migratory songbirds, shorebirds, and raptors rest

and refuel in the area during their spring and fall migrations (Table 2-6). Others winter south and return to the watershed each spring to breed.

Migratory birds are defined as those described by the FWS in the 50 CFR 10.13 and consist of species that that belongs to a family or group of species in the United States as well as Canada, Japan, Mexico, or Russia. Most birds native (naturally occurring in the U.S.) to the U.S. belong to a protected family and are protected by the Migratory Bird Treaty Act. A species qualifies for protection under the Migratory Bird Treaty Act if it meets one or more of the following four criteria:

(1) It (a) belongs to a family or group of species named in the Canadian convention of 1916, as amended in 1996; (b) specimens, photographs, videotape recordings, or audiotape recordings provide convincing evidence of natural occurrence in the United States or its territories; and (c) the documentation of such records has been recognized by the American Ornithologists Union or other competent scientific authorities.

(2) It (a) belongs to a family of group of species named in the Mexican convention of 1936, as amended in 1972; (b) specimens, photographs, videotape recordings, or audiotape recordings provide convincing evidence of natural occurrence in the United States or its territories; and (c) the documentation of such records has been recognized by the AOU or other competent scientific authorities.

(3) It is a species listed in the annex to the Japanese convention of 1972.

(4) It is a species listed in the appendix to the Russian convention of 1976.

Table 2-6: Migratory Birds Known or with the Potential to Occur in the Region of Influence

Common Name	Scientific Name	Common Name	Scientific Name
American Oystercatcher	*Haematopus palliates*	Lesser Yellowlegs	*Tringa flavipes*
Bald Eagle	*Haliaeetus leucocephalus*	Long-eared Owl	*Asio otus*
Black Scoter	*Melanitta nigra*	Long-tailed Duck	*Clangula hyemalis*
Black Skimmer	*Rynchops niger*	Nelson's Sparrow	*Ammodramus nelsoni*
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Northern Gannet	*Morus bassanus*
Black-legged Kittiwake	*Rissa tridactyla*	Parasitic Jaeger	*Stercorarius parasiticus*
Bobolink	*Dolichonyx oryzivorus*	Prairie Warbler	*Dendroica discolor*
Bonaparte's Gull	*Chroicocephalus Philadelphia*	Prothonotary Warbler	*Protonotaria citrea*
Bridled Tern	*Onychoprion anaethetus*	Purple Sandpiper	*Calidris maritima*
Brown Pelican	*Pelecanus occidentalis*	Razorbill	*Alca torda*
Buff-breasted Sandpiper	*Calidris subruficollis*	Red Phalarope	*Phalaropus fulicarius*
Canada Warbler	*Cardellina Canadensis*	Red-breasted Merganser	*Mergus serrator*
Cerulean Warbler	*Dendroica cerulean*	Red-headed Woodpecker	*Melanerpes erythrocephalus*
Clapper Rail	*Rallus crepitans*	Red-necked Phalarope	*Phalaropus lobatus*
Common Eider	*Somateria mollissima*	Red-throated Loon	*Gavia stellata*
Common Loon	*gavia immer*	Ring-billed Gull	*Larus delawarensis*

Common Tern	*Sterna hirundo*	Roseate Tern	*Sterna dougallii*
Cory's Shearwater	*Calonectris diomedea*	Royal Tern	*Thalasseus maximus*
Double-crested Cormorant	*phalacrocorax auritus*	Ruddy Turnstone	*Arenaria interpres morinella*
Dovekie	*Alle*	Rusty Blackbird	*Euphagus carolinus*
Dunlin Calidris	*alpina arcticola*	Saltmarsh Sparrow	*Ammodramus caudacutus*
Eastern Whip-poor-will	*Antrostomus vociferous*	Seaside Sparrow	*Ammodramus maritimus*
Evening Grosbeak	*Coccothraustes vespertinus*	Semipalmated Sandpiper	*Calidris pusilla*
Golden Eagle	*Aquila chrysaetos*	Short-billed Dowitcher	*Limnodromus griseus*
Golden-winged Warbler	*Vermivora chrysoptera*	Snowy Owl	*Bubo scandiacus*
Great Black-backed Gull	*Larus marinus*	Surf Scoter	*Melanitta perspicillata*
Great Shearwater	*Puffinus gravis*	Thick-billed Murre	*Uria lomvia*
Herring Gull	*Larus argentatus*	Whimbrel	*Numenius phaeopus*
Hudsonian Godwit	*Limosa haemastica*	White-winged Scoter	*Melanitta fusca*
Kentucky Warbler	*Oporornis formosus*	Willet	*Tringa semipalmata*
King Rail	*Rallus elegans*	Wilson's Storm-petrel	*Oceanites oceanicus*
Leach's Storm-petrel	*Oceanodroma leucorhoa*	Wood Thrush	*Hylocichla mustelina*
Least Tern	*Sterna antillarum*		

2.15 Air Quality

2.15.1 Air Quality

With respect to the National Ambient Air Quality Standards (NAAQS, 40CFR§81.333), Kings County is currently classified as in 'marginal' nonattainment of the 2008 and 2015 8-hour ozone standards and 'maintenance' for the 2006 particulate matter less than 2.5 microns ($PM_{2.5}$) standard. The county is part of the Ozone Transport Region. Ozone levels are controlled through the regulation of its precursor emissions, which include oxides of nitrogen (NO_x) and volatile organic compounds (VOC). Sulfur dioxide (SO_2) is a precursor of $PM_{2.5}$ (USACE 2014). The project is anticipated to produce emissions associated with diesel-powered construction equipment that will be temporary in nature, spanning only the construction period.

2.16 Climate

The project ROI for this resource, Gravesend Anchorage, has a predominantly humid subtropical climate with an oceanic influence, which gives New York City and New York Harbor Anchorages a warmer winter than more inland cities of similar latitude in New York State. This results in frequent short-term meteorological changes. Southerly winds, often in the form of local sea breezes, have a moderating effect on the local temperature, particularly during the spring and summer months.

Two types of storms are of primary significance in the local region, tropical storms (hurricanes), which typically affect the ROI from July through October, and extratropical storms (Nor'easters), which can occur during the winter. Nor'easters are usually, but not always, less intense than hurricanes but tend to be of longer duration, which can result in flooding and related damage similar to a hurricane due to high water levels and strong storm surge wave conditions. Both

types of storms can cause significant damage to harbor infrastructure as well as the urban environment surrounding the anchorages. The ROI for the climate change and sea level rise analysis is limited to the waters of the New York and New Jersey Harbor area as well as the shorelines and adjacent upland areas proximate to the proposed navigation improvements and dredged material placement areas.

2.17 Climate Change and Sea Level Rise

2.17.1 Climate Change

Climate change and global warming have been observed during the 20th and 21st centuries and have resulted in changes in localized sea levels. The 2014 Intergovernmental Panel on Climate Change (IPCC) report states that over the period of 1901 to 2010, the global mean sea level rose by 0.62 ft. and this rate has been accelerating in recent decades (IPCC, 2014). Data from the Battery, NY tidal gauge which lies within the project ROI indicate that local waters of the project ROI has experienced an increase of 1.36 ft. of relative sea level rise between 1856 and 2006, with nine inches of this since 1950. The mean rate of this rise in water level from 1856-2006 has been 2.77 mm/yr., though the rate has been accelerating in recent decades due to climate change (NOAA, 2019).

The U.S. National Climate Assessment (2012) has established a range of global sea level rise predictions for the year 2100 that all predict sea level rise and range in the predicted value from 0.7 ft. on the low end to 6.6 ft. as a high prediction with intermediate values (1 to 4 ft. expected) between the extremes (U.S. National Climate Assessment 2012, 2018).

The IPCC also predicts local sea level rise, addressing the localized factors of subsidence and oceanic currents at any particular location. Changes to the relative sea level can result from a number of factors including isostatic rebound (a process by which the earth's crust, having been compressed beneath the weight of glaciers, bounces back), faulting and consolidation of sediments in fill structures, and sediment compression caused by groundwater withdrawals (Boon, 2010). Oceanic currents influence local sea level rise on the Atlantic Coast due to temperature and salinity changes in the Atlantic Ocean, which cause pressure gradients between the Gulf Stream and coastal waters to decrease, which then cause coastal waters to rise (Sallenger et al., 2012). As a result of several of these factors, local, relative sea level rise (RSLR) on the mid-Atlantic Coast of the United States from North Carolina northward, including New York City waters, is occurring faster than the global mean rate, and additionally, the rate of sea level rise is accelerating both globally and locally (IPCC, 2018). New York City is especially vulnerable, one of the most vulnerable cities world-wide to impacts from sea level rise and associated higher flood risk (Hallegatte et al., 2013). Waters are rising rapidly in the region, and with much of New York City being low-lying, the City is considered one of the most vulnerable U.S. Cities to coastal flooding at this time and expected to remain so into the future (Kopp et al., 2014).

An increase in storm surge events is another issue related to climate change because the IPCC predicts an increase in the intensity of hurricanes, which increases wind speed and precipitation, leading to flooding and property damage (IPCC, 2014). New York City is also prone to significant storm surges roughly every five years (Colle et al., 2010), which could be influenced by the effects of climate change, increasing in frequency and/or intensity (IPCC, 2018, Patricola and Wehner 2018; Knutson et al. 2010). It is expected that the kind of flooding

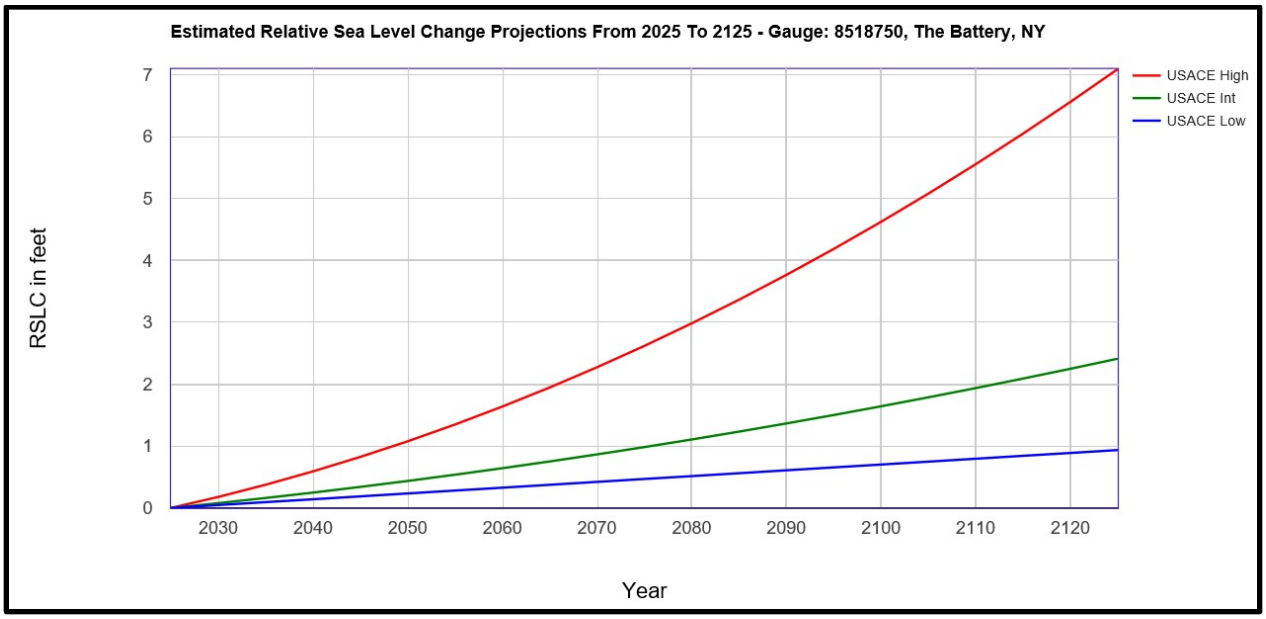
that occurred during Hurricane Sandy in 2012 will be 17 times more likely to occur by 2100 than it was in the 1800s (Lin et al., 2016).

2.17.1 Sea Level Change

The USACE engineering documents require that planning studies and engineering designs evaluate the entire range of possible future rates of sea-level change, represented by three scenarios of “low,” “intermediate,” and “high” sea-level change (USACE, 2013; USACE, 2014).

In 2013, the USACE published Engineering Technical Letter 1100-2-1, “Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation” (USACE, 2014) and Engineering Regulation ER-1100-2-8162, “Incorporating Sea Level Change into Civil Works Programs” (USACE, 2019), which provide guidance to the USACE for how to incorporate sea level change for civil works projects.

The use of sea level change scenarios as opposed to individual scenario probabilities underscores the uncertainty in how local relative sea levels will actually play out into the future. At any location, changes in local relative sea level reflect the integrated effects of global mean sea level change plus local or regional changes in geologic, oceanographic, or atmospheric origin. Our local rate, determined by the USACE Sea Level Change Calculator, using the Battery, NY tide gauge, and the Sandy Hook, NJ tide gauge, both of which are within the project ROI and have been operating for decades, was determined using the USACE sea level rise predictor (USACE, 2019), the results can be seen in the following figure 2-14 projected to year 2125. This estimated sea level change projection accounts for the project life from construction start. An increase in Relative Sea Level Rise (RSLR) will serve to benefit shallow anchorages, providing greater depths and reduction in dredge requirements to maintain those depths. However, all sea level scenarios will have some impact to the coast and the infrastructure located within its proximity. The lowest scenario yielding the least impact (approximately 1 foot by 2125). The highest scenario yielding the greatest impact (approximately 7 feet by 2125). Section 5.9 of the report and the H&H Sub-Appendix in Engineering Appendix A also provide RSLR projections to year 2125 and discussion on the three scenarios.



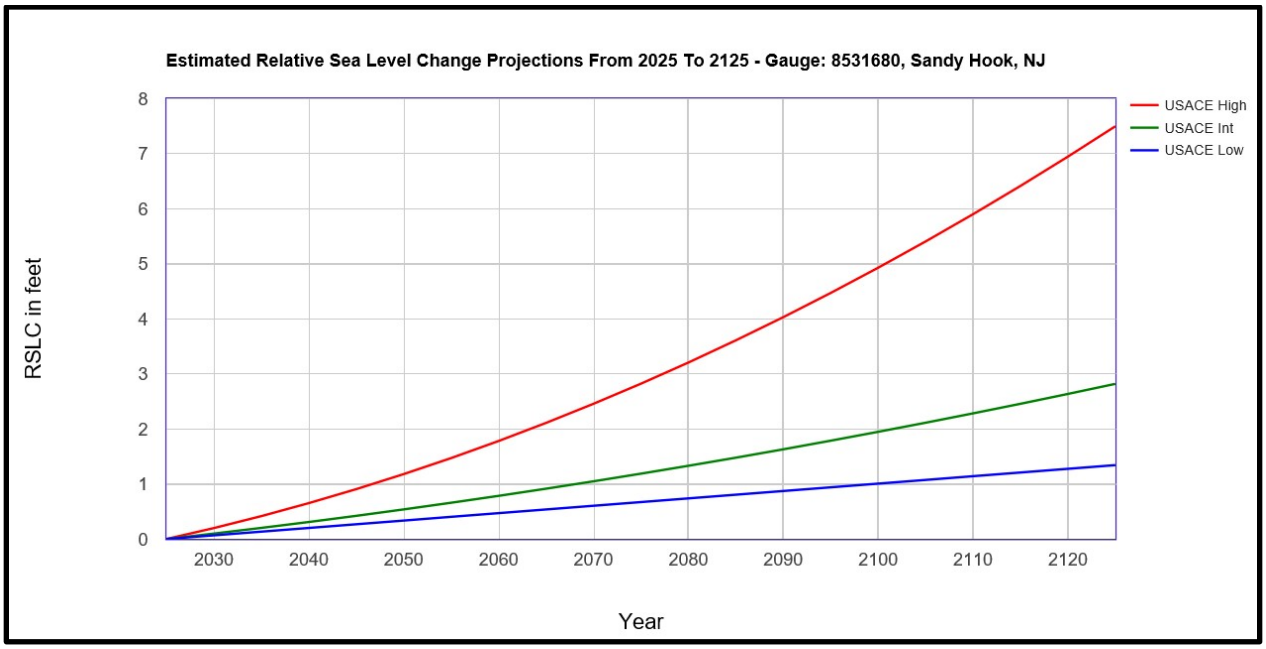


Figure 2-14: Projected Relative Sea Level Rise in the Project ROI, Lower New York Harbor, Considering Both Tide Gauges in the Local Area

2.18 Floodplains

Through Executive Order (EO) 11988, Federal agencies are required to evaluate all proposed actions within the one percent annual exceedance (100-year) floodplain. Actions include any Federal activity involving 1) acquiring, managing, and disposing of Federal land and facilities, 2) providing Federally undertaken, financed, or assisted construction and improvements, and 3) conducting Federal activities and programs affecting land use, including, but not limited to, water and related land resources planning, and licensing activities. In addition, the 0.2 percent

annual exceedance (500-year) floodplain should be evaluated for critical actions or facilities, such as storage of hazardous materials or construction of a hospital. The EO provides an eight-step process to evaluate activities in the floodplain that generally includes 1) determine if the proposed action is in the floodplain, 2) provide public review, 3) identify and evaluate practicable alternatives to locating in the one percent annual exceedance floodplain, 4) identify the impacts of the proposed action, 5) minimize threats to life and property and to natural and beneficial floodplain values and restore and preserve natural and beneficial floodplain values, 6) reevaluate alternatives, 7) issue findings and a public explanation, and 8) implement the action. Proposed actions may have limited impacts such that the eight-step process may vary or be reduced in application, which is the case for this project.

The proposed action, deepening of anchorages associated with the navigation channels of New York and New Jersey Harbor, is not in the floodplain, should not impact floodplains under the criteria listed under EO 11988, as any dredged material should be placed either in the offshore HARS site or at upland disposal sites able to handle and properly store contaminated dredged materials, should any be within the dredging footprint. Potential sites that are both permitted and actively accepting material include the nearby UTEX A380 Development Site, numerous smaller sites in the State of New York, and several large sites in the Commonwealth of Pennsylvania including Hazelton Mines and Coplay Quarry. Deepening of the harbor anchorages will not influence the chance of flooding in the local floodplain. No effect on local floodplains due to project implementation is expected, and impacts to floodplains, as defined in EO 11988, are dismissed from further consideration.

2.19 Noise and Vibration

Noise and vibration is often defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or diminishes the quality of the environment. Response to noise varies by the type and characteristics of the noise source; distance from the source; receptor sensitivity; and time of day. Noise can be intermittent or continuous, steady or impulsive, and it may be generated by either mobile or stationary sources, and changes in noise are typically measured and reported using a weighted sound intensity (or level), which represents sound heard by the human ear and is measured in units called decibels (dBA). The ROI includes the navigation channels dredged, dredged material placement/disposal areas, and the transit of dredging vessels through the project area. The geographic extent of noise impacts is dependent upon factors such as the type of dredging equipment, length of time spent dredging, and environmental conditions such as wind speed and direction. Noise can carry for considerable distance underwater and overland. Underwater noise from blasting as well as other dredged related noise as part of the New York Harbor Channel Deepening and Kill Van Kull were examined in detail (USACE, 2004, 2012) and impacts to underwater life were determined to be minor from blasting as well as various dredging equipment types, relative to the background noise already present in lower New York Harbor. No blasting is necessary for the proposed dredging.

The dredges used in the New York and New Jersey Harbor for dredging are mechanical or hydraulic dredges. Sound production is largely influenced by sediment properties – to excavate hard, cohesive and consolidated soils, the dredger must apply greater force to dislodge the material (Robinson et al., 2011) Sound from dredges can be variable, depending on the phase of operation, and the type of dredge used, but typically occur at low frequencies (<500) (Reine et al., 2014).

2.19.1 Ambient Noise in New York and New Jersey Harbor ROI

Ambient noise is the all-encompassing sound associated with a given environment at a specified time. Humans hear sound from 0-140 dB, and sound above this threshold is associated with pain. There are several sources of ambient noise within the ROI which can be attributed to both natural (wind waves, fish, tidal currents, mammals) and anthropogenic (general city noise, commercial and recreational ships/vessels, dredging, pile driving, etc.) inputs. While some anthropogenic underwater noise is produced intentionally (e.g., naval sonar, echosounders), most noise sources are an incidental by-product of human activity (e.g., shipping, construction) (Farcas et al. 2016). For underwater environments, ambient noise includes tides, currents, and waves, as well as noise produced by marine mammals, fish, invertebrates, and by humans. Low frequency noise levels such as these, as well as those produced by human activities, tend to carry long distances in the water but are attenuated the farther away one is from the source.

The ROI is a working waterway with adjacent land use characterized largely by industrial, commercial, and residential uses along with significant roadways and associated truck and car noise. In 2017, 2,011 container vessels carrying 3,396,469 TEU utilized the port, following a decreasing trend in number of calls/year while at the same time the volume has been increasing (3,214,338 TEU and 2,251 vessel calls at the port in 2015). The trend indicates that fewer, larger ships call at the port, a common trend world-wide as container vessels increase in size. Noise sources for vessels include cranes, whistles, and various motors for propulsion, while adjacent dockside noise sources include cranes, trucks, cars, and loading and unloading equipment. One unique feature of the port is the express rail network, which was built to support movement of TEU via rail, which reduces the need to transport cargo to its final destination by truck, though most cargo is still transported by truck. Ship traffic, including ships transiting the study area can generate sounds ranging from 10 to 1,000 Hz, with most produced at low frequencies (20-500 Hz) with a noise level as high as 188dB at 1 m for a 54,000 gross ton container ship traveling at 21.7 knots, though the dB decreases rapidly with distance though shipping traffic can elevate noise in a wide area (by 15-20 dB at frequencies below 300 Hz) (McKenna et al., 2013).

Cruise ports in the local area carried 730,617 passengers in 2017, such vessels typically dock at the Cape Liberty Cruise Port in Bayonne or the Brooklyn Cruise Terminal, and may also use the New York and New Jersey navigation channels and anchorages as they make their way to and from their docking facilities.

A major source of noise in the project ROI is the network of roads servicing the area, with major highways having noise levels as high as 70-75db within and adjacent to the road during periods of high traffic (Department of Transportation, 2018). Urban noise is also significant. The following map illustrates the number of noise complaints in New York City for 2015 (DiNapoli, 2018) (Figure 2-15). The area across the river, north east of major harbor facilities seems to an area where nuisance noise occurs frequently. This area, according to the Department of Transportation, is the region of highest traffic noise in New York City (Department of Transportation, 2018).

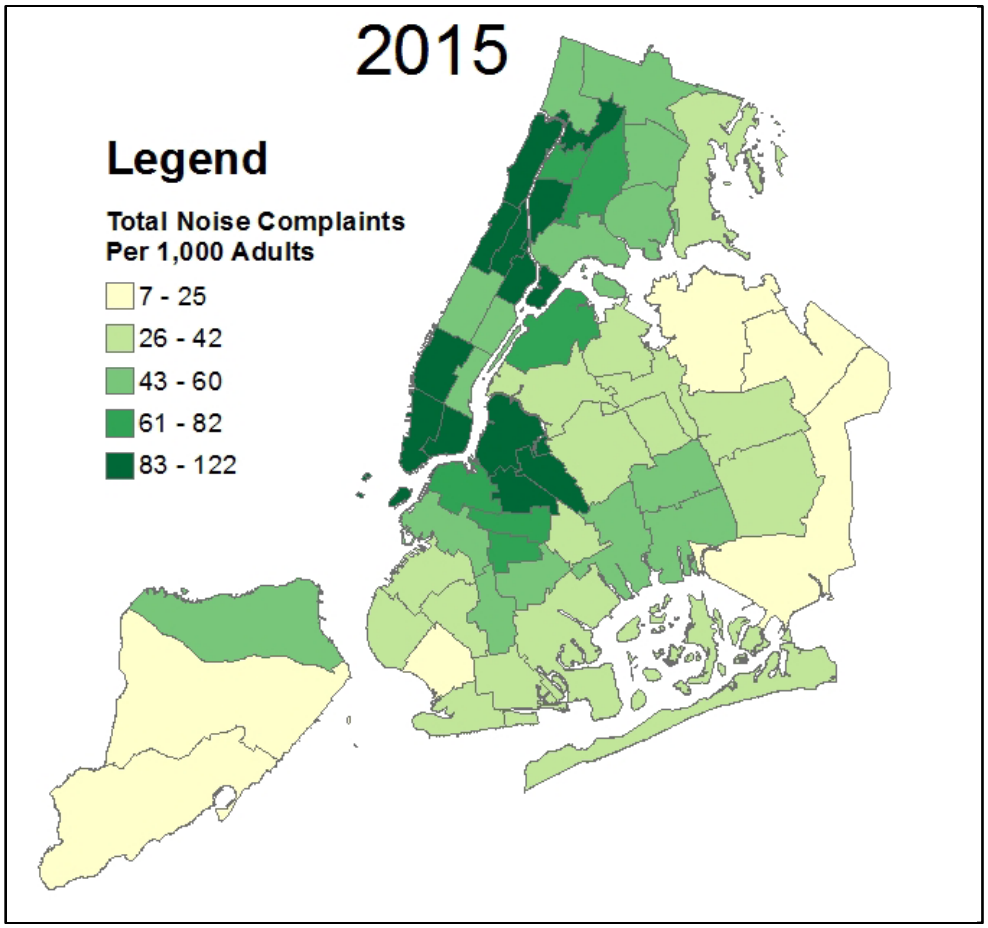
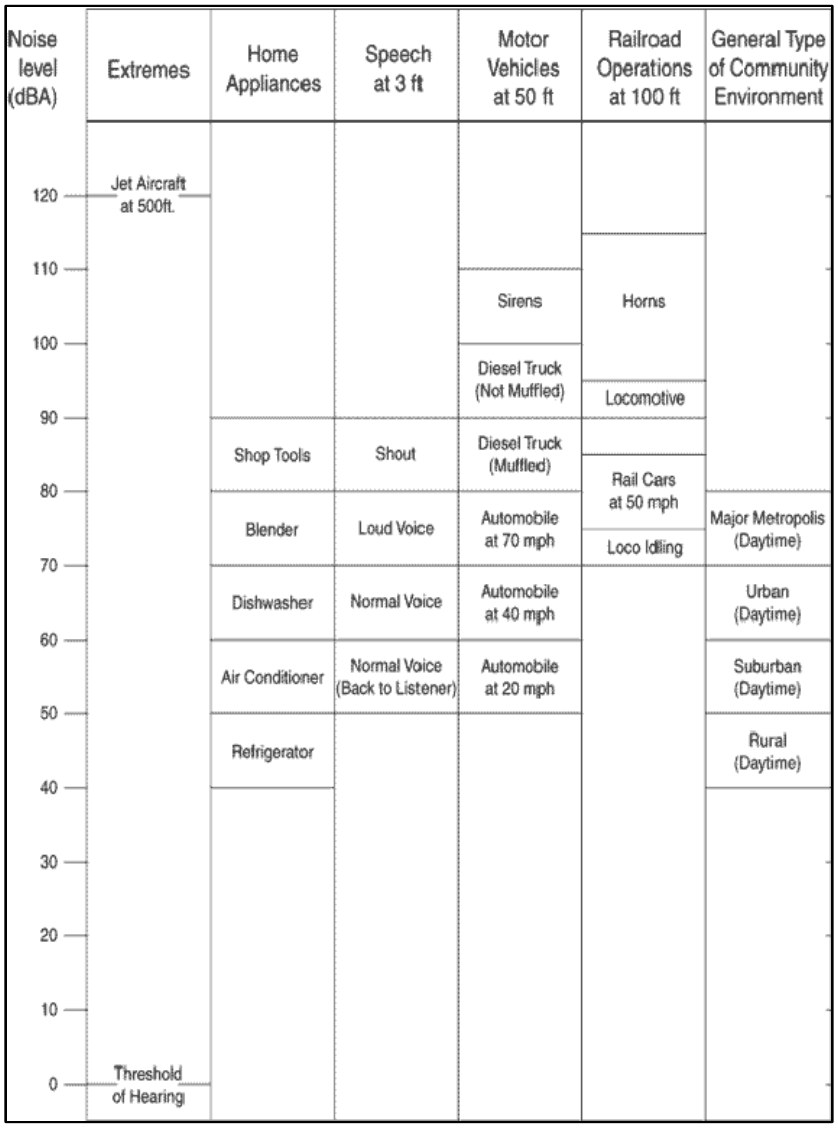


Figure 2-15: Total Noise Complaints

In addition to noise and vibrational inputs attributed to this being a bustling commercial, industrial, and military center, the potential areas affected by noise and vibration include expanses of parks, open spaces, and greenways, as well as residential areas. These areas are considered to be sensitive noise receptors, or areas where human activity may be adversely affected by excess noise inputs. These receptors include, but are not limited to schools, churches, cemeteries, homes, golf courses, and parks/playgrounds. Sensitive noise receptors are located in areas that generally have lower ambient noise levels, which can range anywhere from 40 dBA (quiet suburban area at night) to 70 dBA (Table 2-7).

Blasting rock to deepen the navigation channels has also been done at times, and these impacts have been examined (USACE, 2004) when the Kill Van Kull channel deepening required underwater blasting to remove stone. This blasting did not significantly increase the noise level in the terrestrial environment, though it did temporarily and significantly but briefly increase underwater noise while blasting was done in the marine environment.

Table 2-7: Displays a Comparison of Noise Levels for Various Sound Sources (USDOT N.D.)



2.20 Occupational Health and Safety

The occupational health and safety (OSH) environment in the ROI of this project would be in the work of navigating to dredging site(s) and dredged material placement/disposal sites, dredging operations to deepen any anchorage selected for construction, and placing the dredged materials at placement/disposal sites. Risk factors in this OSH environment include operation of heavy equipment, potential exposure to hazardous materials in the dredged material and water, and navigational hazards (American National Standards Institute, 2011).

Phases of work each have their own set of potential hazards. Dredging projects involve the following phases of work:

- Mobilization
- Hydrographic surveying
- possible underwater cable movement/replacement

- Hazards to navigation
- Dredging
- Disposal site activities
- Severe weather precautions
- Demobilization

Contractors are required to prepare an Accident Prevention Plan (APP) for review by USACE safety staff prior to begin given notice to proceed with work (U.S. Army USACE of Engineers. EM-385-1-1). The APP specifies the safety and occupational health plan, responsible personnel and their OSHA certifications, safety training for all personnel, protective equipment, clothing and Personal Protective Equipment (PPE) are typically required for workers. PPE includes:

- Appropriate clothing for weather conditions;
- Steel toed boots;
- Hard hat;
- Protective eyewear matched to work type (e.g., cutting or welding);
- Work vest/personal floatation device; and
- Hearing protection if exposed to various decibel levels for a scale of time periods.

Safety hazards in dredging operations are evident in a USACE safety checklist for dredges. Safety concerns include food safety, personal hygiene, vermin, first aid and emergency medical care, eye injuries, water safety, fire hazards, electrical hazards, slip and fall hazards, and equipment hazards. There are a total of 40 items on the checklist (USACE, 2009).

Bureau of Labor Statistics data on reported nonfatal occupational injuries tabulates the rate of cases reported for 100 workers over a year (200,000 hours). Separate statistics for dredging are not available, but the rate for heavy and civil engineering construction, where dredging would be placed, was 3.0. In comparison, the rate for all industries was 3.4, with securities brokerage at 0.02 the low and the highest was air transport with 7.5 (Bureau of Labor Statistics, 2015).

2.21 Utilities

The ROI for utilities are the footprint(s) of any anchorages proposed for dredging. Some sites may have underwater utility cables within them, as several NOAA Identified cable areas are located in the lower New York Bay area. If a site that has a cable area within the dredged footprint is selected, a detailed survey of utilities will be necessary to identify any utility lines that may be impacted by dredging. No cable area lies within the USACE anchorages.

2.22 Cultural Resources

2.22.1 Definition of Resource

Several Federal laws and regulations have been established to manage cultural resources, including the National Historic Preservation Act (NHPA) of 1966, the Archeological and Historic Preservation Act of 1974, the American Indian Religious Freedom Act of 1978, the Archeological Resource Protection Act of 1979, the National Environmental Policy Act (NEPA), and the Native American Graves Protection and Repatriation Act of 1990. In addition, DoDI 4710.02, *Department of Defense Interactions with Federally-Recognized Tribes* (2006), governs DoD interactions with Federally-recognized tribes and EO 13175, *Consultation and Coordination with Indian Governments* (2000), charges Federal departments and agencies with regular and meaningful consultation with Native American tribal officials in the development of policies that

have tribal implications. As definitions of significance vary by law and regulation, a common practice is to use the NHPA, under this significance is defined by meeting one or more of the following criteria for inclusion on the National Register of Historic Places (NRHP):

"The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and: 1) that are associated with events that have made a significant contribution to the broad patterns of our history; or 2) that are associated with the lives or persons significant in our past; or 3) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or 4) that have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR 60.4).

2.22.2 Archaeological and Historic Context

The New York City area was at the southeastern margin of the continental glacier, which began to recede around 13,000 years ago. Rock and gravel carried by the glacier deposited at this margin, known as a terminal moraine, dammed up the glacial meltwater forming a lake. About this time 13,000 years ago the first known inhabitants, Paleoindians, were inhabiting North America. Although not abundant, there is evidence they inhabited the New York City area. The Paleoindian Period gives way to the Archaic Period 9,000 years ago. Like the Paleoindian, Archaic people were hunter-gatherers, with a low population density, estimated to have been 100-125 persons per 100 square kilometers. While it is possible that submerged archaeological sites have survived the early Holocene inundation of Upper and Lower New York Bay, the possibility is slim. In a systematic coring of sediments in these areas Schuldenrien et al. (2014) examined geological and ecological evidence in developing a GIS model of archaeological sensitivity (potential). Their results were that Gravesend, Stapleton, and Red Hook anchorage areas had low archaeological sensitivity, although Bay Ridge Flats had moderate archaeological sensitivity.

Toward the end of the Archaic Period, around 3,000 years ago the subsistence focused increasingly on shellfish and other marine resources. The time from then until the 17th century is called the Woodland Period, and it is marked by the introduction or development of ceramics. During the Late Woodland Period maize agriculture was added to the subsistence regimen. Submerged sites from the Paleoindian and early part of the Archaic Period may have survived inundation, and could be buried beneath the bay floor. Native Americans of the Eastern Woodlands built canoes from hollowed out tree trunks and others from birch bark over frames. Occasionally, the former type are found submerged or buried.

Although there is some possibility of submerged early prehistoric archaeological sites within the ROI of this project, there are no tribal lands or treaty areas within the ROI. Four federally recognized tribes were contacted: The Delaware Nation, the Delaware Tribe of Indians, the Shinnecock Tribe, and the Stockbridge Munsee Community of Wisconsin. Only the Delaware Nation responded, and did not specify any special cultural significance to the ROI of this project.

The earliest known exploration of New York Bay was by Giovanni da Verrazzano, an Italian mariner exploring for the French, in April of 1524. Verrazzano explored the coast from Cape Fear to Narragansett Bay, but did not venture far into the bays or rivers, and the French did not

follow up with efforts in this part of North America. In 1609, Henry Hudson, an Englishman exploring on behalf of the Dutch, entered not only New York Bay but sailed 150 miles up the river that would later bear his name. The Dutch did follow up on his reconnaissance, and established a trading post on Manhattan in 1613. The settlement grew with the Dutch West India Company arriving in 1623, and the founding of the town of New Amsterdam in 1625. As the 17th century Atlantic trade circuit evolved, ships would sail from Europe to Africa, sail the trade winds to the West Indies, then up the east coast of North America. New York Bay became an attractive last stop before sailing back to Europe, with the lengthy avenue of the Hudson River reaching inland to furs and other goods. The Dutch trade came into competition with that of the English, and during a period of tensions leading up to the Second Anglo-Dutch War the English seized New Amsterdam in 1664.

Renaming the town New York the English revved up their own trading patterns. Privateering was also active from the port, sometimes verging into piracy. The most infamous of the latter was Captain Kidd. By the 1720's more than 200 ships were calling at New York. The number mushroomed over the next 50 years to more than 700 in 1772. The Port of New York continued its impressive growth into the 19th century with two-thirds of American imports and one-third of its exports flowing through the harbor by 1860. Most merchant vessels of the time were sailing ships, but ferries and tugs under steam were already plying the inshore waters. Throughout the 19th century and into the 20th canals and railroad connections fueled commerce, making New York among the busiest ports in the world. Serving the fleets of merchant ships and local transport in 1916 there were 559 tugs or tow boats, 125 ferryboats, and 5,433 "unrigged craft" including barges, lighters, etc.

Engebretsen (1982) inventoried shipwrecks known or presumed to have occurred in the New York Harbor area. The list counts some 380 vessels of various types ranging from 51 to 6,109 tons, where the tonnage is listed; and ranging in date of loss from 1760 to 1959. So this impressive list does not count any vessels that may have been lost in the area during the first century and a half of the port.

The New York State Cultural Resource Information System (CRIS) shows no archaeological sites or shipwrecks in or near the anchorage study areas. The survey for the Port of New York and New Jersey channels deepening (Lydecker and James, 2002) comes close to the anchorage areas, bordering the anchorage (Figures 2-16 & 2-17).

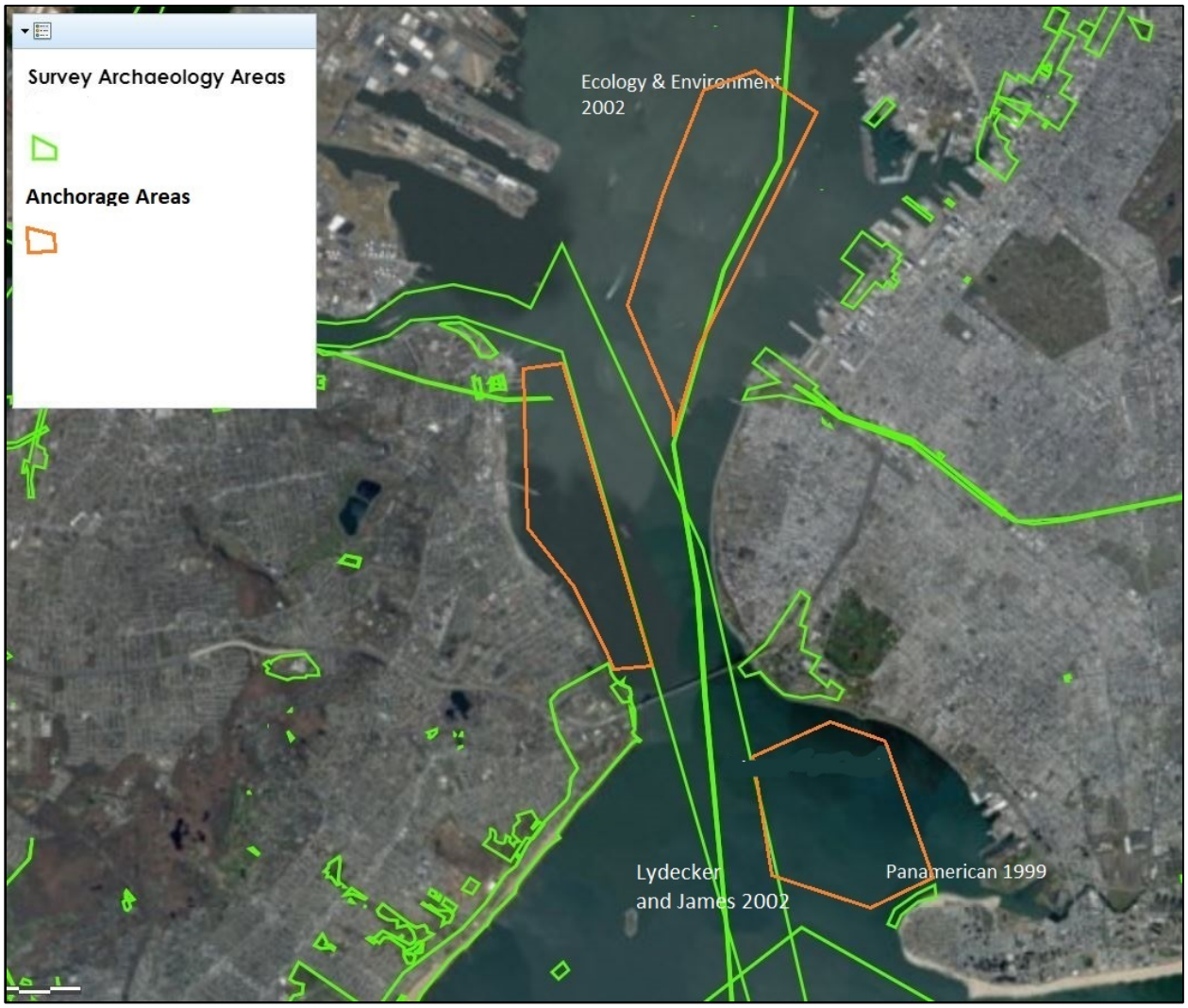


Figure 2-16: Previous Archaeological Surveys near Project Areas (New York State Division for Historic Preservation, 2019)

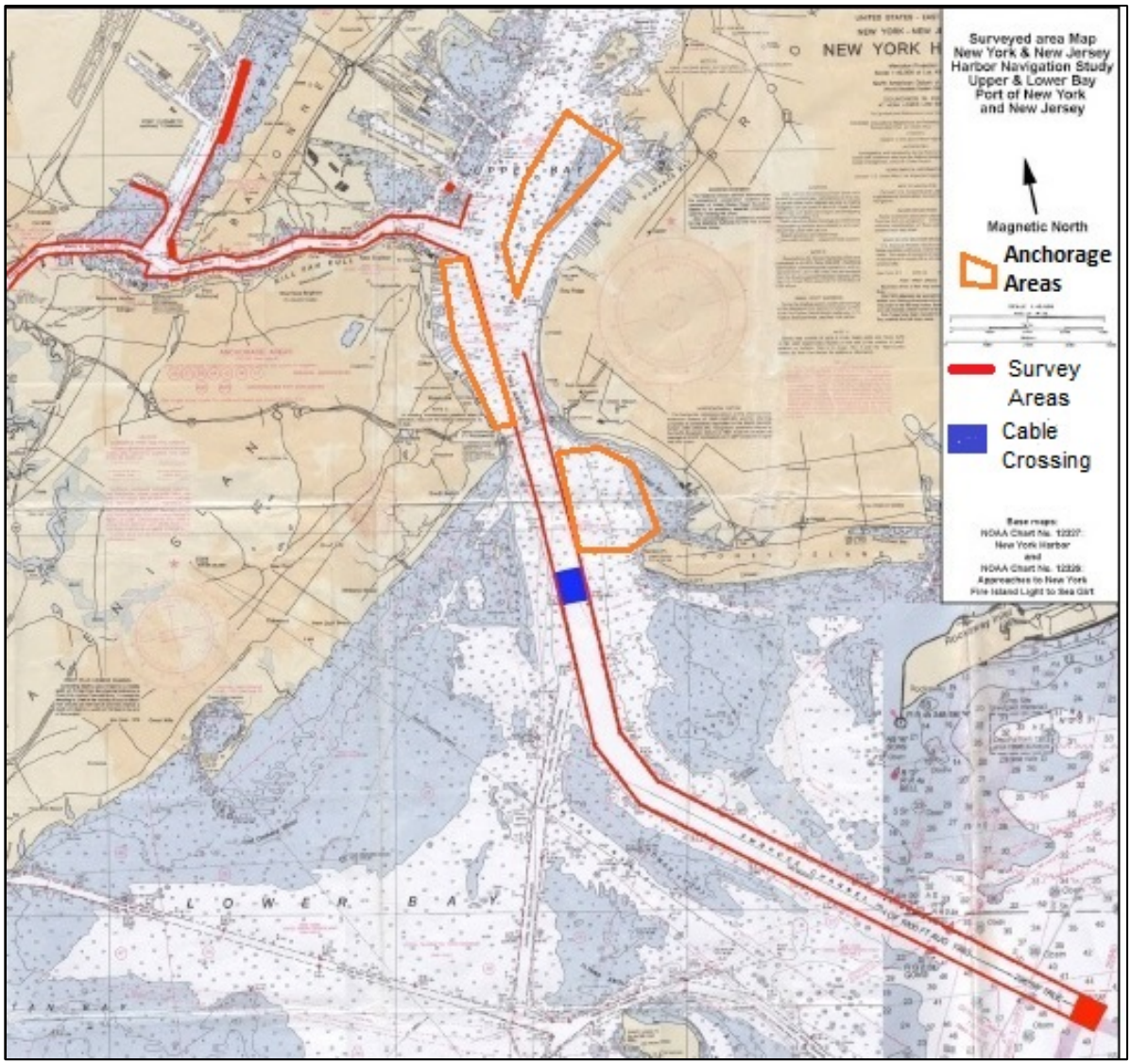


Figure 2-17: Cultural Resource Remote Sensing Survey Locations (Red) (Lydecker and James 2002)

2.23 Aesthetics

The ROI for visual resources are the industrial, commercial, urban, residential, recreational, and tourist sites as well as transportation routes which include bridges and various highways, with views of the New York Harbor Anchorage area. All dredged material that meets or exceeds the level of contamination criteria for ocean disposal will be placed at one or many upland sites already designed and used for the purpose of dredged material placement and their associated view sheds.

The visual experience is dependent upon the pattern of the land (i.e., the topography), the pattern of water bodies, vegetation, and manmade development at any location. Views along the Anchorages include a waterfront with a mix of industrial, commercial, naval, marine, and urban shoreline uses. Within the vicinity of the proposed project, the topography is relatively flat.

Because much of the ROI is low elevation with very slight relief, viewers can generally see long distances from locations that are only slightly higher than the surrounding area. From the ground level, these locations are only near the river bank. Due to the highly urbanized nature of New York City, with numerous tall buildings throughout the City, the view of the water is quickly lost as you move inland. However, both multi-story commercial and residential buildings can provide attractive waterfront views. Depending on the height of the individual building, these views can be had from significant distance inland from the riverfront. The residential neighborhood that has the best view of the waterfront and also has a small beach, is Sea Gate, which lies south of the Gravesend Anchorage at the far southeast corner of the Anchorage ROI, south of the Verrazzano-Narrows Bridge. This is the only bridge that crosses the Anchorage Area and connects Staten Island to Brooklyn, and its associated view shed. The bridge crosses the Narrows, which separates Lower New York Bay from Upper New York Bay, which receives the flow of the Hudson River.

Undeveloped land in the Anchorage view shed is limited to thin strips along either side of the Verrazzano-Narrows Bridge ranging from 0.05-0.1 miles wide and up approximately a mile long, the Ocean Breeze, Last Chance Pond, Calvert Vaux, Dyker Beach, Shore Road, Liberty State, Red Hook parks, and the South Beach Wetlands (Figure 2-18). There are also a number of recreational ballfields, mainly along the eastern bank of the Hudson River. Two golf clubs with extensive recreational acreage, the Liberty National and Bayonne, lie immediately north and south, respectively, of the MOTBY on the Port Jersey Peninsula. The remaining view shed area is industrial, commercial, and urban. Very heavily developed commercial and urban land dominates the view shed on either side of area from the Verrazzano-Narrows Bridge to the confluence of the Kill Van Kull with the Hudson River and includes the Stapleton Anchorage Site which lies immediately west of the New York Harbor Anchorage Channel. Industrial facilities include numerous piers and associated port infrastructure, dominates the view shed from North of the Kill Van Kull confluence to just south of the Governors Island, which lies approximately 0.75 miles north of the of the Red Hook and Bay Ridge Flats, the northernmost Anchorage areas and within the view shed.

Throughout the industrial portion of the ROI view shed, there are numerous towering cranes and related land-side infrastructure used for loading and unloading ships along the waterfront. Navigation within the ROI includes large commercial deep draft navigation vessels, smaller tugs and service vessels, as well as large and small recreational vessels. Large recreational vessels include national and international passenger ships (cruise liners), which can dock at the Manhattan Cruise Terminal at piers 88 and 90 along the Hudson River within the project ROI.

Figure 2-18: Gravesend Anchorage Area and Associated View shed, Verrazzano -Narrows Bridge in the Background.

2.24 Recreation

Although opportunities for recreation are present within the ROI, the major use of the navigation channels and associated anchorages within the ROI is for marine vessel navigation to/from marine terminals and shipyards via the New York and New Jersey Harbor channels.

Recreational boaters as well as charter fishing boats and cruise liners also use the lower New York Bay for access to attractions along the river, which includes non-commercial fishing as well as land-based sites and tourist attractions, depending on the activity, as well as for access from points upstream in the Hudson River to pursue similar activities.

Recreationalists use the lower New York Bay waters of the ROI for access to the Atlantic Ocean. Along the waterfront there are many recreational attractions that draw recreationists to the waterfront for concert venues. Several marinas and sailing clubs with docks and boat ramps border the project area, including the Brooklyn, Manhattan, and Pier 90 terminals which serve cruise liners as well as other vessels. There are several parks within the local area outside but near the ROI, which provide a view of the waters of the ROI. These include the John Paul Jones, Dykers Beach, Bath Beach, Bensonhurst, Calvert Vaux, Kaiser, Coney Island Creek,

Von Brissen, and Ocean Breeze Parks. All of these provide mainly land-based recreation, there is the Midland Beach on the west shore near the Ocean Breeze Park which provides for several miles of beach access.

Recreational fishing in the project ROI, the main recreational activity other than passing cruise liners, occurs mostly from boats and includes estuarine and marine fish species (e.g., porgy, weakfish, striped bass, summer flounder, and bluefish) as well as blue crab, the latter of which is also harvested commercially at a limited scale in New York Bay and the Hudson River. The project ROI is generally closed to shellfish harvest, though areas outside of it along cleaner oceanic waters are, in some cases, open to such harvest (https://www.dec.ny.gov/outdoor/103483.html). Overall, recreational opportunities are limited to boat-based activity due to the offshore, deep water nature of the anchorages in the immediate area of proposed construction.

3 FUTURE WITHOUT PROJECT ECONOMIC AND NAVIGATION CONDITIONS

Under the future without-project condition, there would be no modifications to the New York New Jersey Harbor Anchorages. The future without project (FWOP) condition is assessed through a determination of how relevant elements of the existing condition are likely to change over time in the absence of a Federal alternative. It is also the no action alternative considered for NEPA purposes throughout this report.

Elements used to determine the FWOP include commodities, vessels, and port facilities. The change in commodity volume over the period of analysis is informed by IHS Markit, the Port Authority of New York and New Jersey, and U.S. Gross Domestic Product. The composition of the vessels carrying those commodities is informed by empirical data, Clarksons, Lloyd's Register, and other east coast fleet forecast used for USACE deep draft navigation studies.

The number of vessel calls needed to move these commodities is based on analysis conducted of vessel loading patterns extracted from existing condition datasets and load factors. Port facilities/infrastructure are assumed to remain constant over time. With the exception of the movement of containerized cargo, the proportion of commodities as distributed across marine terminals is assumed to be similar to the existing condition. Segregated trade routes were not analyzed because the benefit of anchorage improvement is not affected by the origin or destination of vessels. Analysis within the FWOP condition examine an expanded APE to look at the larger port and regional economics associated with the port activities. Additional information can be found in Appendix B Economics.

Under the FWOP condition, existing navigational uses within the project area (industry, commerce, and recreation) would continue into the foreseeable future with the predicted increase in vessel traffic assumed to occur over the period of analysis.

3.1 Navigation Features

The existing Federal Navigation Project (See Figure 1-2) includes the main navigation channels and associated anchorages in the PONYNJ. The main channels depths are constructed and maintained at -50 ft MLLW. The Port includes six container terminals that receive vessels currently ranging in size from the Sub-Panamax up to Post-Panamax Generation 3 vessels.

Gravesend Bay Anchorage is located along the New York New Jersey Harbor Ambrose Channel in the Lower Bay. The anchorage is -47 ft. MLLW depth. This allows vessels with a 46 ft. draft to use the anchorage.

The Red Hook anchorage is situated alongside the Anchorage Channel in the Upper Bay and is -45 ft. MLLW in the southern area, -40 ft. MLLW in the middle section, and -35 ft. MLLW in the northern section. The anchorage boarders Bay Ridge Flats which is an approved USCG anchorage.

The Port of New York and New Jersey currently has six container terminals in New York and New Jersey (Figure 3-1). The existing total container throughput capacity for New York and New Jersey Harbor is 9.5 million twenty equivalent units (TEUs). The following sections briefly describe each terminal.

Figure 3-1: Containerized Cargo (Source: Port Authority of New York and New Jersey)

3.1.1 Port Newark Container Terminal (PNCT)

The Port Newark Container Terminal (PNCT) is a 272 acre facility at the Port Newark Marine Terminal in New Jersey. It has 13 Post-Panamax Class ship-to-shore cranes; seven accommodating the Super Post-Panamax vessels with an outreach of up to 225 ft. and six accommodating the Post-Panamax vessels with an outreach of up to 167 ft. Moreover, PNCT has a total berthing area of 4,400 linear ft.

This container facility is transited via the Kill Van Kull. Vessel traffic is subject to delays due to weather closures at Bergen Point or delays caused by a vessel transiting one-way through the Kill Van Kull. In calendar year 2017 (typical year), Bergen Point zone restrictions were enforced 53 times due to visibility and wind restrictions. For vessels greater than 1,100 feet long, there is no “bail out” spot for the vessel in the event of inclement weather conditions or a vessel outbound in the Kill Van Kull Reach.

3.1.2 Global Container Terminals (GCT) Bayonne, New Jersey

The Global Container Terminals (GCT) Bayonne is a 169 acre facility located outside the Bayonne Bridge in New Jersey, making it the closest container terminal to the entrance of NYNJ Harbor. It has eight Post-Panamax ship-to-shore cranes; two of which are able to accommodate the Super Post-Panamax vessels with an outreach of up to 203 ft., and six are able to handle the Post-Panamax vessels with an outreach of up to 185 ft. GCT Bayonne has a total berthing length of 2,678 ft. It also has an associated rail line, ExpressRail Port Jersey.

For vessels greater than 1,100 feet long, there is no “bail out” spot for the vessel in the event of inclement weather conditions. Larger vessels utilizing this terminal may at time have to return to the Ocean anchorage if port closures occur due to inclement weather or emergencies.

3.1.3 Maher Container Terminal

The Maher Container Terminal is a 450 acre facility located at the Elizabeth Port Authority Marine Terminal in Elizabeth, New Jersey. It has 20 ship-to-shore cranes; among them, six are Super Post-Panamax cranes with an outreach of up to 225 ft. and 11 are Post-Panamax cranes with an outreach of up to 200 ft., and three are Panamax cranes with an outreach of up 135 ft. In addition, it has a total berthing length of 10,128 ft. The Maher Container Terminal is immediately adjacent to the ExpressRail Elizabeth (EMT), which has 18 working tracks totaling 43,000 linear ft.

This container facility is transited via the Kill Van Kull and is thus are subject to are closures at Bergen Point due to environmental reasons or delays caused by an outbound vessel transiting the one-way traffic Kill Van Kull. Vessel Traffic Services provided Bergen Point restrictions for calendar year 2017 which was a typical year for the harbor and closures. The zone restrictions were enforced 53 times due to visibility restrictions and wind restrictions navigating Bergen Point due to the sharp angle of the turn. For vessels greater than 1,100 feet long, there is no “bail out” spot for the vessel in the event of inclement weather conditions or a vessel outbound in the Kill Van Kull Reach.

3.1.4 APM Terminals

The APM Terminal is a 350 acre facility located at the Elizabeth Port Authority Marine Terminal in Elizabeth, New Jersey. It has 14 ship-to-shore Post-Panamax cranes; eight Super Post-Panamax cranes with an outreach of 217 ft. and six Post-Panamax cranes with an outreach of up to 165 ft. It has a berthing length of 6,001 ft. Like the Maher Terminal, APM terminal is also adjacent to the EMT.

This container facility is transited via the Kill Van Kull and is thus subject to are closures at Bergen Point due to environmental reasons or delays caused by an outbound vessel transiting the one-way traffic Kill Van Kull. Vessel Traffic Services provided Bergen Point restrictions for

calendar year 2017 which was a typical year for the harbor and closures. The zone restrictions were enforced 53 times due to visibility restrictions and wind restrictions navigating Bergen Point due to the sharp angle of the turn. For vessels greater than 1,100 feet long, there is no "bail out" spot for the vessel in the event of inclement weather conditions or a vessel outbound in the Kill Van Kull Reach.

3.1.5 Global Container Terminal (GCT) New York

The Global Container Terminal (GCT) New York is a 210 acre facility located at the Howland Hook Marine Terminal, near the Goethals Bridge, in Staten Island, New York. It has six ship-to-shore Post-Panamax cranes, with an outreach of up to 164 ft. It has a berthing length of 3,012 ft. This terminal is uniquely equipped with an expanded on-dock rail transfer service, by ExpressRail Staten Island (ESI), which has five tracks totaling 6,000 linear ft.

3.1.6 Red Hook Container Terminal

The Red Hook Container Terminal is a 65.6 acre facility located in Brooklyn, New York. It has five cranes with an outreach of up to 150 ft., and the length of ship berth is 2,080 ft. The Red Hook Terminal connects to EMT via barge service.

For vessels greater than 1,100 feet long, there is no "bail out" spot for the vessel in the event of inclement weather conditions. Larger vessels utilizing this terminal may at time have to return to the ocean anchorage if port closures occur due to inclement weather or emergencies.

3.2 Navigation Features

3.2.1 Without Project Condition Maintenance Dredging Assumptions

The New York and New Jersey Harbor Anchorages are dredged periodically to maintain anchorage dimensions. Under without-project conditions, maintenance dredging is projected to continue. Existing condition dimensions are presented in Table 3-1. An analysis of maintenance dredging records from 1975 to 2019 indicates that maintenance dredging occurs on an infrequent basis (once per decade or less) with an average dredged material volume of 640,000 CY in Red Hook Flats per event and only a single event of maintenance has occurred in Gravesend with 250,000 CY removed. Note that these estimated volumes are anticipated to be placed at HARS without the need for any new offshore disposal areas (further information can be found in Appendix A, Section 2.5, and Appendix D).

Table 3-1: Port of New York and New Jersey Anchorages, Depth

Anchorage	Depth (ft., MLLW)
Gravesend Bay	-47
Red Hook Flats	-35 to -45

3.3 Gravesend Bay Anchorage

Gravesend Bay Anchorage is located along the New York New Jersey Harbor Ambrose Channel. The anchorage is constructed to the authorized dimensions of 2,270 ft. wide, 1.08 nautical miles in length, and -47 ft. MLLW depth. This allows vessels with a 46 ft. draft to use the anchorage (note that tidal shifts may allow vessels of deeper draft to use the anchorage but not stay through a complete tidal cycle). In the FWOP condition there will be no changes to this anchorage.

3.4 Red Hook Flats Anchorage

The Red Hook anchorage is situated in the Upper Harbor, along the Anchorage Channel. Authorized to -45 ft. MLLW in the southern area, -40 ft. MLLW in the middle section and 35 ft. MLLW in the northern section. The anchorage boarders Bay Ridge Flats which is an approved USCG anchorage. In the FWOP condition there will be no changes to this anchorage.

3.5 Economic Conditions -- Projected Growth

3.5.1 Socio-Economics

The socioeconomics of the community area are summarized in this section as part of the FWOP conditions. The parameters used to describe the demographic and socioeconomic environment include recent trends in population of the United States as a whole, the states of New Jersey and New York, and the selected counties of Bergen and Hudson Counties in New Jersey and Kings, Richmond, and New York Counties in New York. These make up the immediate economic study area of the New York and New Jersey Anchorage study, private sector employment, and wage earnings by sectors for New York and New Jersey.

3.5.2 Population

New York is ranked as the third largest state in the U.S. in terms of resident population, as of 2010, with 19,378,102 million residents. New Jersey is ranked the 11th largest state with 8,791,894 residents. Between the years of 1990 and 2010, New York and New Jersey's populations combined increased by 19.34 percent, from 26 million to 28 million persons, as shown below in Table 3-2. All counties within the immediate economic region of the New York New Jersey Harbor Anchorages have seen a population growth during this period.

Table 3-2: NYNJ Population Trends 1990 to 2010

Geography	Population			Percent Change		
	1990	2000	2010	1990 to '00	2000 to '10	1990 to '10
Bergen County, NJ	825,517	884,118	905,116	7.09%	2.37%	9.64%
Hudson County, NJ	552,990	608,975	634,266	10.12%	4.15%	14.69%
Kings County, NY	2,299,000	2,465,326	2,504,700	7.32%	1.59%	8.94%
Richmond County, NY	378,977	443,728	468,730	17.08%	5.63%	23.68%
New York County, NY	1,487,536	1,537,195	1,585,873	3.38%	3.16%	6.61%
New Jersey	7,757,000	8,414,350	8,791,894	8.47%	4.48%	13.34%
New York	18,280,000	18,976,457	19,378,102	3.8%	2.11	6%
United States	248,709,873	281,421,906	308,745,538	13.15%	7.48%	24.14%

3.5.3 Employment

New York and New Jersey's employment in 2010 averaged 12 million as shown in Table 3-3-3. Statewide the service-providing and trade industries comprise 73 percent of employment between the two states, transportation and utilities comprise 18 percent of total employment, followed by education and health services with 17 percent of total employment. Within the region, New York County makes up 27 percent of employment for the entire state of New York and Bergen and Hudson counties comprise 11 percent and six percent of employment in New Jersey, respectively.

Table 3-3: New York and New Jersey Private Sector Employment – 2010

NAICS Industry Sector		Bergen County, NJ	Hudson County, NJ	Kings County, NY	New York County, NY	Richmond County, NY	NY	NJ	US
101	Goods-producing	47,361	12,143	42,544	57,021	7,081	788,446	396,936	18,775,587
1011	Natural resources and mining	282	83	93	135	0	27,156	11,836	1,798,592
1012	Construction	13,794	3,833	22,909	30,290	5,867	305,601	129,166	5,489,499
1013	Manufacturing	33,285	8,227	19,542	26,596	0	455,689	255,933	11,487,496
102	Service-providing	328,188	177,645	412,797	1,778,083	79,205	6,117,358	2,738,145	87,425,645
1021	Trade, transportation, and utilities	100,361	56,478	106,064	234,397	23,394	1,450,950	803,973	24,442,734
1022	Information	8,316	7,391	6,693	129,353	2,000	251,171	78,889	2,703,886
1023	Financial activities	22,852	37,998	28,989	346,637	3,282	663,250	239,561	7,401,812
1024	Professional and business services	68,460	26,743	38,149	456,767	6,712	1,095,755	580,188	16,712,011
1025	Education and health services	74,895	27,826	175,599	295,666	30,870	1,579,113	563,914	18,656,160
1026	Leisure and hospitality	37,160	15,190	30,643	223,570	8,232	732,122	332,835	13,006,814
1027	Other services	13,346	4,561	22,672	86,513	4,265	319,678	123,236	4,349,563
	Total, Private and Government	422,456	228,120	492,125	2,280,092	93,156	8,340,732	3,735,703	127,820,442

3.5.4 Income

Median household incomes for the selected counties in 2010 are shown in Table 3-4, with Bergen County showing the highest median household income at $100,310 which is higher than the state median income of $69,811. Richmond County has an average median household income of $71,084 which is also above the state median household income of $55,603.

Table 3-4: Median Household Income

Geography	Median Household Income	% of State/US* Median Household Income
Bergen County, NJ	$100,310	1.44%
Hudson County, NJ	$55,275	.79%
Kings County, NY	$61,158	1.09%
Richmond County, NY	$71,084	1.28%
New York County, NY	$64,971	1.17%
New York	$55,603	1.07%*
New Jersey	$69,811	1.34%*
US	$51,914	

3.6 Commodity Forecast (Containers)

Empirical data for containerized imports and exports was collected to observe historical trends and fluctuations. Table 3-5 and

Table 3-6 display container growth rates for imports and exports, respectively. Growth rates were derived using information from IHS Markit, Port Authority of New York and New Jersey and Gross Domestic Product tonnage over the period from 2018 to 2045. The “2018-2025” growth rates displayed in the aforementioned tables were applied to the 2017 import and export tonnage estimates to yield the import and export tonnage estimates displayed in Table 3-7 Table 3-8, and 3-9. The “2025-2030” growth rates were then applied to the resulting 2025 import and export tonnages to yield the 2030 import and export tonnage estimates. This process continued through 2045, the last year in which commodity growth was assumed.

Table 3-5: Import Container Growth Rates

IMPORT CONTAINER GROWTH RATES					
	2018-2025	2025-2030	2030-2035	2035-2040	2040-2045
New York New Jersey Harbor	5%	3%	2%	2%	2%

Table 3-6: Export Container Cargo Growth Rates

EXPORT CONTAINER GROWTH RATES					
	2018-2025	**2025-2030**	**2030-2035**	**2035-2040**	**2040-2045**
New York New Jersey Harbor	4%	3%	2%	2%	2%

Table 3-7: Forecasted Import Tonnage

	2025	**2030**	**2035**	**2040**	**2045**
Total	30,564,600	36,248,600	40,021,400	44,186,900	48,785,900

Table 3-8: Forecasted Export Tonnage

	2025	**2030**	**2035**	**2040**	**2045**
Total	15,055,400	17,622,800	19,457,000	21,482,000	23,718,000

Table 3-9: Forecasted Total Tonnage

	2025	**2030**	**2035**	**2040**	**2045**
Total	45,620,000	53,871,400	59,478,400	65,668,900	72,503,800

3.7 Fleet Forecast/ Containerships

The containership fleet has grown over time. Vessel length is the critical factor in determining anchorage capability because of the swing radius during tide changes. According to harbor pilots, containerships with lengths up to 1,100 ft. are allowed to use Gravesend anchorage even though they swing into the adjacent channel. Containerships with lengths greater than 1,100 ft. must return to the ocean to anchor because there isn't a place north of the Verrazzano Bridge for large containerships to anchor. The efficiency to be gained by improving the Gravesend anchorage is the reduction in transportation cost of container vessels having to return to the ocean as opposed to anchoring in the harbor. According to the harbor pilots, vessels may need to unexpectedly anchor due to environmental conditions such as wind or fog or if an outbound vessel is delayed transiting Kill Van Kull, which is one way traffic.

Even though it is not officially tracked how often containerships must return to the ocean due to lack of anchorage capacity, it was estimated by the Pilots to happen 24 times in 2017. When taking the number of vessels that called with lengths 1,100 ft. or more in 2017 this equals 13 percent of the fleet. This assumption is carried forward throughout the study.

As part of the New York New Jersey Harbor study, empirical data and other east coast forecasts were analyzed to project changes in the fleet composition. The Clarksons and Lloyds Register-Fairplay historical register of vessels were compared to world fleet projections as well. In order to estimate the forecast to New York New Jersey Harbor, several steps were needed. First, historical port call data (2012-2018) was used to establish a representative call list used for economic model calibration. The commodity forecast was distributed among the vessels classes. Data from the existing condition was used to represent annual vessel loading patterns.

Finally, the rate of change between vessel class TEU capacities was used to represent changes in fleet composition over the period of analysis.

Table 3-10 shows the transition for the containership fleet over the period from 2025 through 2045. One trend of note is that the percentages of total capacity allocated to Sub-Panamax, Panamax, and post-Panamax Generation 1 and post-Panamax Generation 2 containerships decline. However, neither drop to zero, suggesting that there are some services on routes that the use of smaller vessels is preferable even when larger vessel options exist. Post-Panamax Generation (PPX) 3 and 4 vessels see growth throughout the forecasted period. As of 2018, the largest container vessels to call New York and New Jersey Harbor were classified as a PPX3 and had capacities of approximately 14,000 TEU's. The analysis assumes that some of the PPX3 calls in the historical record will be replaced by PPX4 calls over time.

Table 3-10: Forecasted Containership Fleet

Year	Sub-Panamax	Panamax/ Generation1	Generation 2	Generation 3	Generation 4
2025	2%	30%	42%	19%	8%
2035	2%	19%	38%	31%	11%
2045	2%	10%	31%	41%	16%

Table 3-11 provides detail on the projected number of containership calls over the analytical period by model year. As discussed above, growth in container throughput at New York and New Jersey Harbor is anticipated over the period from 2018 to 2045. Thus, the number of calls needed to carry the goods forecasted to pass through the Harbor increases over time. As previously mentioned it is estimated 13 percent of the vessel calls with lengths greater than 1,100 ft. could be impacted by current anchorage capacity. The 13 percent of calls is carried forward in the analysis and the number of assumed impacted calls is shown in Table 3-11: Containership Vessel Calls by Model Year.

Table 3-11: Containership Vessel Calls by Model Year

Year	Total Calls	Number of Impacted Calls
2025	1936	65
2035	2459	114
2045	2931	169

The FWOP condition is characterized using the number of vessel calls, system times, and transportation costs expressed in average annual equivalent dollars. The system times and transportation cost include the additional return trip to the harbor entrance. The number of vessel calls include containerships moving through New York and New Jersey Harbor. Port cost consists of the cost of all traffic moving from the entrance of the harbor to and through New York and New Jersey Harbor. Voyage cost represents the cost of the vessel at sea, however the route group was set to default and had a value of one nautical mile. Using one nautical mile for

the default route group for all vessel classes ensured the change in port cost would reflect a more accurate estimate of the benefit associated with anchorage improvements. The improvement to the anchorage affects the port cost and the cost of the additional transits to the ocean in the FWOP condition.

Table 3-12: FWOP Condition Transportation Cost, AAEQ

FWOP Condition Transportation Cost					
Model Year	**# Calls**	**System Time (hours)**	**Voyage Cost**	**Port Cost**	**Transportation Cost**
2025	7,520	171,762	$10,000	$28,322,000	$28,332,000
2035	8,477	198,863	$10,000	$27,749,000	$28,759,000
2045	9,729	228,714	$10,000	$30,350,000	$30,359,000
AAEQ FWOP Transportation Cost					**$29,328,000**

Note: AAEQ = Average Annual Equivalent

4 PLAN FORMULATION

The USACE plan formulation process identifies existing and anticipated problems and opportunities to develop planning objectives. It then identifies and refines specific measures that could be combined to assemble alternative plans that comprehensively meet the planning objectives. These alternatives are then repeatedly screened, refined, and compared with each other to identify the alternative that best balances the many factors that need to be considered to make a prudent decision. Preliminary plans were formulated by combining management measures. Each plan was formulated in consideration of the following four criteria described in the P&G:

- Completeness: Extent to which the plan provides and accounts for all necessary investments or actions to ensure realization of the planning objectives;
- Effectiveness: Extent to which the plan contributes to achieving the planning objectives;
- Efficiency: Extent to which the plan is the most cost-effective means of addressing the specified problems and realizing the specified opportunities, consistent with protecting the nation's environment; and
- Acceptability: Workability and viability of the alternative plan with respect to acceptance by Federal and non-Federal entities and the public, and compatibility with existing laws, regulations, and public policies.

PLAN FORMULATION RATIONALE

Plan formulation was conducted with a focus on achieving the Federal objective of water and related land resources project planning, which is to contribute to NED consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Alternative plan development considered study area problems, opportunities, and constraints.

Alternative plan evaluation includes all effects, beneficial or adverse, to each of the four evaluation accounts identified in the Principles and Guidelines (1983), which are National Economic Development, Environmental Quality, Regional Economic Development, and Other Social Effects.

The underlying rational of the Planning Process is described in ER 1105-2-100 as "Formulation of Alternative Plans."

- Alternative plans are formulated to identify ways of achieving planning objectives within the project constraints, in order to solve the identified problems and realize opportunities.
- Structural and nonstructural management measures are identified and combined to form alternative plans.
- Planners will keep focus on complete plan(s) while doing individual tasks, to ensure their plans address the problems of the planning area.
- Section 904 of the WRDA (Water Resources Development Act) of 1986 requires USACE to address the following during the formulation and evaluation of alternative plans:
    - Enhancing national economic development (NED) - including benefits to particular regions that are not transfers from other regions
    - Protecting and restoring the quality of the total environment
    - The well-being of the people of the United States
    - Preservation of cultural as well as historical values

- Nonstructural measures must be considered in the plan formulation process as means to address problems and opportunities.
- Revised costs of mitigation will be included in the final cost/benefit analysis.

4.1 Problems, Opportunities, Objectives, and Constraints

4.1.1 Problems

The primary problem is that the dimensions of the existing Federal anchorages are insufficient for the larger vessels that use the Harbor now and in the future. This results in cargo transportation inefficiency and increased vessel safety risk.

Currently, larger vessels calling on the Port exceed the maximum dimensions of the anchorages (-47 ft. MLLW and length of 1100 ft.) and are unable to fully utilize the anchorages in the event of channel closures (i.e. weather (visibility or high wind.) As a result, larger vessels must re-transit back to the ocean. Also larger vessels must utilize the navigation channels to make a complete turn, potentially impacting channel traffic.

Multiple issues were identified by key harbor users and stakeholders to support the primary problem as stated above:

- Insufficient anchorage space and width to accommodate all of the vessels that need to anchor for various reasons
- Insufficient depth to accommodate deeper draft vessels that currently use the harbor
- Inadequate depth at Gravesend and Red Hook Flats anchorages

Many of these issues are related to the volume of vessels that utilize both the USACE anchorages in Gravesend and Red Hook Flats and other USCG approved anchorages such as Bay Ridge and Stapleton.

4.1.2 Opportunities

Opportunities are the desirable future outcomes which address the water resource problems and improve conditions in the study area. Opportunities identified for this analysis include:

- Reduce transiting inefficiencies
- Reduce risk to port operations by providing anchorage space for larger vessels that currently do not have available anchorage space
- Preserve use of anchorages for certain types of essential use, such as security boarding at Gravesend

4.1.3 Planning Constraints

Constraints are conditions to be avoided or things that cannot be changed, which limit the development and selection of alternative plans. The planning constraints for this study include avoiding impacts to existing channels in the Federal navigation project and impacts to existing bridges and tunnels within the study area.

There are also specific planning considerations that were identified for the study:

- Avoid impacts to environmental and cultural/historic resources in the study area
- Avoid impacts to the other types of navigation traffic in the harbor, such as ferries, cruise ships, recreational vessels, etc.
- Avoid impacts to other anchorages and channels not included in the Federal navigation project
- Avoid impacts to existing utilities
- Preserve use of anchorages for certain types of essential use, such as security boarding at Gravesend

4.1.4 Objectives

Federal Objective:

The Planning Guidance Notebook (ER 1105-2-100, dated 22 April 2000) states that "water and related land resources project plans shall be formulated to alleviate problems and take advantage of opportunities in ways that contribute to study planning objectives and, consequently, to the Federal objective" (page 2-1). Plan formulation has been conducted for this GRR/EA with a focus on achieving the Federal objective of water and related land resources project planning, which is to contribute to NED consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements (Principles and Guidelines, 1983).

Planning Objectives:

The goal of this study is to reasonably maximize New York New Jersey Anchorages' contribution to the NED, consistent with protecting the Nation's environment, by addressing the physical constraints and inefficiencies in the existing navigation system's ability to safely and efficiently serve the forecasted vessel fleet and process the forecasted cargo volumes. Specific objectives for this study are:

- Reduce navigation transportation costs to and from the Harbor to the extent possible over the period of analysis, starting in the base year for 50 years
- Reduce transportation costs caused by inefficient transiting during channel closures

4.1.5 Assumptions

Modeling (HarborSym) and Planning took into consideration the following assumptions:

- Underkeel Clearance Assumption – Designed to match nominal upper harbor depth of -50 feet.
- Useable Tide – Designed to meet existing harbor; varies approximately 4-5 ft.
- FY 2019 Discount Rate (i) – 2.875%
- Duration (n) – 50 years
- Base Year – 2025
- FY 2019 Price Levels
- Model Years – (2025, 2035, 2045)
- Generic Design Vessel 13-14K TEU Vessel with Length overall (LOA) of 1,200 ft., Beam 158 ft., Design draft 50.0 ft. (Post-Panamax)

4.2 Measures, Screening, and Alternatives

The measures (structural and management/nonstructural) identified were developed with information gathered during workshops with the Harbor Operations Steering Committee for PONYNJ. The PDT conducted a workshop with members of the committee on 22 August 2018 to discuss problems and opportunities with the anchorages. The group was comprised of participants from the Maritime association of the Port of New York/New Jersey, Metro Pilots and Sandy Hook Pilots, the USCG, and the New Jersey Maritime Pilot and Docking commission. The PDT compiled a list of measures for this study during the meeting and utilized these measures as part of the NEPA scoping meeting that was held on 08 November 2018. After the initial meeting the study continued to coordinate and update the Harbor Operations Steering Committee with additional meeting in November 2018, and March and July 2019. The USACE also continued to hold Inter-agency meetings for NEPA coordination. Coordination and consultation letter can be found in the Environmental Appendix (Appendix E)

Structural measures, anchorage deepening and widening, advanced through the screening process to be used in the development of alternatives. Management/nonstructural measure identification and screening is presented below.

4.2.1 Measures and Screening

The universe of applicable measures was developed using input gathered from key harbor users and stakeholders. These measures were then screened based on their ability to meet study objectives and avoid study constraints.

Management/Nonstructural measures

Nonstructural measures identified as potential anchorage improvements to the harbor include:

- Maximize utilization of existing anchorages
- Improve vessel scheduling and timing of transits
- Take advantage of naturally deep areas within the harbor and vicinity as additional anchorage areas

Maximize utilization of existing anchorages: This measure would reexamine the use of existing anchorages to increase the number of vessels that can anchor at the same time. After two meetings with harbor users and the USCG, it was determined that the existing harbor operations are fully utilizing the anchorage space to the maximum potential. In addition, small vessels are currently using virtually all appropriate space remaining in the harbor for anchorage. Considering this, the measure was screened from further consideration.

Improve vessel scheduling and timing of transits: This measure would reexamine the usage guidelines to increase the turnover of vessels to increase the number of vessels that can anchor. After two meetings with harbor users and the U.S. Coast Guard, it was determined that the existing harbor operations are fully utilizing the anchorages to the maximum potential. Harbor operations have already been revised to allow the maximum utilization of anchorages. Considering this, the measure was screened from further consideration.

Take advantage of naturally deep areas within the harbor as additional anchorage areas: This measure would examine areas of the harbor that are not already identified as anchorages for

use as anchorage space. After two meetings with harbor users and the USCG, it was determined that the most optimal areas that are available and have dimensions appropriate for anchorage are currently being used as anchorages by whatever vessels can utilize them. However, users of the harbor suggested that there are areas that could be suitable for tug/barge anchorage in Newark Bay, Raritan Bay, Hudson River, and Perth Amboy. Most likely, this measure would be implemented to accommodate tugs and barges that may be displaced by the enlargement of the footprint of the Gravesend and/or Red Hook Flats anchorages. This measure was carried forward for further consideration.

Structural measures

Measures identified as potential anchorage improvements to the harbor are best considered when categorized by area. Structural measures are also sought to improve anchorage capacity for larger vessels and reduce navigational risk. This risk was communicated to the study team by the USCG in a letter dated 1 April 2019 (see letters from USCG and Harbor Operations Steering Committee in Appendix E). Identified structural measures should alleviate or minimize such risks and improve navigation inefficiencies and meet project objectives.

Structural measures identified as potential improvements to the Gravesend anchorage include:

- Deepen Gravesend anchorage within existing footprint (depth incrementally justified with max set at adjacent channel depth)
- Expand footprint of Gravesend anchorage to accommodate the container design vessel length

<u>Deepen Gravesend anchorage within existing footprint</u>: This measure would examine the incremental justification of additional depth within the existing footprint of the anchorage included in the Federal navigation project. Depth would be evaluated based on the container design vessel and the maximum depth considered would be consistent with the depth of the adjacent Ambrose Channel, considering underkeel clearance and other design considerations. This measure was carried forward for further consideration.

<u>Expand footprint of Gravesend anchorage to accommodate design vessel length</u>: This measure would enlarge the area of the anchorage to fully accommodate the swing space required for the container design vessel. This measure was carried forward for further consideration.

Structural measures identified as potential improvements to the Red Hook/Bay Ridge Flats anchorage include:

- Deepen existing Red Hook Flats anchorage uniformly within existing footprint (depth incrementally justified with max set at adjacent channel depth)
- Deepen existing Bay Ridge Flats anchorage within existing footprint consistent with the depth established for Red Hook Flats anchorage and add this area on to the Red Hook Flats anchorage to expand the Federal anchorage)

<u>Deepen existing Red Hook Flats anchorage within existing footprint</u>: This measure would examine the incremental justification of additional depth within the existing footprint of the anchorage included in the Federal navigation project. Depth would be evaluated based on the design vessel and the maximum depth considered will be consistent with the depth of the

adjacent anchorage channel, considering underkeel clearance and other design considerations. This measure is carried forward for further consideration.

Deepen existing Bay Ridge Flats anchorage within existing footprint and add it to the Red Hook Flats anchorage: This measure would examine deepening the Bay Ridge Flats anchorage within its existing footprint consistent with the depth established for the Red Hook Flats anchorage. By deepening Bay Ridge Flats consistent with Red Hook Flats, the end result is functionally an expansion of the Red Hook Flats anchorage, to be included as part of the Federal navigation project. Note that this measure may be considered whether Red Hook Flats is deepened beyond its current depth or not, but that the depth, which is currently less than Red Hook Flats, must be consistent with that of Red Hook Flats. This measure was carried forward for further consideration.

Structural measures identified as potential improvements to other areas within the harbor include:

- Create a new USACE anchorage on west side of the Ambrose Channel across from Gravesend that would accommodate the design vessel
- Create a new USACE anchorage on the west side of the Ambrose Channel across from Gravesend that would accommodate tug and barge (would provide anchorage for vessels displaced from Bay Ridge Flats and East area of Gravesend)
- Create a new USACE anchorage in Stapleton that would accommodate the design vessel (would provide anchorage for vessels displaced from Bay Ridge Flats and East area of Gravesend)

Create a new USACE anchorage on west side of the Ambrose Channel across from Gravesend that would accommodate the design vessel: This measure would create a new anchorage on the west side of the Ambrose Channel across from the Gravesend anchorage that would accommodate the dimensions of the design vessel. This measure is carried forward for further consideration.

Create a new USACE anchorage on the west side of the Ambrose Channel across from Gravesend that would accommodate tug/barge: This measure would create a new anchorage on the west side of the Ambrose Channel across from the Gravesend anchorage that would accommodate the dimensions of a typical tug/barge. This measure would address the possibility that some tug/barges will be displaced if the Gravesend and/or Red Hook Flats anchorages are expanded beyond their existing footprints into areas that are currently used as anchorage for tug/barge. This measure is carried forward for further consideration.

Create a new USACE anchorage in Stapleton that would accommodate tug and barge: Stapleton is an area that is naturally deep enough to accommodate some smaller vessels and is currently identified as an anchorage by the USCG. Use of Stapleton as an anchorage is part of normal harbor operations, however, it could be deepened, especially in the northern portion, to accommodate deeper vessels and/or more tug/barge. This measure is carried forward for further consideration.

4.2.2 Screening of Measures

Measure were considered as to whether or not they would work towards meeting the study objectives (see Section 4.1.4 and 4.2.1). Table 4-1 provides a summary of which measures were screened out and which were carried forward to be included in the initial array of alternatives.

Table 4-1: Measures Screening Summary

Measure	Carried Forward
Maximize existing utilization of anchorages	No
Improve vessel scheduling and timing of transits	No
Use naturally deep areas as additional anchorages	Yes
Deepen Gravesend anchorage	Yes
Expand footprint of Gravesend anchorage to accommodate design vessel	Yes
Deepen Red Hook Flats anchorage	Yes
Deepen Bay Ridge Flats consistent with Red Hook Flats anchorage	Yes
Create a new USACE anchorage on west side of Ambrose Channel to accommodate design vessel	Yes
Create a new USACE anchorage on west side of Ambrose Channel to accommodate tug/barge	Yes
Create a new USACE anchorage in Stapleton to accommodate tanker and/or tug/barge	Yes

4.3 Initial Array of Alternatives (Formulation of Alternatives)

Once measures were established and initial screening completed (Table 4-1), a PDT meeting was held to develop a plan formulation strategy. A phased approach was established as the best plan formulation strategy. The plan formulation strategy prioritized the evaluation of the anchorages already included in the Federal navigation project over additional improvements to and/or creation of anchorages not currently part of the Federal navigation project. This strategy provides for the cost savings associated with deepening existing anchorages vs. dredging shallower areas for new anchorage development.

This strategy also reduces future maintenance costs and avoids environmental impacts in new areas. Following this strategy, alternatives for the improvement of Gravesend and Red Hook Flats are evaluated first in phase one. Next, phase two considers whether there is additional NED benefit to be gained by making improvements to other existing anchorage areas within the study area, such as Stapleton and the area across from Gravesend.

Table 4-2 shows the eight measures carried forward and assigns an identification number to each one for ease of combining into alternatives. The table also indicates which phase of the plan formulation process each measure will be evaluated in (phase one or two).

Table 4-2: Measures for Formulation of Alternatives

ID	Measure	Phase of Evaluation
1	Deepen Gravesend anchorage	Phase 1
2	Expand footprint of Gravesend anchorage to accommodate design vessel(s)	Phase 1
3	Deepen Red Hook Flats anchorage	Phase 1
4	Expand Red Hook Flats to accommodate design vessel(s)	Phase 1
5	Create a new USACE anchorage on west side of Ambrose Channel to accommodate design vessel(s)	Phase 2
6	Create a new USACE anchorage on west side of Ambrose Channel to accommodate tug/barge	Phase 2
7	Create a new USACE anchorage in Stapleton to accommodate tanker and/or tug/barge	Phase 2
8	Use naturally deep areas as additional anchorages	Phase 2

Next, measures were used to develop alternatives in keeping with the two phase plan formulation strategy (i.e. examine improvements to anchorages that are currently included in the authorized Federal navigation project before looking to add additional anchorage areas).

It is also important to note that there are some key assumptions that are integral to the two phase plan formulation strategy:

- The alternative identified during Phase 1 formulation will be included in the future without project condition in the HarborSym model for the evaluation of Phase 2 alternatives.
- Measures 6 and 8 are considered exclusive for plan formulation purposes due to the fact that their purposes are the same and would create unnecessary redundancy if included in the same alternative plan.
- A No Action/FWOP condition, while not specifically listed in the table, was carried forward through the Final Array of Alternatives to allow a comparison of each alternative in the final array to the no action plan.

The initial array of alternatives is shown below in Table 4-3. Each alternative or combination therefore is designed to reduce navigation transportation costs by providing improved anchorage. Alternatives that meet the second objective are those that can combine deepening and expansion together. These will, to the extent possible, reduce navigation constraints caused by inefficient transiting during channel closures.

Table 4-3: Two Phase Plan Formulation Strategy/Initial Array of Alternatives

Two Phase Plan Formulation Strategy	
Phase 1: Evaluate Measures 1-4 and Select Justified Plan Components for Alternative 1	
Alternative	Plan Components
A	Measure 1 Deep Gravesend only
B	Measure 2 Expand Gravesend only
C	Measures 1 and 2 Deepen and Expand Gravesend only
D	Measure 3 Deepen Red Hook Flats only
E	Measure 4 Expand Red Hook Flats only
F	Measures 3 and 4 Deepen and Expand Red Hooks Flats only
No Action	N/A
Phase 2: Evaluate Measures 5-8 Given Phase 1 Alternative	
Alternative	Plan Components
G	Phase 1 Alternative + Measure 5 only
H	Phase 1 Alternative + Measure 6 only
I	Phase 1 Alternative + Measure 7 only
J	Phase 1 Alternative + Measure 8 only
K	Phase 1 Alternative + Measures 5 and 6 only
L	Phase 1 Alternative + Measures 5 and 7 only
M	Phase 1 Alternative + Measures 5 and 8 only
N	Phase 1 Alternative + Measures 6 and 7 only
O	Phase 1 Alternative + Measures 7 and 8 only
P	Phase 1 Alternative + Measures 5, 6, and 7 only
No Action	N/A

The criteria developed by the PDT to evaluate the alternatives are listed in Table 4-4 and include the alternative's benefits, costs, environmental impacts, and their contribution to the planning objectives and avoidance of constraints.

Table 4-4: Evaluation Criteria

Criteria	Metric	Inventory	Notes
Technically Feasible	Design Criteria	Sufficient width and depth	Design criteria associated with design vessel
Project Costs	Dollars	Dredged Quantities & Unit Costs	Data is available to develop cost estimates. Data will be based on dredge volumes to meet various vessel lengths and depths
Economic Benefits	Dollars	Commodity and Fleet Forecasts	HarborSym will be used to calculate transportation cost savings. Data will be combined with Cost data based on dredge volumes to meet various vessel lengths and depths
Environmental Benefits	Yes/Neutral	Best Professional Judgment	Beneficial use of dredged material
Environmental Impacts	Significance/Intensity	Water Quality Modeling	Potential increase in tidal prism
Contribution to Federal Objective	Y/N	Qualitative Assessment	Systems of Accounts analysis
Meets Planning Objectives	Y/N	List objectives met	
Avoid Planning Constraints	Y/N	List constraints avoided	
Completeness, Effectiveness, Efficiency: Acceptability:	Y/N	Qualitative Assessment	Analysis using the four evaluation criteria

4.4 Focused Array of Alternatives

4.4.1 Screening of Initial Array of Alternatives

Utilizing the evaluation criteria, the alternatives were compared to identify those to carry forward to a focused array.

Technically feasible

The first screening that occurred was to utilize design criteria associated with the design vessel (i.e. the largest vessel that a navigation project is designed to accommodate based on the existing and future fleet). Various design templates were developed to attempt to accommodate the design vessel. Based upon this screening, it was determined that only the alternatives that included both expansion and deepening would be carried forward as neither anchorage currently has sufficient width or depth to accommodate the design vessel – a 1,200 ft. Length Overall All (LOA) vessel (Swing radius equates to 3 times the ship length). The Initial Array was

therefore screened down to a Focused Array of two actionable alternatives in addition to the No Action alternative (Table 4-5).

Table 4-5: Screening of Phase 1 Initial Array of Alternatives

Phase 1 Alternative	Description	Meets Study Objectives	Carried Forward
1-A	Deepen Gravesend anchorage	NO (will not accommodate design vessel)	No
1-B	Expand footprint of Gravesend anchorage to accommodate design vessel(s)	NO (will not accommodate design vessel	No
1-C	Deepen and Expand Gravesend to accommodate design vessel(s)	Possible	Yes
1-D	Deepen Red Hook Flats anchorage	NO (will not accommodate design vessel)	No
1-E	Expand footprint of Red Hook Flats anchorage to accommodate design vessel(s)	NO (will not accommodate design vessel)	No
1-F	Deepen and Expand Red Hooks Flats to accommodate design vessel(s)	Possible	Yes

4.4.2 Screening of Focused Array of Alternatives

The team next examined the Focused Array of alternatives (Alternatives C and F) in light of the environmental impacts, costs, and benefits to determine the viability of the plans and their contribution to the planning objectives.

Various designs were analyzed for each alternative and information generated including an estimate of volume of dredged material, rough order of magnitude cost estimates, preliminary economic benefits, and environmental impact identification. The designs were organized by depth and width of the design template to accommodate a vessel swing template (details can be found in the Engineering and Cost appendices A & D). Designs that were below and exceeded the design vessel requirements were also examined. The study examined the following designs between depths of -50 to -53 ft.:

Alternative 1 F

- Red Hook Flats, 3,000 ft. diameter. This plan would accommodate a vessel up to 1,000 ft. in length, but not the design vessel. Red Hook is currently maintained by USACE to depths of 35 ft. to 45 ft.
- Red Hook Flats, 3,600 ft. diameter. This plan would accommodate the design vessel of 1,200 ft. in length.

Alternative 1 C

- Gravesend, 3,000 ft. diameter. This plan would accommodate a vessel up to 1,000 ft. in length, but not the design vessel. Gravesend is currently maintained by USACE to a depth of 47 ft.
- Gravesend, 3,600 ft. diameter. This plan would accommodate the design vessel of 1,200 ft. in length.
- Gravesend, 4,000 ft. diameter. This plan would accommodate the design vessel, as well as a vessel up to 1,300 ft. in length.

The cost per cubic yard of material was estimated using preliminary designs for remaining Phase 1 alternatives (Alternatives 1 C and F) as discussed above. Rough Order of Magnitude (ROM) costs were developed for each design utilizing projected volumes and associated history of construction costs. These costs indicated a significant jump in cost as design templates encountered shallower depths and increased distance from HARS (proposed dredged material placement site).

4.4.3 Economics

The designs were utilized to determine the benefits associated with each anchorage. The preliminary economic analysis determined that at each location the benefits are relatively similar and that project implementation cost would be the driver to determine the location of improvements and justification of a project. In addition, analysis of the vessel classes utilizing the current anchorages determined that benefits would only be achievable from the cost savings associated with the reduction of the transit times of containerized vessels. While a variety of other vessels utilize the anchorages, current depths and widths are sufficient for these other vessels. Therefore, the savings in transportation cost would be relatively the same for each alternative and that accommodation of the design vessel (See section 4.1.5) would be necessary to achieve project benefits. Early estimates anticipated benefits to be roughly $1.2 million annually (at FY19 2.875% annual discount rate) and would therefore support a total project cost not to exceed approximately $30 million.

4.4.4 Environmental

Environmental analysis indicated that expansion into the Bay Ridge Flats Area for the creation of an expanded Red Hook Flats anchorage would likely have more environmental impacts than expanding the Gravesend anchorage due to the fact that these two flats areas, as defined via bathymetry (depth, benthos and sediment type), are regulated habitats under the MSFCMA-EFH Amendment, the CWA and CZMA, for winter flounder early life stages, and as pertains to

potential habitat loss or exchange. Bay Ridge - Red Hook Flats is a relatively shallow area and has had little modification over its history.

4.4.5 Red Hook Flats

Once cost data was obtained, the team was able to review Red Hook Flats designs associated with Phase 1 Alternative 1-F and conduct project screening. In examining potential designs and layout of Red Hook Flats, it was determined that, in order to meet the requirements of the design vessel, a 3,600 ft. design template would be required. Placement of this template indicated that the design would not fit within Red Hook Flats proper and that expansion into Bay Ridge Flats would be required. However, the cost of this design far exceeded the anticipated benefits.

All designs for this anchorage would require a large volume of dredge material removal. Projected costs were in excess of double the benefits. In addition, expansion into Bay Ridge Flats would likely have more environmental impacts. This is due to the shallower waters, which serve as critical spawning habitat for the winter flounder, a species of special interest in New York Bay, as well as being more attractive to many fish and wildlife species as shallower waters tend to be more productive than deeper waters. Because of these reasons, Red Hook Flats location was further screened out as the costs far exceeded anticipated project benefits.

4.4.6 Gravesend

In examining the designs associated with Phase 1 Alternative 1-C, it was determined that the Gravesend designs capable of meeting the requirements of the design vessel also exceeded the anticipated project benefits. However, designs associated with the 3,600 ft. template were much lower than those at Red Hook Flats. On the other hand, the expansion and deepening of the Gravesend anchorage to a 3,000 ft. template was determined to produce less than anticipated benefits as that template design was unable to accommodate the design vessel. The team then examined whether the existing designs could be modified and if a hybrid transitional design that accommodates cost restrictions could be developed while still accommodating the design vessel. Specifically, the team examined the possibility of reducing the projected dredge volume by designing the template with effectively a 3600 ft. swing but that that had dredge volumes equivalent to the 3,000 ft. template. This would be utilized to create a hybrid design.

4.4.7 CEEA Criteria

Information from the Environmental, Economics, and Costs were utilized to help under the screening of the alternatives. The analysis of the focused array of alternatives provided above is displayed in the table below relative to the four Plan Formation criteria (Table 4-6):

- Completeness: Extent to which the plan provides and accounts for all necessary investments or actions to ensure realization of the planning objectives;
- Effectiveness: Extent to which the plan contributes to achieving the planning objectives;
- Efficiency: Extent to which the plan is the most cost-effective means of addressing the specified problems and realizing the specified opportunities, consistent with protecting the nation’s environment; and

- Acceptability: Workability and viability of the alternative plan with respect to acceptance by Federal and non-Federal entities and the public, and compatibility with existing laws, regulations, and public policies.

Table 4-6: Screening of Phase 1 Focused Array of Alternatives, CEEA criteria

Phase 1 Alternative	Completeness	Effectiveness	Efficiency	Acceptability	Carried Forward
No Action	Required for NEPA				Yes
1-F Red Hook 3000 ft.	Yes	No, does not accommodate design vessel	Not cost effective, Costs > Benefits	Acceptable No issues	No
1-F Red Hook 3600 ft.	Yes	Yes	Not cost effective, Costs > Benefits	Acceptable Env. Issue: Requires expansion into Bay Ridge Flats	No
1-C Gravesend 3000 ft.	Yes	No, does not accommodate design vessel	Not cost effective, Costs > Benefits	Acceptable No issues	No
1-C Gravesend 3600 ft.	Yes	Yes	Not cost effective, Costs > Benefits	Acceptable No issues	No
1-C Gravesend 4000 ft.	Yes	Yes	Not cost effective, Costs > Benefits	Acceptable No issues	No
1-C Gravesend Hybrid	Yes	Yes	Benefits > Costs	Acceptable No issues	Yes

4.4.8 Screened Focused Array

Alternative 1-C and the No Action alternative were therefore carried forward with the premise that design modifications to 1-C were possible (Table 4-7).

Table 4-7: Focused Array of Phase 1 Alternatives, Evaluation Summary

Phase 1 Alternative	Description	Meets Study Objectives	Carried Forward
No Action	Required for NEPA	No	Yes
1-C	Deepen and Expand Gravesend to accommodate design vessel(s)	Possible with re-design	Yes
1-F	Deepen and Expand Red Hooks Flats to accommodate design vessel(s)	Not economically achievable and potential environmental impacts	No

Efforts to derive a specific Alternative 1-C design that accommodated both the cost restrictions as well as the dimensions of the design vessel ultimately resulted in a hybrid design which expands the anchorage to 3,000 ft. wide but will accommodate a swing template of 3,600 ft. at Gravesend. The design reduces dredging volumes, and yet still provides adequate space for the design vessel. By taking advantage of existing conditions whereby vessels are currently permitted to swing out into the Federal channel up to 1,000 ft., widening the eastern portion of the anchorage to a total anchorage width of 3,000 ft. (Figure 4-1) would accommodate a 3600 ft. diameter design. The changes in the design over the traditional design originally considered is as follows:

- Gravesend, 3,000 ft. wide footprint will be dredged but a 3,600 ft. diameter will be delineated that utilizes the already deep areas within the western side of the eastern anchorage and channel, with steeper approach angle (60 degrees instead of 45 degrees). This plan would accommodate a vessel up to 1,000 ft. in length within the 3,600 ft. diameter capability and accommodate the design vessel with some swinging into the Ambrose Channel.

Therefore, on the basis of these considerations, it was determined that Alternative 1-C (hybrid design) could be constructed to meet the design vessel dimensions at cost that would provide economic benefits because the dredging volume for the hybrid design alternative is similar to that for the 3,000 ft. design template.

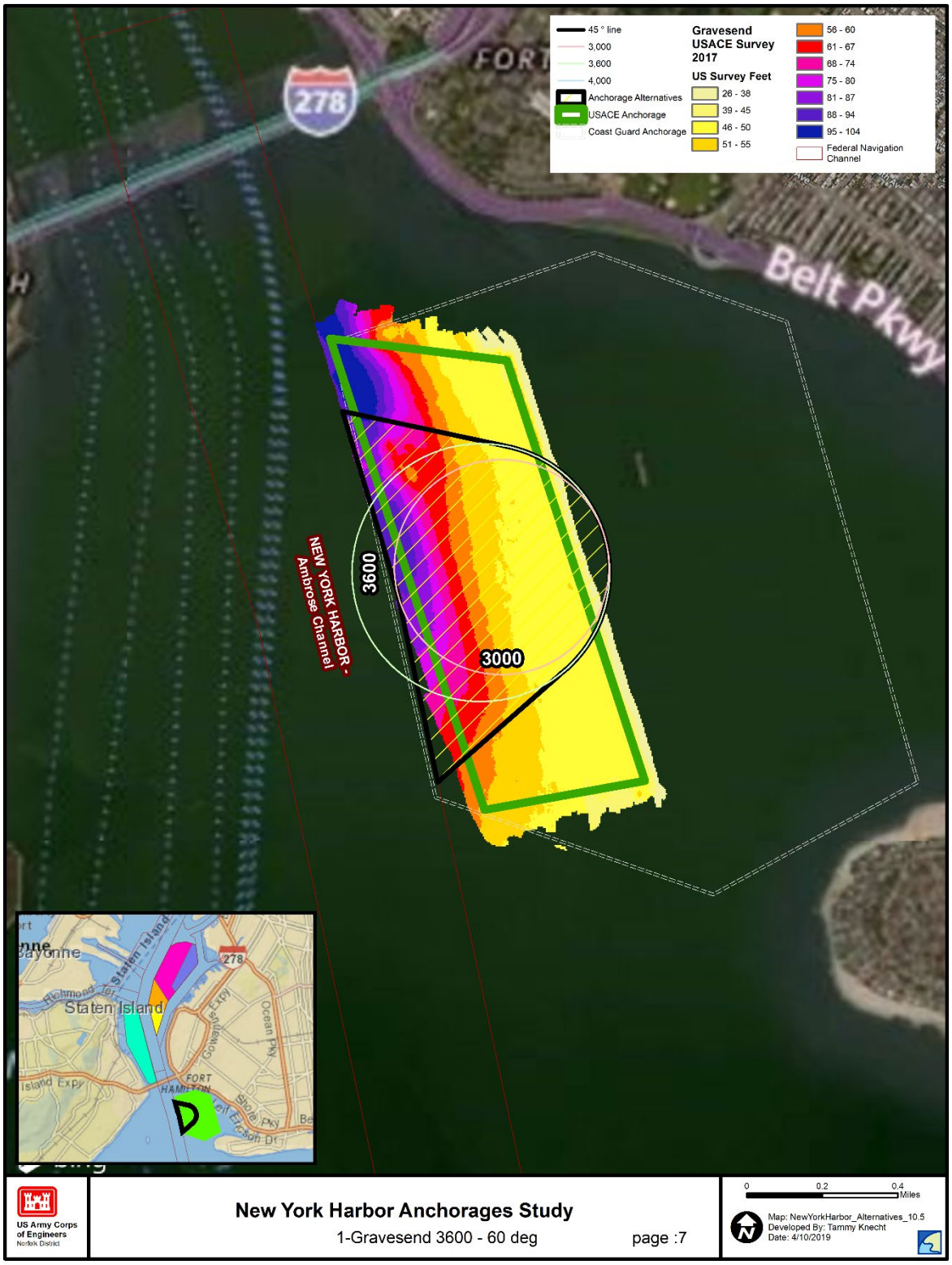


Figure 4-1: Gravesend Hybrid Design

4.5 Final Array

4.5.1 The Final Array

The Final Array was selected from the remaining Alternatives which would meet study objectives and the selection criteria initially set for screening of the alternatives (Table 4-8). The continued refinement of the phase 1 focused array resulted in the development of two final alternatives. The No Action Alternative and Alternative 1-C (hybrid design) were carried forward.

Table 4-8: Final Screening of Phase 1 Focused Array of Alternatives

Alternative	Description	Meets Study Objectives
No Action/Future Without Project	No action alternative whereby the no modification to the anchorages would be conducted.	N/A
1-C	Expand/Deepen footprint of Gravesend anchorage to accommodate design vessel(s) (hybrid design)	Yes

To further understand Alternative 1-C (hybrid design), the alternative was examined at various depths below the requirements to see if additional project depths were achievable. Alternative 1-C (hybrid design) was therefore examined at 4 depths ranging from -50 to -53 ft. The goal was to determine if additional benefits could be determined or if the sponsor would desire a locally preferred plan that utilized additional depths.

Alternative	Description
Alt 1-C-1	Hybrid -50 ft.
Alt 1-C-2	Hybrid -51 ft.
Alt 1-C-3	Hybrid -52 ft.
Alt 1-C-4	Hybrid -53 ft

While it is understood that the likely design at -50 ft. would reasonably maximize benefits since benefits are static and the -50 ft. depth would accommodate the design vessel, additional depths were examined to determine if they too would be justified with a benefit to cost ratio above 1.0. The goal is to provide a better analysis and provide additional options for the project should the sponsor wish to include additional depth as a locally preferred plan.

The environmental quality account considers non-monetary effects on ecological, cultural, and aesthetic resources. Under this account, the recommended plan should avoid or minimize

environmental impacts and maximize environmental quality in the project area. Potential beneficial use sites are described in Chapter 5 and to the extent practicable will be available for use. Consideration of environmental impacts are described for the No Action Alternative and Alternative 1-C (hybrid design) within chapter 6 of this document.

Finally, it was determined that Alternative 1-C (hybrid design) is the only actionable alternative that would contribute to the Federal objectives. It will reduce transportation costs while the No Action Alternative would see cost inefficiencies continue. Alternative 1-C (hybrid design) would accommodate the design vessel and reduce potential transits associated with weather and shipping related closures of the channel which forces the largest vessels to return to ocean. The No Action Alternative is carried forward for further discussion in this study in order to compare the environmental, economic, and other impacts of Alternative 1-C (hybrid design). Additional information is also available in the attached appendices on both the No Action and Alternative 1-C (hybrid design).

4.5.2 Phase 2 Alternatives

As noted in Tables 4-2 and 4-3 above, the Phase 2 alternatives included various combinations of measures to create or establish new anchorage areas. As also noted above, benefit classes were determined, during Phase 1 evaluation, to be limited solely to the reduction of transit costs associated with large containerized vessels. Preliminary review of the Phase 2 alternatives revealed that new anchorage areas would not result in increased transportation cost savings in comparison to the use of existing anchorages. Therefore, it was determined that project benefits associated with new anchorages would not support the cost of developing them. As a result, all Phase 2 alternatives were eliminated from further consideration as they were not economically justified. Therefore the Phase 1 Final Alternatives would serve the purpose of the final array of alternatives for the study.

4.6 Alternative Plan Costs

4.6.1 Construction Assumptions

Construction assumptions are feasibility level assumptions regarding the proposed alternative modification actions. Estimates of materials and methods necessary to construct and maintain the different anchorage improvement alternatives were developed using the USACE's Cost Engineering Dredge Estimating Program (CEDEP), best professional judgment, and previous analyses for similar, completed projects. These construction assumptions are the basis for project cost estimates and environmental impact assessments.

Construction Methods, Schedule, Dredging Equipment, and Material Placement

Construction of the NY/NJ Harbor project will consist of dredging, with dredged material placement at Historic Area Remediation Site (HARS). Navigation buoys will be relocated to accommodate the expanded anchorage dimensions. No new ranges are required because the project is based on the existing channel centerline, which will not be relocated.

Prior to all dredging, sediment sampling will be performed to ensure that materials are suitable for the proposed placement location, and the appropriate permits will be obtained. All dredging will be performed within the voluntary environmental windows established by the USACE for the protection of anadromous fish. No dredging will occur from 1 March to 30 June.

Overall, the dredging component of the NY/NJ Harbor project is expected to be 2 months, depending on the final depth and width selected as the recommended plan. It will be coordinated with time of year restriction for anadromous fish. Dredging may be performed by crews working 24 hours per day, and seven days per week. Although dredging crews are projected to be on-site and working as described above, dredging production will likely be limited to 25 days per month due to necessary set up, break down, and equipment maintenance operations.

Dredging assumptions for the screening utilized a clam shell mechanical dredge. The dredged material will be loaded into bottom-dump or split-hull barges and hauled to the placement area at HARS for disposal. Average one-way haul distance from Gravesend is estimated at 8 miles one-way.

One to two clam shell dredges (depending on the size and type of bucket) would be assumed to operate 24/7, with several shifts performing dredging seven days per week.

Historical Maintenance Dredging

A desktop analysis has been conducted for a first-order estimate of the maintenance dredging rate to be expected in the anchorages following deepening. Historic maintenance dredging records were provided by the USACE for the period 1975 to present, and reviewed to inform the desktop analysis (USACE, 1994, USACE, 2016). The available maintenance dredging records were used to develop an estimate of the annual sedimentation rate within the anchorages in the study area. Historical (from 1975 onwards) and recent data were examined and used for developing the sedimentation rate (see Engineering Appendix A, Section 8, Future Maintenance Dredging Estimation).

The NY/NJ Harbor Anchorage project has been dredged periodically to maintain anchorage dimensions. An analysis of maintenance dredging records from 1970 to present indicates that maintenance dredging occurs once per decade in the Red Hook Flats, whereas Gravesend has only had one single episode of maintenance in 1992 and has since been naturally scouring for the last 27 years. Although maintenance dredging of the project occurs infrequently, dredged material placement follows a consistent pattern of use of HARS receiving material from each of the anchorages. Table 4-9 presents historical maintenance dredged material volumes for the project area since the deepening to -50 ft.

Table 4-9: NY/NJ Harbor Anchorage Historical Maintenance Dredging Volume

Year	Project	estimated quantity	Cost per cubic yard	Cost	Description
1975	Red Hook Flats	2,475,000	$1.13	$25,767,977	Dredging above 35 ft., contract used a clam shell
1977	Red Hook Flats	1,050,000	$0.93	$986,440	Removal and disposal of all materials except ledge rock lying above the plane of 35 ft. below mean water
1986	Red Hook Flats	217,774	$4.50	$943,524.00	Removal and disposal of all materials except ledge rock lying above the plane of 35 ft. below mean water
2001	Red Hook Flats	500,000	$4.75	$2,390,482	Removal and disposal of all materials except ledge rock lying above the plane of 35 ft. below mean water
2013	Red Hook Flats	793,130	$10/45', $9/40'. $8/35'.	$6,292,565	Removal and disposal of all materials except ledge rock lying above the plane of 45, 40 & 35 ft. below mean water placement in HARS
1978	Grave send Bay	1,401,000	$1.46	$1,863,894	Removal and disposal of all materials except ledge rock lying above the plane of 47 ft. below MLLW
1992	Grave send Bay	200,000	NA	NA	Maintenance record provided by NY District

4.6.2 With Project Conditions Maintenance Dredging Assumptions

Under with-project conditions, maintenance dredging volumes at Gravesend Bay are not expected to increase (Table 4-10). The total projected maintenance dredged material volume over the 50-year study period, under with-project conditions, is 250,000 CY. Note that under with-project conditions, HARS is projected to be available to continue receiving dredged material for the duration of the project life (further information can be found in Appendix A, Section 2.5, and Appendix D). There is no anticipated increase in maintenance over that of the FWOP condition (See Section 3.14)

Table 4-10: With-Project-Annualized Maintenance Dredging Volume

Anchorage	**Annualized Volume (CY)**	**% Increase Over Without-Project Conditions**
Gravesend Bay	5,000	0

4.6.3 With Project Initial Dredging Assumptions

Dredged areas and volumes are presented (Tables 4-11) for the range of depths assessed for the Gravesend hybrid plan. Additional information can be found in Appendix D.

Table 4-11: Dredged Material, Estimated Volume (CY)

Anchorage	-50	-51	-52	-53
Gravesend	952,000	1,133,000	1,326,000	1,529,000

4.6.4 Construction Assumptions Summary on Final Array

The projected dredging for Alternative 1-C (hybrid plan) will take several months (the actual construction schedule is located in Appendix D). The project is not expected to increase maintenance costs for the anchorages with no additional cubic yards being removed from the widened and deepened anchorage. Over the course of the 50 year life of the project, materials are expected to be able to be placed at HARS. This will be the primary disposal location for maintenance materials unless otherwise specified.

4.7 Economic Alternative Analysis

A phased approach to plan formulation and economic modeling was used to analyze study alternatives and “build” a Recommended Plan. NY/NJ Harbor Anchorages study measures were initially going to be grouped into two economic modeling phases based on availability of benefits to create additional anchorages. Once it became clear that anticipated benefits would be low, the second phase was eliminated (see above). Benefits resulting from the Final Array of Alternatives are outlined in the sections that follow.

4.7.1 NED Benefits (National Economic Development)

Anchorage Deepening Benefits

The Gravesend economic analysis examined deepening and widening of the anchorage up to a maximum of -53 ft. and width of 3,600 ft. As discussed in Section 4.5, initial designs were examined to develop preliminary benefits assumptions. Various designs were analyzed to select the depths that maximize net benefits. Based in the analysis it was determined that benefits associated with using Red Hook Flats or Gravesend would be the same at either anchorage.

Improvement of either would be needed to achieve project benefit but that benefits could not be increased by improving both. This limited the project to a maximum of set benefits whereby cost would be the variable that would be most influential in determining the NED plan.

As described above, preliminary design concepts associated with Red Hook Flats and Gravesend indicated that costs for Red Hook Flats would far exceed benefits and that only designs associated with a smaller revised design template would be achievable within the Gravesend Alternative. The Hybrid design at Gravesend was then examined.

Table 4-12 summarizes the average annual costs, benefits, and net benefits for each of the analyzed depths of Alternative 1-C (hybrid design) for the Tentatively Selected Plan which was used to focus in on the recommended plan during project optimization (Section 4.8)). Net benefits were maximized at a depth of -50 ft. in the Gravesend anchorage hybrid design. This combination of depth and width yielded average annual net benefits of approximately $321,000 and was therefore identified as the plan being carried forward for optimization.

Table 4-12: Alt-1C Hybrid Design – NY/NY Harbor Planning Economic Summary (AAEQ)

Alternative	Description*	NED Benefits	NED Costs	Net NED Benefits	BCR
Alt 1-C-1	Hybrid 50 ft.	$ 1,205,000	$ 884,000	$321,000	1.36
Alt 1-C-2	Hybrid 51 ft.	$ 1,205,000	$ 1,037,000	$168,000	1.16
Alt 1-C-3	Hybrid 52 ft.	$ 1,205,000	$ 1,162,000	$43,000	1.04
Alt 1-C-4	Hybrid 53 ft.	$ 1,205,000	$ 1,298,000	-$93,000	.92
* The “Description” represents the Gravesend Anchorage depth (in ft.) associated with each alternative.					

Note: FY19 price level, FY19 interest rate 2.875%, 50-year period of analysis

Benefits are derived by the cost savings associated with the reduction in the number of returns to the ocean anchorage (e.g. due to environmental closure of Kill Van Kull). Such unsuccessful transits into the harbor result in increased transportation costs (in-port costs).

4.8 System of Accounts

Per ER 1105-2-100, Section 2-3 d(4), alternatives in the final array must be evaluated using three other accounts in addition to NED, including Regional Economic Development (RED), Environmental Quality (EQ), and Other Social Effects (OSE). However, in this study, all of the plans in the focused array of alternatives were not capable of meeting the project needs. Only the hybrid design in Gravesend would meet the project requirements and was carried forward to the Final Array. Therefore, a comparison of Red Hook Flats and Gravesend (Focused Array) was conducted to further highlight the differences between Red Hook Flats and Gravesend Anchorages. NED benefits have already been discussed in this report and the RED, EQ, and OSE evaluations for the RP are presented below.

4.8.1 Regional Economic Development

The Port of New York and New Jersey is one of the major drivers of the regional economy. The RED account was established by the Economic and Environmental Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council,1983). The RED account identifies changes in the distribution of regional economic activity resulting from

project alternatives and from the selected plan. The effects on the RED account for each of the alternatives considered are expected to be minor and do not have a material bearing on the plan selection process.

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Changes to the RED account for the RP were assessed using the USACE Online Regional Economic System (RECONS). This modeling system provides estimates of regional, state, and national economic impacts of construction spending associated with a USACE Civil Works Navigation Project. The USACE is planning on expending $25,526,000 (FY 20 Costs) on the project. Of this total project expenditure $19,596,790 (FY 20 Costs) will be captured within the regional impact area (Table 4-16). The rest will be leaked out to the state or the nation. The expenditures made by the USACE for various services and products are expected to generate additional economic activity in that can be measured in jobs, income, sales and gross regional product as summarized in the following table and includes impacts to the region, the State impact area, and the Nation.

Table 4-13. Overall Summary Economic Impacts

Impacts		Regional	State	National
Total Spending		$25,526,000	$25,526,000	$25,526,000
Direct Impact				
	Output	$19,596,790	$21,276,395	$24,962,408
	Job	196.65	207.86	224.19
	Labor Income	$12,712,732	$13,773,003	$14,896,339
	GRP	$14,480,180	$15,708,308	$17,290,178
Total Impact				
	Output	$38,225,913	$44,408,901	$66,446,681
	Job	312.58	361.37	493.87
	Labor Income	$19,900,583	$22,139,839	$28,434,507
	GRP	$26,621,516	$30,074,239	$40,739,009

4.8.2 Environmental Quality

The possible consequences of the RP were considered in terms of probable environmental impact, social well-being, and economic factors. Endangered Species Act, Section 7 consultation completed with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service notified, as there is no formal consultation required. Species Determinations will conclude based on anticipated impacts of the Action Alternative. Impacts to these species and any designated critical habitat are not anticipated to be “significant,” as defined by the

significance thresholds in NEPA guidelines (40 CFR Parts 1500-1508). Best Management Practices and standard USACE protocols will be implemented for the protection of listed turtle and whale species, Atlantic Sturgeon, as well as other species protected by the Marine Mammal Protection Act to reduce any potential negative impacts of the project. A discussion of the difference of environmental impacts for the alternatives can be found in Chapter 6 of this report.

Environmental quality account information is contained within Section 6 of this integrated report and summarized in the FONSI.

4.8.3 Other Social Effects

An increase in the amount of cargo moving through the port over time is expected to occur with or without navigation improvements associated with this project. Without improvements, more vessels would be required to transport the increased cargo volumes that are forecasted.

One of the main effects of the project will be beneficial effects to security and economic vitality of the region. The port is a key economic driver within the states of New York and New Jersey. While the design of anchorage incorporates a design whereby the vessels will continue to use the allowable swing space into the channel, the design should reduce the distance that such a large vessel currently could swing by approximately 400 ft. This reduction should have benefits whereby the channel is blocked and vessels passing should have a greater distance to a vessel which is swinging into the channel.

The PDT reviewed the Focused Array of plans based on OSE metrics. For this analysis Red Hook Flats is utilized here for comparative purposes only. (Red Hook Flats was screened from the Final Array of Alternatives but can be used since comparison of the No Action Alternative alone would not be sufficient to demonstrate benefits of the plan selected.) The purpose of its use is to ensure that the multitude of users of both Red Hook Flats and Gravesend, beyond those associated with container transport, understand the variation between the two anchorages and why Gravesend was selected as the alternative that was carried. It also demonstrates the study's consideration of expressed concerns from various users who attended the Corps briefings associated with the NEPA scoping meeting (see Section 1.11) as well as various briefings held by the USACE with the Harbor Operations Steering Committee (see Section 4.2).

The rating scheme that was used to rank the plans were based on the Institute for Water Resources' handbook for Applying Other Social Effects in Alternatives Analysis (2013). This method uses a -3 to 3 scale with -3 representing significant negative effects and 3 representing significant beneficial effects. Zero is negligible effects or no impact. The one and two scores are for minor and moderate effects in either the negative or positive direction. All metrics were scored for each alternative with consideration as to how that particular alternative would impact the metric in the future. Alternative plans can then be compared against each other based on the scoring results. Table 4-17 below shows the OSE matrix comparing the alternatives.

Table 4-14: Other Social Effects Summary of Alternatives and Factors

Factor	Metric	No Action	Red Hook Flats	Gravesend
1. Health and Safety	Emergency Services	0	1	3
2. Economic Vitality	Tax Revenue	0	3	3
3. Regional / National / Global Impact	Traffic	0	2	3
	Commerce	0	3	3
4. Local Community Support		0	2	2
5. Historic Properties	Historic Structures and Districts	0	0	0
	Archeological Sites	0	0	0
6. Socially Vulnerable Populations		0	0	0
7. Displacement		0	-2	-1
8. Energy Conservation		0	2	1
	Total	0	11	14

The scoring justification for each alternative for each factor is in Table 4-18 below.

Table 4-15: Scoring Justification for Other Social Effects

Factor	Scoring Justification
1. Health and Safety	Both anchorages will improve safety and operation of the harbor by creating anchorage locations for vessels that are already using the harbor, yet cannot properly anchor and must go directly to the dock. Gravesend also provides opportunity for the USCG to provide required security boarding. There are an average of 100 per year within the anchorage. Inspections must be conducted prior to entering the harbor proper. Only Gravesend will accommodate the design vessel.
2. Economic Vitality	Both anchorages will provide needed anchoring locations to larger container vessels. As the fleet changes over the life of the project, the number of larger vessels which currently use the harbor without a safe anchorage location will increase and become the norm. Providing anchorages is necessary if container ships are to remain a viable product of the port.
3. Regional / National / Global Impact	The port is the 3rd largest in the US and largest on the eastern coast of the US. The economy of this port is directly tied to the regional and global economy. This continued participation is tied directly with the ability to service larger container vessels.
4. Local Community Support	Community support is a factor. In discussion with local operators it is evident that new anchorages are contentious. This makes the continued use and adaptation of the current ones more important. Within the direct community of users is a recognition that anchorage modification is required. Direct community users are in full support of the project
5. Historic Properties	Historic structures and archaeological sites were researched. A full assessment will be completed later prior to construction. Additional cultural resource information is included in Chapters 2 and 6 of this study.
6. Socially Vulnerable Populations	There were no socially vulnerable populations in the study area.
7. Displacement	Displacements may be necessary based upon the RP. While the majority of the work benefits container ships, other users such as tug and barge, tankers, recreational vessels, and wind farm builders all use the Gravesend or Red Hook Flats anchorage. It is anticipated that with the RP larger container vessels will displace some current users. However, with depth restrictions still in place in Red Hook Flats that area should be able to absorb those who have been displaced. All effort has been made to reduce the RP design from encroaching into the larger USCG anchorage in Gravesend of which the USACE anchorage is only a part. (Designs coordinated through Harbor Operations Steering Committee see Section 4.2 to include representative of those who may be impacted)
8. Energy Conservation	There will be possible energy savings in the reduction in fuel consumption associated with the reduction of re-transiting to the ocean anchorage.

Other Social Effects Summary

While the formulation process only carried the Gravesend design forward, there are still more benefits associated with the RP than designs at Red Hooks Flats. The Gravesend anchorage will have more positive effects than that of Red Hook Flats. Improvements at Gravesend will only have minor negative impacts in some categories. The main benefits from the alternative will be from improvements to safety of those vessels needing to anchor vs. the No Action Alternative. In addition, the area in which a vessel will swing will be reduced (Figure 4-4). This design will help meet the project objectives by accommodating the design vessel.

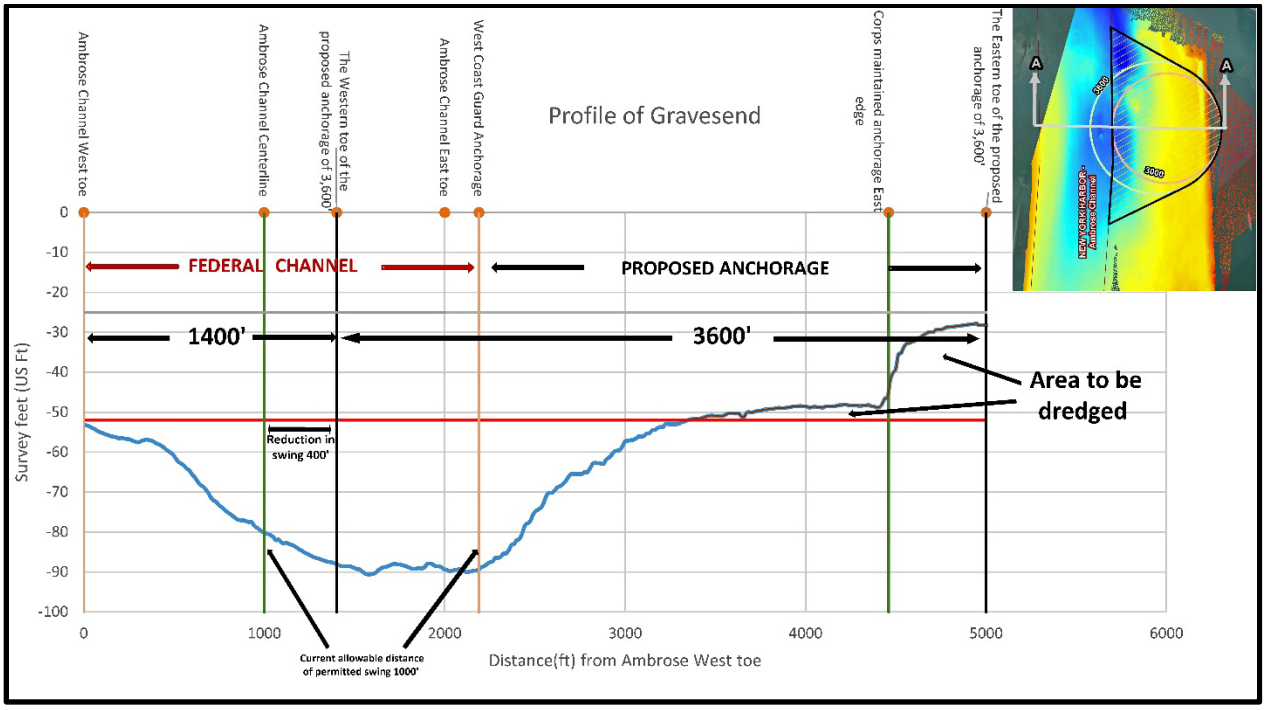


Figure 4-2: Design Profile Showing Reduction of Swing Area

Finally, as discussed in the ratings discussion table (Table 4-5), displacement is of paramount importance. Each anchorage currently services a wide variety of commercial users. Due to high demand and increasing vessel traffic within the harbor, siting of a new anchorage is difficult. Therefore consideration was given to users and anticipated impacts from the RP whereby it is anticipated that as the container fleet increases in size, they will no longer be able to use the Red Hook Flats anchorage which is anticipated to remain at current depths. The expansion and deepening of Gravesend will draw larger vessels to it instead and thus various resources that use the anchorage may be able to benefit from the opening of additional space in Red Hook Flats. It is anticipated that the USCG will have to update its rules for usage of anchorages within the harbor once the RP has been constructed.

4.9 Recommended Plan Selection

The Recommended Plan (RP) was developed by comparing estimated project cost and economic benefits as discussed above. Analysis was conducted to optimize project depth into a comprehensive plan addressing the operational constraints of interest in the current study, namely depth and length constraints that limit vessel size and use of the anchorage.

4.9.1 Plan Selection

The primary decision criteria for identifying the NED Plan includes reasonably maximizing net annual benefits while remaining consistent with the Federal objective of protecting the nation's environment. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. For this study, the contributions to NED plan are the direct net benefits that accrue in the planning area and the rest of the nation.

As shown in Table 4-13, net benefits for Gravesend Anchorage are reasonably maximized at a depth of -50 ft. Based on these results, the recommended NED plan is Alternative 1-C (hybrid design) at a -50 ft. depth. This plan was then carried forward as the tentatively selected plan and examined for optimization to find the best location for siting the final design of the hybrid plan. The goals of optimization was to find a location that would allow best use of the anchorage, reduce cost, and maintain benefits while avoiding environmental impacts. Based on these inputs the RP has the design template for the hybrid plan shifting to the northern edge of the anchorage. This optimization was based upon inputs from various stakeholder and looked at reducing cost while avoidance environmental impacts Figure 4-2.

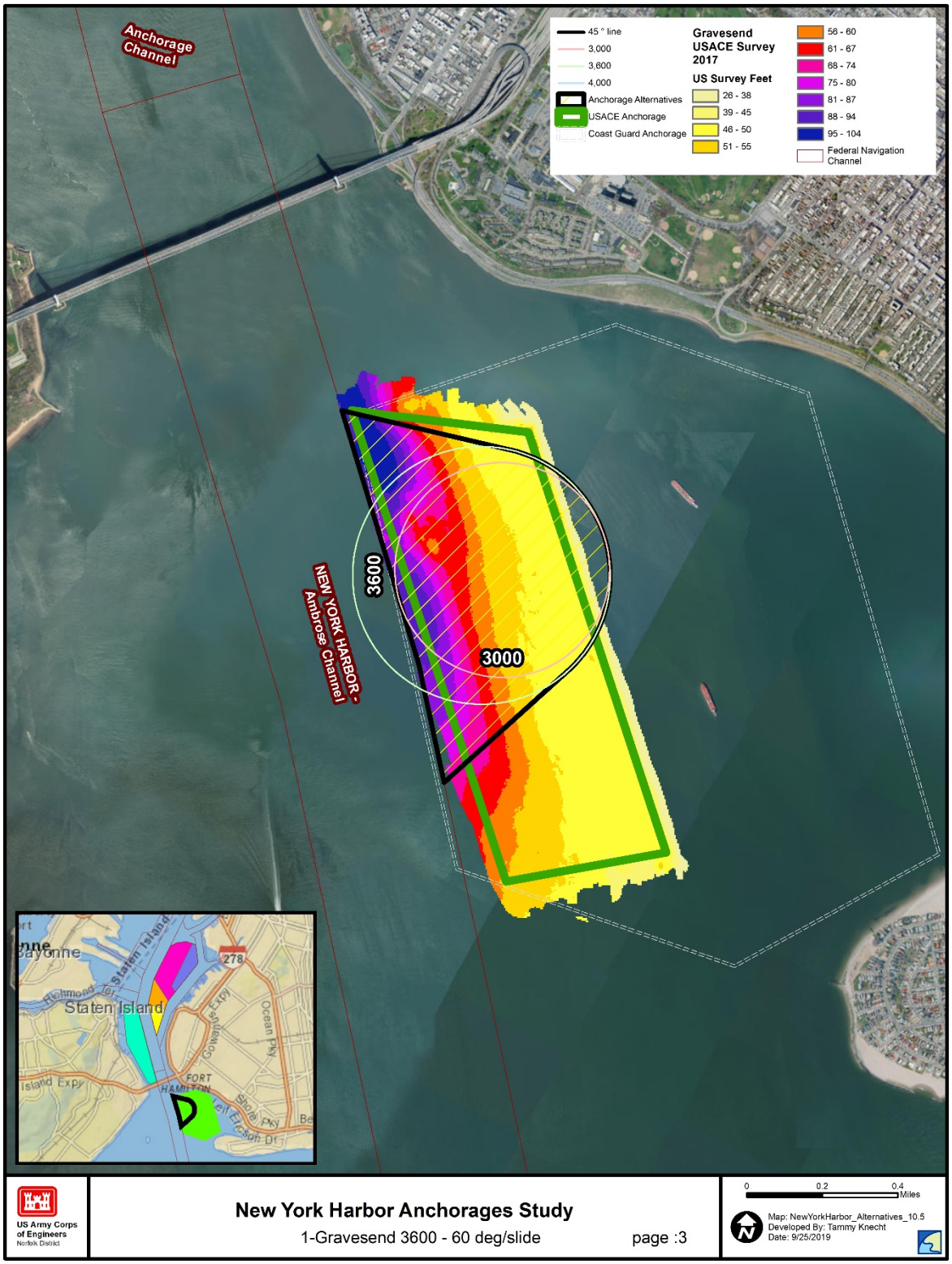


Figure 4-3: Optimized design location of Gravesend Anchorage

4.9.2 NED Plan

The NED Plan is the combination of measures that reasonably maximizes net benefits. The NED plan, which is also the RP and Preferred Alternative, includes the following components:

- Deepening the Gravesend Anchorage to a required depth of approximately -50 ft.
- Widening the Gravesend Anchorage to approximately 3,000 ft. and associated modifications of the Approach Area.
- Maximum designed swing area up to 3,600 ft.

Note that implementation of the RP will result in an Anchorage depth of -50 ft. Engineering considerations (e.g. vertical ship motion, etc.) do not necessitate additional depth beyond -50 ft.

4.9.3 Deviations from the NED Plan

There are no planned deviations from the NED plan. For this study the NED is the Recommended Plan/Preferred Alternative. There is no Locally Preferred Plan.

4.9.4 Recommended Plan/Proposed Action

The Recommended Plan results in a BCR of 1.2 and net NED benefits of approximately $1,148,000 in AAEQ terms at FY20 price levels and using a discount rate of 2.75%. Costs for the RP were provided by New York Cost Engineering. IDC (Interest During Construction) was calculated for a construction duration that includes a PED and construction period of 2 months for the plan with approximately 1 million cubic yards being dredged (see Appendix A). Construction was assumed to begin in 2025 and be completed by the end of 2025. (See Appendix D for Recommended Plan construction schedule). Table 4-13 and Table 4-14 summarize the economic costs and benefits associated with the project RP.

Table 4-16: Summary of Recommended Plan, AAEQ Costs and Benefits

Plan Components	NED Benefits	NED Costs	Net NED Benefits	BCR
Recommended Plan:	**$1,148,000**	**$938,000**	**$210,000**	**1.2**

Note: FY20 price level, FY20 interest rate 2.75%, 50-year period of analysis

Table 4-17: AAEQ Costs and Benefits, Details

Equivalent Annual Benefits and Costs FY2020 Costs & Price Levels 50-Year Period of Analysis / 2.75 % Discount Rate	
Project Costs (rounded)	$25,250,000
Interest During Construction	$86,000
Total Economic Investment	$25,336,000
AAEQ Costs	$938,000
Economic Investment	
Increased O&M Costs	$0
Total AAEQ Costs	$938,000
AAEQ Benefits	$1,148,000
Transportation Cost Savings	
Total AAEQ benefits	$1,148,000
Net AAEQ Benefits	$210,000
Benefit-Cost Ratio (at 2.75%)	1.2

4.9.1 Construction and Investment Costs

Construction and Investment Costs

Dredging quantities were developed based on the latest condition surveys provided by the USACE. Dates of the surveys are noted in the Engineering Appendix (Appendix A). Quantities include 1-Vertical to 3-Horizontal side slopes, to match existing anchorage width. AutoCAD® Civil 3D® software was used to perform the volume calculations. Volumes are broken into "dredging zones," to clarify the calculated volumes, as identified in the following Figure 4-3.

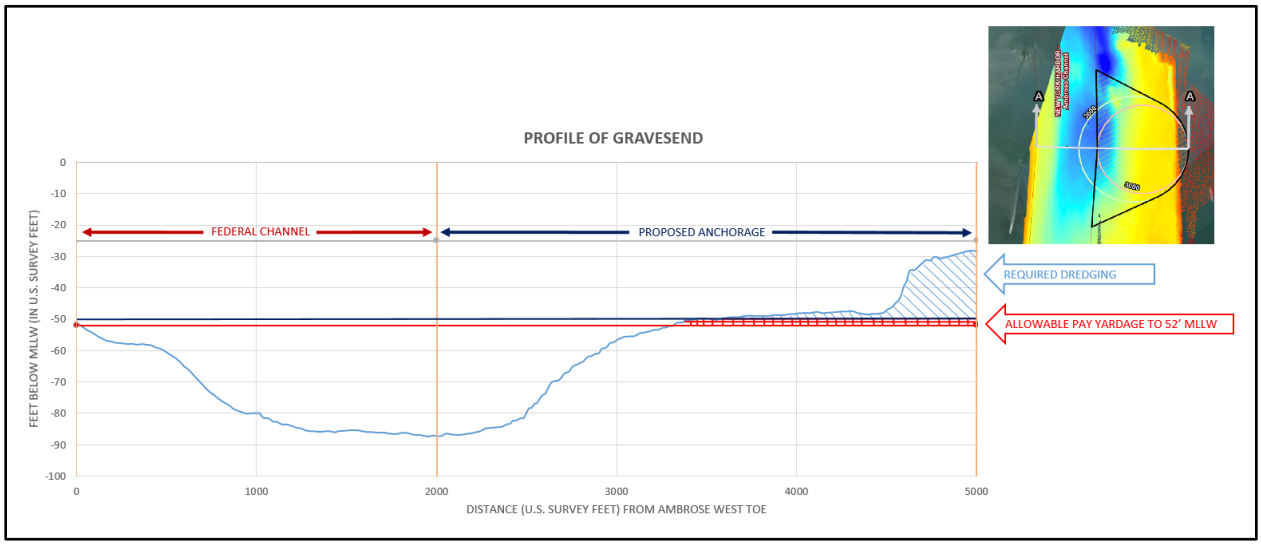


Figure 4-4: Typical Channel Cross Section with Dredging Zones and Channel Nomenclature

Project Costs

Dredging costs are developed using the CEDEP worksheet that accounts for the efficiency of the dredges for anchorage based upon the areas, volume, amount of pay amount not dug on average, and the amount dredged in excess of the allowable pay amount, and many other factors associated with dredging operations. All costs associated for the contractor including overhead, profit, and bonds are included in the unit price calculated. The CEDEP spreadsheet also calculates costs for mobilization and demobilization, which are provided separately from the unit costs. It was assumed that the USACE would provide the post construction survey, so no cost was estimated with regards to surveys (note: the contractor is assumed to have a surveyor of their own, but no surveys were included for the owner). For the initial deepening scenarios, it is assumed that the initial mobilization is included in the maintenance dredging (where applicable).

There are no submerged utilities that cross the RP project area. In addition, the area has also been examined for the possibility of unexploded ordinance. Due to the areas Military, Maritime History data was examined on Formerly Used Defense Sites and materials associated with Fort Lafayette and Fort Hancock (see Engineering Appendix A Section 9 Utilities, Obstructions and potential impacts).

Pre-construction, engineering and design (PED) costs are estimated for input into the total project costs. The estimate for PED includes a breakdown of field work including cultural resources Phase I and II survey, sediment sampling and testing, engineering and surveys to assemble bid documents, as well construction management and support through construction. A contingency of up to 1% of the project authorization for mitigation of adverse effects to archaeological sites, per the Moss-Bennett Act, is within the 16.8% project contingency amount.

An Abbreviated Risk Analysis (ARA) was performed to evaluate uncertainties associated with each major construction cost item or feature in coordination with input with other members of the project development team. The ARA was developed via Cost Planning Center of Expertise guidelines. No Cost and Schedule Risk Analysis (CSRA) is required for this project as the estimate is below the $40,000,000 threshold

Section 1111 of the Water Resources Development Act of 2016 specifies project cost sharing between the Federal government and the non-Federal sponsor is based on material being dredged from waters in excess of -20 ft. MLLW but not in excess of -50 ft. MLLW (cost-shared 75% Federal / 25% non-Federal). The non-Federal sponsor is also responsible for an additional payment of 10% of the cost of the general navigation features of the project in cash over a period not to exceed 30 years, at an interest rate determined by the Secretary of the Treasury, taking into considerations the average market yields on outstanding marketable obligations of the United States with remaining periods to maturity comparable to the reimbursement period, during the month preceding the fiscal year in which costs for the construction of the project are first incurred (or in the case of recalculation the fiscal year in which the recalculation is made), plus a premium of one-eighth of one percentage point for transaction costs. A breakdown of cost apportionment is located in Table 4-15.

Table 4-18: NED Plan Cost Shares (50 ft. nominal depth), FY20 Price Level

	Total Cost	Federal	Non-Federal
Mob and Demobilization	$5,100,000	$3,825,000	$1,275,000
Dredging Cost	$13,754,000	$10,315,500	$3,438,500
Environmental Mitigation	$ -	$ -	$ -
Monitoring	$ -	$ -	$ -
Construction Management	$1,104,000	$828,000	$276,000
PED	$1,656,000	$1,242,000	$414,000
Contingency (16.8%)	$3,636,000	$2,727,000	$909,000
Total Construction of GNF	$25,250,000	$18,937,500	$6,312,500
Lands & Damages	$-	$-	$-
Total Project First Costs	**$25,250,000**	**$18,937,500**	**$6,312,500**
Relocating Aids to Navigation	$-	$-	$-
10% GNF Non-Federal	$-	($2,525,000)	$2,525,000
Total Cost	**$25,250,000**	**$16,412,500**	**$8,837,500**

5 RECOMMENDED PLAN/PROPOSED ACTION

5.1 Description of the Recommended Plan

The RP deepens and widens the Federal anchorage at Gravesend. For the purpose of this study and to conform to NEPA requirements and USACE planning regulations, the RP may also be referred to as the preferred alternative.

5.1.1 General Navigation Features

ER 1105-2-100 defines general navigation features as: “General navigation features of harbor or waterway projects are channels, jetties or breakwaters, locks and dams, basins or water areas for vessel maneuvering, turning, passing, mooring or anchoring incidental to transit of the channels and locks. Also included are dredged material disposal areas (except those for the inland navigation system, the Atlantic Intracoastal Waterway and the Gulf Intracoastal Waterway) and sediment basins” (USACE, 2000).

The RP general navigation features include the following anchorage:

- Deepening the Gravesend Anchorage to a required depth of approximately -50 ft.;
- Widening the Gravesend Anchorage to approximately 3,000 ft. and associated modifications of the Approach Area;
- Maximum designed swing area up to 3,600 ft.

5.1.2 Gravesend Anchorage

The Gravesend Anchorage is one of a series of anchorages located within the New York and New Jersey Harbor. The anchorage is currently authorized to a depth of -47 ft. MLLW with an approximate 2500 ft. width. The anchorage was constructed in 1977. The RP is recommended to deepen the Gravesend Anchorage to -50 ft. and portions of it widened to 3,000 ft. (Figure 5.1 & See Figure 4-3). This design was optimized for its placement with its location based on utility to the harbor pilots and USCG. It is also the optimized design which provides the lowest construction costs. During tidal shift some vessels may continue to swing into the Federal channel and the placement of the swing template will allow better alignment for inbound ships with the channel and Verrazzano Bridge. In addition, the clarification to the original 1965 design will be implemented were approach areas along the southern end of the anchorages will be incorporated into the maintained anchorage. The current design has a gap between the actual anchorage and the channel and while this has not affected performance, this re-alignment will clarify the anchorage approach going forward. The additional area will be maintained at the current nominal depth of 47 ft. MLLW like the rest of the unimproved anchorage. Currently, depths of this areas are well below the areas nominal depth as the area.

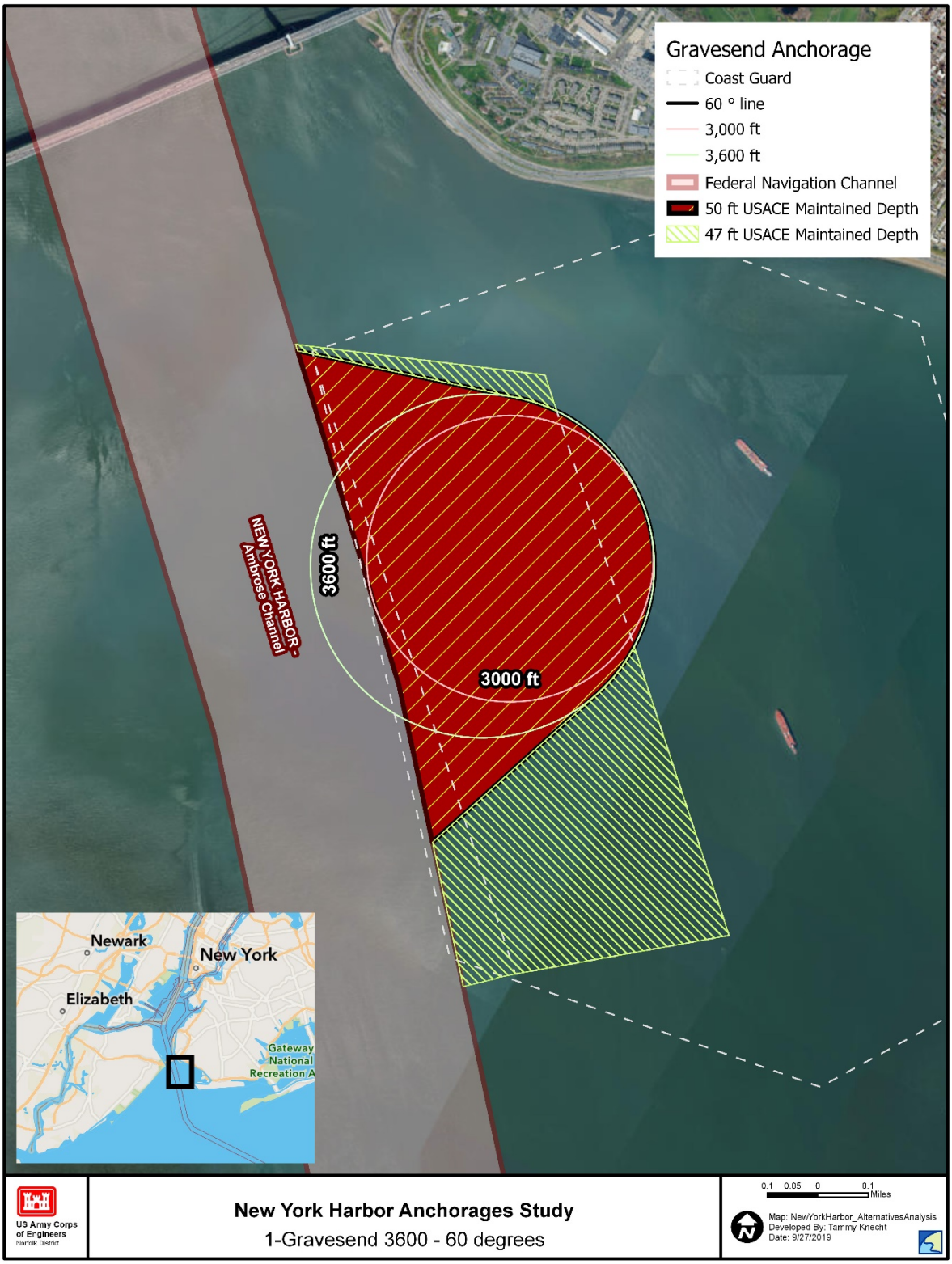


Figure 5-1: Recommended Plan at Gravesend Anchorage

5.1.3 Disposal Area

Dredged material generated from the improvement project is expected to go HARS. Approximately 1 million cubic yards of materials are expected (see Appendix A for details). The team relied on geological information for dredge material characteristics. Additional testing to confirm suitability for placement at HARS will be conducted in accordance with established protocols prior to project construction. Project dredged material quantities were computed based on USACE 2017 bathymetric survey of conditions within the Harbor. It is anticipated that HARS will have sufficient capacity for the project construction. O&M dredge quantities are not anticipated to increase as a result of this project (See Appendix A).

5.1.4 Beneficial Use of Dredged Material

HARS is recognized as a beneficial use site and is the proposed placement site for the anchorage improvement project. Currently, there are no additional identified beneficial use sites for the project's dredged material. If additional beneficial use sites are identified in the future, they may be considered through the USACE's Section 204, Beneficial Use of Dredged Material Continuing Authority Program. For example, the 2008 report "Dredged Material Management Plan for the Port of New York and New Jersey", indicated that materials within the adjacent Ambrose Channel were identified as a potential a source of beach quality material. Beneficial use would need to conform to project timelines and meet all compliance and any cost-sharing requirements.

5.1.5 Environmental Mitigation

No compensatory environmental mitigation is anticipated to be required with implementation of the Recommended Plan. For a summary of avoidance and minimization measures to reduce any potential impacts to environmental resources, please see Chapter 7: Summary of Proposed management Actions, Best Management Practices, and Compensatory Mitigation.

5.2 Operations and Maintenance Considerations

Operation and maintenance of the recommended plan will continue existing O&M practices. Maintenance dredging will continue to occur infrequently and the RP will not increase O&M requirements beyond current activities. The area identified for construction required minimal maintenance in the past as a large portion of the project area naturally scours. Records indicate that dredging was confined to the northeast and southeast corners of the anchorage. The eastern center of the anchorage has remained stable for the past 41 years. The entire anchorage has historically exhibited an average shoaling rate of approximately 5,000 cubic yards per year. The RP will not increase current O&M cost or the anticipated volume of material needed to be removed (See Appendix A). This includes the additional area to the south of the RP where the existing anchorage will continue to be maintained at -47 ft. and the gap between the existing Federal channel and the current anchorage alignment. All future maintenance activities will continue to be placed in HARS unless a new Dredged Material Management Plan (DMMP) is developed and identifies a new site. The DMMP was last updated in 2008 and was designed to account for anticipated O&M needs associated with the Gravesend Anchorage (USACE 2008).

5.3 Real Estate Considerations-Land Easements, Rights of Way, and Relocation

The Port Authority of New York and New Jersey (the non-Federal Sponsor of the recommended plan) will not be required to purchase any lands, easements, rights of way, or perform any relocations for this project. There are no anticipated impacts to utilities/facilities in the proposed project limits and no land requirements. Therefore, as described in the Description of Land, Easements and Rights-of-Way in Section 5.0 of the Real Estate Plan (See Appendix C), LERR credits are not authorized.

5.4 Implementation Requirements

This section defines implementation responsibilities necessary to insure that the RP goals and objectives are achieved. Included are discussions of the division of plan responsibilities between Federal and non-Federal interests, institutional requirements, cost sharing, analysis of non-Federal financial capability, a discussion of the Project Cost Agreement, and views of the non-Federal sponsor.

5.4.1 Cost Sharing

Cost sharing for the RP will be done in accordance with Section 101 of the WRDA 1986, as amended, and cost shared as a General Navigation Feature[1]. RP cost shares are based on all recommended depths not being in excess of -50 ft. Channel depths are not in excess of -50 ft. but are in excess of -20 ft. The cost share is therefore 25 percent non-Federal and 75 percent Federal. There are no anticipated LERRs from the non-Federal sponsor. Disposal necessary for the Federal project is cost-shared as a general navigation feature. An additional 10 percent of the total costs of General Navigation Features will be repaid by the non-Federal sponsor over a period not to exceed 30-years. Currently there are no LERR credits, but if they are later to be deemed necessary, during PED after project authorization, such credits would credited against the additional cash contribution. While no additional OMRR&R costs are anticipated, if such costs do occur in the future, the project is not in excess of -50 ft. and the non-Federal sponsor shall not be responsible for the excess cost of operation and maintenance of the project. Currently, there is no anticipated increase in operations and maintenance costs because the RP does not incur any additional an O&M per year beyond the FWOP action. A summary of cost shares is presented in Table 5-1.

[1] Under WRDA 1986, as amended by Section 201 of WRDA 1996, Federal participation in navigation projects is limited to sharing costs for design and construction of the general navigation features (GNF) consisting of breakwaters and jetties, entrance and primary access channels, widened channels, turning basins, anchorage areas, locks, and dredged material disposal areas with retaining dikes.

Table 5-1: RP Cost Shares, FY20 price level

	Total Cost	Federal	Non-Federal
Mob and Demobilization	$5,100,000	$3,825,000	$1,275,000
Dredging Cost	$13,754,000	$10,315,500	$3,438,500
Environmental Mitigation	$ -	$ -	$ -
Monitoring	$ -	$ -	$ -
Construction Management	$1,104,000	$828,000	$276,000
PED	$1,656,000	$1,242,000	$414,000
Contingency (16.9%)	$3,636,000	$2,727,000	$909,000
Total Construction of GNF	$25,250,000	$18,937,500	$6,312,500
Lands & Damages	$-	$-	$-
Total Project First Costs	**$25,250,000**	**$18,937,500**	**$6,312,500**
Relocating Aids to Navigation	$-	$-	$-
10% GNF Non-Federal	$-	($2,525,000)	$2,525,000
Total Cost	**$25,250,000**	**$16,412,500**	**$8,837,500**

5.5 Financial Analysis of Non-Federal Sponsor's Capabilities

The non-Federal sponsor, the Port Authority of New York and New Jersey, concurs with the financial responsibility as it pertains to the cost shares presented in Table 5-1, above.

Current policy requires the sponsor to document their ability to pay through submission of a self-certification of financial capability as described in CECW-PC memorandum dated 12 June 2007. The Port Authority of New York and New Jersey provided Self-Certification of Financial Capability for inclusion in final version of this GRR/EA on 4 December 2019.

Non-Federal interests are also responsible for and bear all costs for acquisition of necessary lands, easements, rights-of-way and relocations; terminal facilities; as well as dredging berthing areas and interior access channels to those berthing areas.

5.6 View of the Non-Federal Sponsor

The Port Authority of New York and New Jersey fully supports the RP and has agreed to the cost sharing as outlined above. PANYNJ provided a letter of intent on 7 December 2019 with acceptance of, or any desired departures from, the terms of the applicable model Project Partnership Agreement (PPA), including: 1) applicable cost sharing and financial policies; 2) policies regarding provision and valuation of non-Federal lands, easements, rights-of-way, and disposal areas provided by the non-Federal sponsor; 3) policies governing non-Federal project construction; and 4) other provisions required by law and policy for new start construction projects.

5.7 Section 902 Limit

Because this project is not a component of a previously authorized project, it will be subject to a separate Section 902 limit should Congress authorize the project with a total expenditure limit.

The project first cost described in this GRR/EA will inform the identification of any new such 902 limit.

5.8 Risk and Uncertainty

Risk and uncertainty exists in the potential fluctuation of the Federal interest rate, changes in vessel operating costs, and deviations from vessel or cargo forecasts. Interest rates, forecasts, and vessel operating costs are discussed further in the Appendix B (Economics). Cost contingencies, incremental costs, and estimates for the dredging costs are discussed in Appendices A & D (Engineering & Cost). There are also risks which were addressed during the study using a Risk Register. The purpose of the register is to apply a risk-based decision making approach throughout the study. The register was used to highlight areas of study risks and identify ways to address those risks, such as reducing the schedule, optimizing the study area, and identifying the optimum amount of modeling to make a risk-based decision.

Several assumptions applied to analyses during the study resulted in conservative cost and impact estimates and reduced cost risks. Of particular note is the use of existing geological data to define dredge material characteristics. Soils borings will not be completed until the project enters PED. The overall risk to the nonperformance of the RP is low. While there could be additional costs associated with the project, the team has worked with users of the anchorage and USCG to assess project performance. The goal was to determine if the hybrid design would work and vessels would be able to operate utilizing the designed anchorage and they have expressed their support for the RP. Under the project objectives, we sought to improve anchorage capacity for larger vessels and reduce navigational risk. This risk was communicated to the study team by the USCG in a letter date 1 April 2019 (see letters from USCG and Harbor Operations Steering Committee in Appendix E).

5.9 Sea Level Change and Navigation Structures

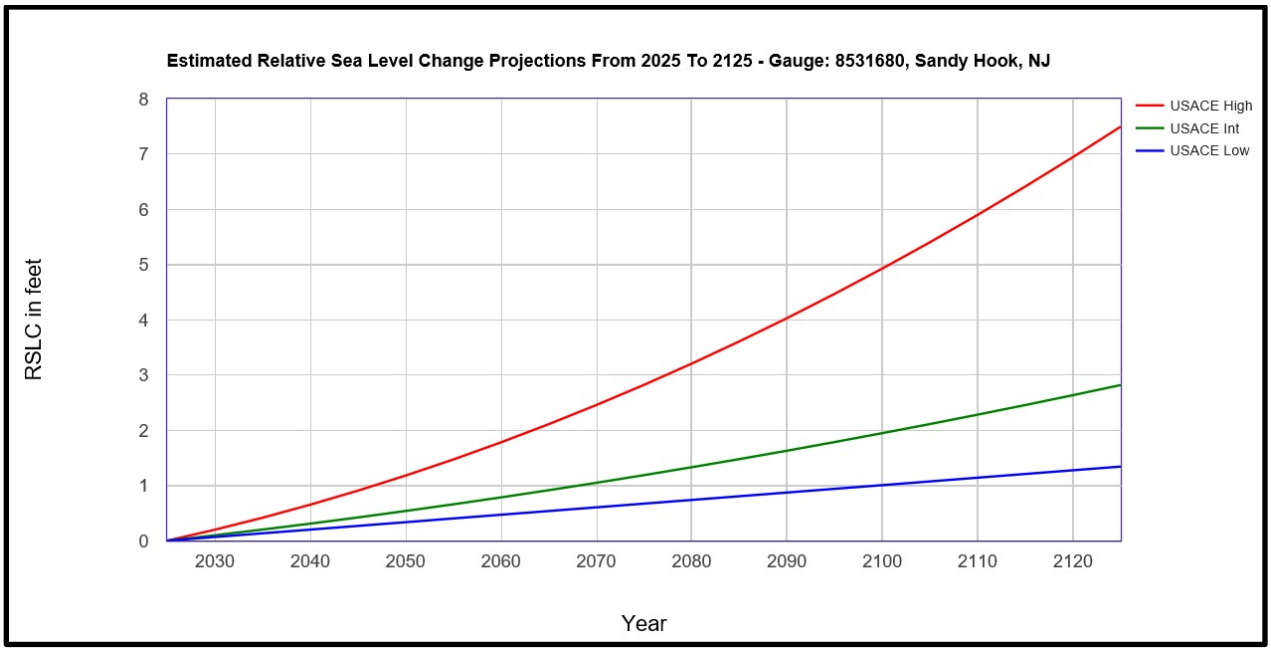
The potential impacts of future local relative sea level change (RSLC) on GNF and the possible adaptations that can be developed to counteract these impacts must be considered in all USACE studies and projects located in tidally influenced waters. Current USACE guidance (ER 1100-2-8162 and EP 1100-2-1) requires planning studies to consider SLC in the development and assessment of planning alternatives. EP 1100-2-1 recommends that analyses assess the effects of RSLC on the project at three future time periods post-construction, including 20 years, 50 years, and 100 years (Table 5-2 & 5-3). Because the rate of future RSLC (i.e. ft. per century) is uncertain, the guidance specifies that the evaluation should consider the three different SLC curves (low, intermediate, and high) included in the USACE's online RSLC calculator. Tables 5-2 and 5-3 and Figure 5-2 uses the Sandy Hook, NJ tide gauge, and the Battery, NY tide gauge, both of which are within the project ROI and have been operating for decades, was determined using the USACE sea level rise predictor (USACE, 2019). RSLC for the Upper Bay in New York New Jersey Harbor averages 0.0134 ft. per year (4.09 mm/year) for the Sandy Hook, NJ tide gauge which is closest to the Gravesend Bay anchorage. The project start year was populated with 2025 to determine future sea level rise.

Table 5-2: Est. Sea Level Change (Sandy Hook, NJ Gauge)

Years Post Construction	Low	Intermediate	High
20 Years - 2045	0.27	0.42	0.91
50 Years - 2075	0.67	1.19	2.82
100 Years - 2125	1.34	2.82	7.50

Table 5-3: Est. Sea Level Change (Battery, NY Gauge)

Years Post Construction	Low	Intermediate	High
20 Years - 2045	0..19	0.34	0.83
50 Years - 2075	0.47	0.98	2.62
100 Years - 2125	0.94	2.41	7.09



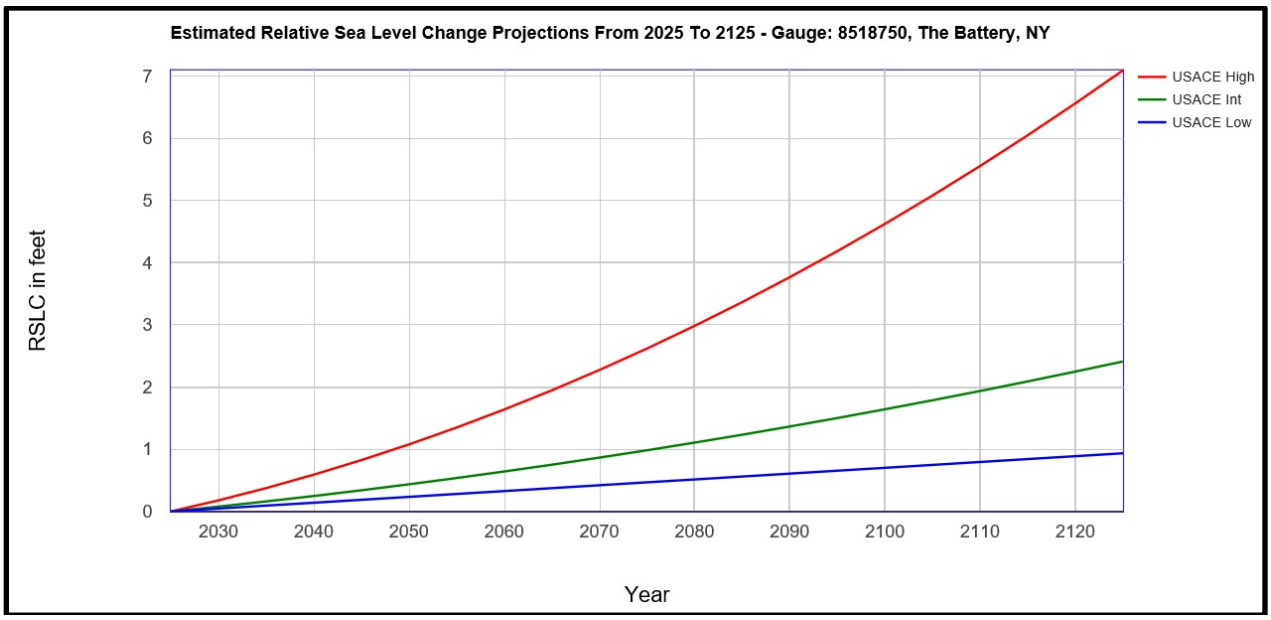


Figure 5-2: Projected Sea Level Change in the Region of Influence.

Sea level is projected to increase gradually under all three USACE scenarios. An increase of approximately 0.7 ft. of sea level rise is not projected to occur until approximately 2075 under the low scenario and by 1.2 ft. in the intermediate scenario (at the Sandy Hook Gauge). In the high scenario, sea level would increase by 2.8 ft. by approximately 2075 which would be 50 years into the project's life (see Appendix A). General navigation features within this Federal project include anchorages and a dredged material placement area (overboard remediation site). The project does not include Federal locks, breakwaters, jetties, groins, revetments, or wave absorbers.

None of the project's Federal GNF are projected to be impacted to an extent that would impact functionality and the realization of project benefits. The most likely effect to Federal navigation, including the anchorage, would be that less maintenance dredging maybe required in the out-years of the project's life. The offshore placement area HARS is unlikely to be impacted by projected SLC.

Non-Federal navigation features such as docks, wharfs, bulkheads, seawalls, dolphins, and berthing areas are projected to be functional throughout their currently planned useful lives and were part of the original 1999 study and designed to meet current channel depths. No additional Non-Federal navigation features will require additional modification and anticipated to be built to withstand the impacts of future sea level rise.

6 ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

This chapter describes the existing and projected future conditions for each of the resources that reasonably could be expected to be impacted by the project and it's APE. Existing and projected future condition descriptions include physical, chemical, biological, and sociological conditions. These conditions are described without implementation of the alternative actions and with implementation of the alternative actions. The comparison of without-project (which assumes no dredging activity and continued navigation use as at present) and with-project conditions defines the impacts of the alternatives. Table 6-1 provides a summary of the impacts for the resources that could be potentially affected by implementation of the project alternatives.

Table 6-1: Environmental Consequences of the Project Alternatives Summary Table

Resource	No Action Alternative/Future Without Project Alternative	Action Project Alternative
Geology, Physiography, and Topography	There would be no impacts to geology or physiography. Continued use of the potential dredged material placement/disposal sites would have an adverse, permanent and negligible to minor impact to topography if upland sites are used, HARS impacts have been addressed. Continued maintenance of the channel system should have no effect on seismicity because the ROI is not within a seismically-active geologic setting.	There would be no impacts to geology or physiography. Impacts to topography would be at the same threshold level of impact as the NAA/FWOP (adverse, permanent, and negligible to minor), but topography may change at the location of upland sites if used, HARS impacts have been addressed in other NEPA documents and management plans.
Bathymetry, Hydrology, and Tidal Processes	There would be no anticipated effects to bathymetry, hydrology, or tidal processes.	The anchorage deepening and widening will alter the bathymetry in the anchorage, deepening it removes sediments shallower than the desired depth. This may also potentially increase the tidal prism in the area of the channel. This bathymetric alteration may influence effects of the tides. These impacts would be permanent, minor and not significant.

Resource	No Action Alternative/Future Without Project Alternative	Action Project Alternative
Hazardous, Toxic, and Radioactive Waste (HTRW)	No releases of HTRW exceeding regulatory limits are anticipated with present container vessel navigation.	Impacts would be at the same threshold level of impact as the NAA/FWOP (adverse, temporary, and negligible). Any potential redistribution of contaminants resulting from dredging and dredged placement/disposal would be negligible and are not expected to have any substantive permanent adverse impacts. The material should be able to be placed in HARS.
Water Quality	Temporary, minor increases in Total Suspended Solids, turbidity, and nutrients resulting from container vessel anchoring and navigation would continue.	Temporary impacts to water quality would be at the same threshold level of impact as the NAA/FWOP Alternative (adverse and negligible to minor), however, the relative level of impact with the Action Project Alternative would be slightly higher due to the increased duration of dredging. Implementation of the Action Project Alternative would result in adverse impacts to water quality that would be temporary and negligible to minor.
Vegetation, Wetlands, and Submerged Aquatic Vegetation	Current navigational use does not impact any Submerged Aquatic Vegetation (SAV) or wetlands.	Similar to the NAA/FWOP dredging and dredged material placement/disposal would not impact any SAV or wetlands.
Benthic Fauna	No effect from present container vessel navigation.	Impacts would be at the same threshold level of impact as the NAA/FWOP (adverse, temporary, and minor), however, the relative level of impact with the Action Project Alternative would be slightly higher due to the proposed dredging.

Resource	No Action Alternative/Future Without Project Alternative	Action Project Alternative
Plankton Community	Adverse, temporary and negligible impacts to the local plankton community that result from current container vessel navigation include entrainment, burial/siltation, and reduced phytoplankton productivity would continue.	Impacts would be at the same threshold level of impact as the NAA/FWOP (adverse, temporary, and negligible) however, the relative level of impact with the Action Project Alternative would be slightly higher due to the increased duration of dredging due to proposed construction.
Fish and Fish Habitat	Current vessel navigation may affect egg, larval, juvenile, and adult life stages of fishes include direct removal or burial, turbidity/siltation effects, shifts in dissolved oxygen and salinity, entrainment, visual and noise disturbances, and alteration of habitat would continue. The impacts to fish resources and habitat would be adverse, temporary and negligible to minor. Impacts to Essential Fish Habitat (EFH) would be adverse, but temporary and minor.	Similar to the NAA/FWOP, impacts to fish and fish habitat would result in temporary, negligible to minor adverse impacts, including those to EFH. Impacts would range from mostly temporary impacts to some permanent impacts due to increased depths in the anchorage. Such impacts are not significant adverse impacts to fish or fish habitat including EFH are anticipated. No population level impacts to any managed fish species or associated prey species would be anticipated.
Wildlife	Current vessel navigation would have minor, temporary disturbance effects to wildlife.	Impacts would be at the same threshold level of impact (adverse, temporary and negligible to minor) as the NAA/FWOP, however, the relative level of impact with the Action Project Alternative would be slightly higher due to the proposed dredging.

Resource	No Action Alternative/Future Without Project Alternative	Action Project Alternative
Special Status Species	Affect findings for Federally listed green sea turtles, Kemp's ridley sea turtles, leatherback sea turtles, loggerhead sea turtles, and Atlantic and shortnose Sturgeon under the jurisdiction of the NMFS would be May Affect, But Not Likely to Adversely Affect (NLAA) because of potential temporary dredging entrainment impacts and impacts to prey species. However, no population level impacts to Federally listed species or their prey would be anticipated. The affect finding for Federally listed whales with the potential to occur in the Action Area (fin, north Atlantic right) would be May Affect, Not Likely to Adversely Affect because of potential temporary, insignificant disturbance effects. No Affect for nesting sea turtles or seabeach amaranth as no nests or land habitat could be found in the Action Area. Only temporary, insignificant disturbances to marine mammals would be anticipated to occur from disturbance related impacts. No Level A or Level B harassment to marine mammals would be anticipated. Temporary impacts to migratory birds would be negligible to minor resulting from temporary disturbance impacts.	Impacts would be at the same threshold level of impact as the NAA/FWOP, however, the relative level of impact with the Action Project Alternative would be slightly higher due to the increased duration of dredging. Affect findings are May Affect, but Not Likely to Adversely Affect sea turtles, Atlantic sturgeon and whales. No effect on seabeach amaranth, listed birds, shortnose sturgeon or nesting sea turtles.
Air Quality	Current maintenance and navigation operations would continue to generate emissions from the combustion of fuel used to operate vessels and equipment (e.g., dredge operation, pumps, transportation, and final dredged material placement/disposal). There would be adverse, temporary, negligible to minor impacts to air quality. The region is currently not in attainment and any major construction activity requires a detailed emissions analysis to see if emissions are below *de minimus* threshold or require mitigation for negative impacts to local air quality.	Impacts would be at the same threshold level of impact (adverse, temporary, and negligible to minor) as the NAA/FWOP, however, the relative level of impact with the Action Project Alternative would be slightly higher due to the increased duration of dredging and dredged material placement/disposal but air emissions are below the *de minimus* threshold and no mitigation is required. A record of non-applicability (RONA) has been prepared for the proposed project.

Resource	No Action Alternative/Future Without Project Alternative	Action Project Alternative
Climate Change	Current navigation operations would continue to generate emissions from the combustion of fuel used to operate dredge vessels and equipment. There would be adverse, temporary, negligible to minor contributing impacts to emissions.	Impacts would be at the same threshold level of impact (adverse, temporary, and negligible to minor) as the NAA/FWOP, however, the relative level of impact with the Action Project Alternative would be slightly higher due to the increased duration of dredging. In future conditions with implementation of the Action Alternative we would anticipate fewer emissions resulting from deep draft vessels as compared to future conditions without implementation of the Action Project Alternative.
Floodplains	No effect	No effect
Noise and Vibration	Implementation of the NAA/FWO is predicted to result in adverse, temporary, and minor noise and vibration impacts resulting from operation of container vessels.	Impacts would be at the same threshold level of impact as the NAA/FWOP, however, the relative level of impact with the Action Project Alternative would be slightly higher due to the increased duration of dredging.
Occupational Safety and Health	Navigation would continue and existing, adverse, temporary, safety risks that are at a negligible to minor level of impact would continue.	The duration of exposure to occupational safety and health risks would increase with implementation of the Action Project Alternative. Although the Action Project Alternative has slightly higher durations of exposures to occupational safety and health hazards, entailing slightly more risk than the NAA/FWOP, the occupational safety and health risks would be very similar and remain at an adverse, temporary and negligible to minor level of impact.

Resource	No Action Alternative/Future Without Project Alternative	Action Project Alternative
Utilities	Existing utilities would remain intact and continued operations and maintenance would have no effect on utility infrastructure.	The Action Project Alternative would be anticipated to have no impacts on utilities, as the area is outside of underwater cable areas. During PED a more detailed survey for utilities will be done and any relocations of utility lines will be done prior to construction but none are expected to be in the Action Area of Gravesend Anchorage.
Cultural Resources	There would be no anticipated direct, indirect, or cumulative effects to cultural resources. Unidentified sites could still be at slight risk to effects from maintenance dredging, although that potential is less than with implementation of the Action Project Alternative. The future without project could subject unidentified submerged archaeological sites to damage from ship strikes, groundings, and prop wash.	There would be no effect on terrestrial architectural cultural resources. No submerged archaeological resources have been recorded within the APE for dredging. Archaeological sites may exist within the APE. Surveys will be conducted for these areas during the PED Stage of the project. A Programmatic Agreement with the State Historic Preservation Office has been executed that sets forth procedures for; completing surveys and mitigating adverse effects to historic properties if any are identified. Avoidance and minimization of impacts would be attempted where feasible, and mitigation of adverse effects (if applicable) would be evaluated and determined during the PED Stage.

Resource	No Action Alternative/Future Without Project Alternative	Action Project Alternative
Aesthetics	There would be no predicted changes to the existing aesthetic environment. The aesthetic environment would continue to be that of a working waterfront with a mix of adjacent land uses.	The aesthetic environment would be similar to the Action/FWOP but temporary impacts to the view shed would increase because of increased dredging and temporary presence of dredge vessels. Implementation of the Action Project Alternative would result in adverse, temporary and negligible impacts to the aesthetic environment.
Recreation	While container vessels use the present anchorage, areas adjacent to the vessel(s) would be unavailable for recreation and represent an adverse, temporary and negligible impact to recreation.	Impacts would be at the same threshold level of impact as the NAA/FWOP (adverse, temporary, and negligible), however, the relative level of impact with the Action Project Alternative would be slightly higher due to the increased duration of dredging.

Resource	No Action Alternative/Future Without Project Alternative	Action Project Alternative
Socioeconomics and Environmental Justice	There would not be substantive changes to demographic, socioeconomic, or Environmental Justice community trends. The effect on the socioeconomic character would be beneficial, temporary, and minor from existing navigation use.	The improved anchorage would allow more efficient movement of the same quantity of cargo, but would not be anticipated to result in changes in the overall quantity of cargo being moved. Implementation of the Action Project Alternative would not result in measurable changes to environmental resources that individuals involved in subsistence fishing or hunting utilize and would not create disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Native American tribes. The Action Project Alternative would result in a temporary, beneficial increase in the local economy. RED benefits would be anticipated to be beneficial and temporary and in relation to the dredging cycle.

NAA/FWOP = No Action Alternative/Future Without Project Alternative

One important consideration in the environmental impact analysis is that the actual dredged depths can be deeper than the required channel depths. Required depths do not necessarily indicate the maximum, potential dredging depths which may also include Paid Allowable Overdepth Dredging (2 ft.). Please see Table 6-2 for an approximate estimate of estimated maximum, potential dredging depths that account for the overdepth dredging with implementation of the Preferred Alternative. For the purpose of the environmental impact analysis (as described in the Environmental Consequences sections), the full range of environmental impacts within Alternative 1 including the maximum, potential dredging depths were evaluated. Alternative 1-C is the RP. The maximum potential dredging depths, durations, and volumes are provided in Table 6-2.

Table 6-2: Summary of Estimated Dredging Depths

Alternative (ft.)	Diameter (ft.)	Depths (ft.)	TDA (acres)	RV (CY)	OV (CY)	Total Volume (CY)	DD
Red Hook Flats - 3,000 Diam. (50 + 2)	3,000	50 + 2.	162.3	2,112,604	987,836	2,800,440	5.3
Red Hook Flats - 3,600 Diam. (50 + 2)	3,600	50 + 2	233.7	5,839,605	1,223,498	7,063,103	13.2
Gravesend - 3,000 Diam. (5' + 2)	3,000	50 + 2	162.3	643,000	247.500	892,500	1.7
Gravesend - Hybrid (50 + 2) (AA)	3,600	50 + 2	233.7	700,000	252,000	952,000	1.8
TDA = total disturbed area, RV = required volume to reach 50 ft. deep, OV = overdepth volume, DD = construction duration in months, assuming two bucket dredges are on site doing the work.							

6.1 Geology, Physiography, and Topography

6.1.1 No Action/Future Without Project Alternative

Existing maintenance dredging operations, dredged material placement/disposal, and navigation within the ROI would continue. The existing sediment within the dredging footprint in the channel would continue to be removed as needed, most of which, from a geologic perspective, is recently-deposited fine sands, as due to the strong currents in the area, most of the bottom sediments are predominantly sand.

Continued maintenance of the channel system should have no effect on seismicity because the ROI is not within a seismically-active geologic setting.

New York and New Jersey Port growth is anticipated to increase throughout the next 50 years, with increasing TEU over time, though fewer vessels may call due to increasing average container vessel size. Also, additional development may occur in the future, though the New York City area is almost entirely built out and redevelopment is more likely. None of these activities are expected to significantly alter the geology and topography in the project ROI. No effect.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue in the future. Climate change impacts such as increased temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. Erosion and loss of estuarine and ocean beaches is anticipated to occur with sea level rise. Over the course of time, more landforms may become submerged, and other areas may become lower-lying and flood more frequently, particularly within the coastal physiographic province in which this project is located. This could alter local topography significantly unless actions are taken to prevent alterations to current elevations and landforms.

The No Action/Future Without Project Alternative is not predicted to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects. Therefore, effects to the geology, physiography, seismicity, and topography from implementation of the No Action/Future Without Project Alternative are predicted to be negligible to minor and permanent.

6.1.2 Action Project Alternative

Impacts to geology, physiography, seismicity, and topography with implementation of Action Alternative, would be similar to those described for the No Action/Future Without Project Alternative.

With implementation of the Action Alternative, the Gravesend Hybrid Anchorage proposed area will be dredged to the dimensions necessary for navigation and maintained to those depths. No geologically significant minerals would be affected, and the project would have no effect on seismicity or physiographic processes, such as the development of landforms. Because there are no bedrock or confining geologic layers within the limits of the proposed dredging, none would be affected, and no blasting of the substrate will be needed to achieve the proposed depth of the proposed anchorage expansion from prior dimensions to the proposed Gravesend Hybrid dimensions.

Compared to current operations, there would be a temporary, increased material placement/disposal at the offshore HARS dredged material placement site, such impacts have already been addressed in HARS NEPA documents previously cited. It is not expected that upland dredged material disposal sites will be needed, but if any contaminated sediments are discovered during final pre-construction monitoring, such contaminated material will be placed in upland disposal sites able to safely handle and contain such materials. This could cause minor, negligible changes in local topography at the disposal sites. As these are man-made sites, and used as such, topographic changes as a result of dredged material placement will not affect any natural geologic landforms.

As described in the No Action/Future Without Project Alternative Section, potential cumulative impacts include increased development such as port growth, increased shipping traffic, and climate change. Various projects currently under consideration in the Gravesend Bay watershed by the City may improve local environmental conditions, if implemented. Implementation of the Action Alternative is not anticipated to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects, including port growth.

6.1.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the No Action/Future Without Project Alternative and Action Alternative, would result in only temporary and negligible impacts. No significant impacts to geology or topography in the project ROI are expected.

Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, resulting in only temporary and negligible impacts. No significant impacts to the geology or topography in the project ROI are expected.

6.2 Bathymetry, Hydrology, and Tidal Processes

6.2.1 No Action/Future Without Project Alternative

With implementation of the No Action/Future Without Project Alternative, there will be no effect to the local bathymetry, hydrology or tidal processes in the ROI. Ongoing navigation issues occurring with multiple ships in the channel, lightering, ships having to wait offshore to enter the harbor channels, difficulty for large container ships to turn at anchorage and related problems with navigation will continue. Periodic maintenance dredging and existing dredged material placement/disposal will be done as needed to maintain current channel depths and widths, as well as those of associated anchorages but to date little maintenance dredging has been needed (Table 4-8, Chapter 4 of this document) due to the nature of the majority of the sediments (sand) as well as strong currents which tend to scour and move down-bay any incoming sediment in the local ROI rather than deposit sediment.

Rising seas due to climate change will, over time, slowly deepen the entire New York Bay including the ROI, though not enough to allow full use of the Anchorages being considered for deepening to accommodate large container vessels. The tidal prism will increase as sea level continues to rise. Hydrologically, waters in the lower Hudson River and New York Bay in the project ROI may increase in salinity as the amount of oceanic water relative to freshwater input is altered, with greater seawater input, this should not affect either bathymetry or tidal processes.

The No Action Alternative will not alter the present channel and associated anchorages, therefore, there will be no cumulative impacts.

6.2.2 Action Project Alternative

The additional dredging that will occur with implementation of the Gravesend Hybrid Anchorage, the selected Action Alternative, will deepen and expand the existing anchorage at Gravesend to -50 ft. with 2 additional ft. of allowable overdredge depth. The current footprint varies in depth, ranging from -88 to -94 ft. below MLLW to as shallow as -26 ft. A small area lies immediately shoreward of the present surveyed footprint at the shallow end, and may be slightly shallower than -26 ft. but, based on the depth contours visible is deeper than -20 ft. Due to the fact that a significant portion (almost half) of the footprint to be deepened already exceeds the required 50 ft. depth, no dredging will be needed in a significant portion of the proposed expanded anchorage.

The proposed dredging will alter the bathymetry in the anchorage, deepening it and removing sediments needed to achieve the desired depth. This may also potentially increase the tidal

prism in the area of the channel. This bathymetric alteration may potentially influence effects of the tides, the benthic community, and/or water quality and these impacts are discussed further in the Water Quality and Benthic Fauna sections. The change in tidal prism is very minor compared to the size of the lower New York Bay area and no effects are expect to local tidal processes and hydrology, with no significant impacts expected as a minor, permanent impact on local bathymetry results from the proposed dredging.

Although climate change has the potential to alter the tidal prism within the ROI, implementation of the Action Alternative is not predicted to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects. Therefore, effects to bathymetry, hydrology, and tidal processes from implementation of the Action Alternative are predicted to be permanent and minor.

6.2.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, would have resulted in more significant impacts, especially to local bathymetry, as this site is much shallower than the Gravesend Anchorage and, as a result, much more material would need to be dredged from the site to achieve the desired 50 ft. depth. This is also a much narrower waterway when compared to the Gravesend site, increasing the chance that local hydrology would have been significantly impacted.

The Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, resulting in minor impacts to local bathymetry and no effect to local hydrology or tidal processes.

6.3 Hazardous, Toxic, and Radioactive Waste

6.3.1 No Action Alternative/Future Without Project

Current HTRW releases into local waters may continue into the future and could potentially result from dredging operations, dredged material placement/disposal, navigation, sewage and/or stormwater and effluent discharges from within the ROI. Existing and future dredging and dredged material placement/disposal may result in a shift in the location of sediment-bound contaminants from channels to upland dredged material disposal sites, where they will be permanently contained. Detectable releases of contaminants from disturbed sediments into the water column are not anticipated as potential contaminants would be anticipated to remain bound to the sediment. Sediment within the ROI has been tested for placement/disposal and the dredged material is within established limits for placement/disposal at these sites. It is expected that future maintenance dredging will continue to have a similar, negligible level of impact and will remain within dredged material placement/disposal limits for any upland site, if contaminated, or for open ocean disposal used for uncontaminated sediments, including HARS. This is not expected to have any substantive long-term adverse impacts in the ROI. It is likely that continuing efforts to remediate PCB contaminated sediments will reduce the amount of and exposure to HTRW in the project ROI as the Hudson River sediment contamination level drops. Better control and treatment of stormwater, sewage and effluents from landfills and other sources will also act to lessen the amount of toxic chemicals that enter waters of the project ROI and is a stated of the NYSDEC (NYSDEC, 2019). Contaminants in waters and sediments would then decrease over time.

Continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact water quality within the ROI and adjacent areas. The Port of

New York and New Jersey's growth is anticipated to increase throughout the next 50 years, which may increase the number of vessels transiting New York Harbor. However, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port along with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Several projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

Monitoring of NPL sites by the responsible party and the tracking of hazardous waste, toxic waste and radioactive waste generators throughout the ROI will continue through applicable state and Federal programs. Existing Site Management and Monitoring Plan (SMMPs) and Ocean Dumping laws will continue to protect dredged material placement/disposal sites from receiving contaminated sediments that could impact the ROI, with only uncontaminated sediments allowable for placement in HARS.

6.3.2 Action Project Alternative

The implementation of the Action Alternative, the Gravesend Hybrid Plan, would not cause any substantial change in the chemical constituents or concentration of contaminants in the sediment dredged and it is expected that all dredged material has sufficiently low enough levels of contamination to allow placement in the offshore HARS site. Implementation of the Action Alternative is not anticipated to result in any generation or regulated release of a HTRW so no significant impacts related to HTRW are expected from project implementation.

However, dredging may result in a shift in the location of sediment-bound contaminants. Detectable releases of contaminants from disturbed sediments into the water column are not anticipated as potential contaminants would be anticipated to remain bound to the sediment. Due to the lower organic content of the primarily sand sediments proposed for dredging, it is unlikely that significant contamination of the sediments is present. Further, extensive sediment testing conducted over the last decade within the ROI as the channels have been maintained and deepened has in large part met guidelines for disposal at HARS. Any dredged material will be subject to existing disposal SMMPs, Ocean Dumping laws, and Section 103 MPRSA compliance. These guidelines along with the USACE Upland Testing Manual if upland sites are necessary due to contamination will continue to protect placement/disposal sites. Therefore, redistribution of contaminants resulting from dredging would be negligible and are not expected to have any substantive long-term adverse impacts in the ROI.

Continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact water quality within the ROI and adjacent areas. The Port of

New York and New Jersey's growth is anticipated to increase throughout the next 50 years, which may increase the number of vessels transiting New York Harbor. However, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

Monitoring of NPL sites by the responsible party and the tracking of hazardous waste, toxic waste and radioactive waste generators throughout the ROI will continue through applicable state and Federal programs. Existing SMMPs and Ocean Dumping laws will continue to protect dredged material placement/disposal sites from receiving contaminated sediments that could impact the ROI, with only uncontaminated sediments being placed at HARS.

Implementation of the Action Alternative is not anticipated to synergistically interact with climate change and other cumulative effects to have any adverse effects resulting in generations or releases of HTRW into the ROI. No significant impacts to HTRW.

6.3.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the No Action/Future Without Project Alternative and Action Alternative, would result in only temporary and negligible impacts to HTRW. No significant generations, releases or increases to HTRW in the project ROI short term during construction or long-term post construction are expected. No significant impacts to HTRW.

Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, resulting in only temporary and negligible impacts to HTRW. No significant generations, releases or increases to HTRW in the project ROI short term during construction or long-term post construction are expected. No significant impacts to HTRW.

Implementation of the Action Alternative is not anticipated to synergistically interact with climate change and other cumulative effects to have any adverse effects resulting in generations or releases of HTRW into the ROI.

6.4 Water Quality

6.4.1 No Action Alternative/Future Without Project Alternative

Temporary and negligible to minor adverse impacts to water quality that result from current maintenance operations that include increased Total Suspended Solids, turbidity, and nutrient levels would continue at the dredging site. Overall impacts to water quality with current operations are temporary, adverse and negligible to minor.

All maintenance dredging activity within the boundaries of present navigation channels would comply with current Water Quality Permits for the New York and New Jersey Harbor system of connected channels. Sediments will be tested in accordance with the Evaluation of Dredged Material for Discharge in Waters of the U.S.- Testing Manual (USEPA, 1998) and the USACE Manual, Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual (USACE, 2003) prior to commencement of dredging to ensure appropriate placement/disposal of dredged material. It is expected that all or most of the dredged material will consist primarily of sandy material and will be disposed of at the offshore HARS site as has been done in the past. The dredging operations would result in temporary, adverse impacts to water quality that are negligible to minor.

Continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact water quality within the ROI, lower New York Bay and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, which may increase the number of vessels transiting New York Harbor. However, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue. Predicted climate change impacts such as increased ocean temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns, have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. The pH within surface waters will likely drop as ocean acidification occurs. Climate change is anticipated to potentially increase winter and spring nutrient loading into the Hudson River watershed due to several additional inches of precipitation (Cornell, 2019). Higher temperatures, lower dissolved oxygen levels, and increased phytoplankton productivity may result in

alterations to the local ecosystem but hypoxic conditions are not expected due to the high flushing rates and strong currents within the project ROI, lower New York Bay.

Implementation of the No Action/Future Without Project Alternative is not anticipated to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects, including port growth to negatively impact water quality. The changes due to sea level rise will occur regardless.

6.4.2 Action Project Alternative

Implementation of the Action Alternative, the Gravesend Hybrid Plan, may result in a temporary increase in Total Suspended Solids and turbidity in the dredging footprint and adjacent areas. . There may be a slight, temporary increase in the level of dissolved nutrients (N and P) in the water column as well following dredging activities as nutrients in sediment are released by dredging. These adverse water quality impacts would be temporary in nature and are anticipated to result in minor levels of impact, primarily in the sediment plume, which should quickly settle due to the predominant sand sediments to be dredged.

Changes in salinity and decreases in Dissolved Oxygen (DO), and flushing rates are anticipated to cause permanent, minor impacts to water quality that are, based on prior water quality modeling for the comparatively much more extensive in size and impact channel deepening of New York and New Jersey Harbor, negligible and not significant in nature. No significant adverse impacts to water quality were found for the channel deepening, and similarly, none are expected for the Gravesend Hybrid Plan, a much smaller-scale dredging action that should have very little influence on local hydrodynamics that could alter water quality, post-construction.

The duration and volumes of expected dredged materials can be found in Appendix D. Sediment testing will be conducted in accordance with the Evaluation of Dredged Material For Discharge in Waters of the U.S.- Testing Manual (USEPA, 1998) and the USACE Manual, Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual (USACE, 2003) prior to the commencement of dredging would ensure that only dredged material that meets suitability criteria would be placed at HARS ocean disposal site and if criteria for disposal at HARS is not met, at appropriate upland disposal sites that can handle such material. Placement impacts of these sediments at HARS site has been documented, there is a Site Management and Monitoring Plan (SMMP) associated with HARS management, which was developed according to the provisions of 40CFR part 228 for management of ocean dredged material disposal sites (USACE, 2019). There would be temporary, adverse impacts to the water quality of the dredging locations and placement sites; however, these impacts would be minor and within SMMP guidelines for HARS. At present, it is assumed all the dredged material will be placed at the HARS.

As described in the No Action/Future Without Project Alternative Section, potential cumulative impacts resulting from deepening the anchorage(s) may include increased potential adverse effects to water quality and to benthic habitat. .

While unrelated to the navigation study or program, cntinued development, shipping and other port operations, as well as stormwater discharges will continue to also negatively impact water quality within the ROI and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years. However, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a

Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue. Predicted climate change impacts such as increased ocean temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns, have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. The pH within surface waters will likely drop as ocean acidification occurs. Climate change is anticipated to potentially increase winter and spring nutrient loading into the Hudson River watershed due to several additional inches of precipitation (Cornell, 2019). Higher temperatures, lower dissolved oxygen levels, and increased phytoplankton productivity may result in alterations to the local ecosystem but hypoxic conditions are not expected due to the high flushing rates and strong currents within the project ROI.

Implementation of the Action Alternative is anticipated to result in adverse impacts that would be temporary to permanent and negligible to minor to water quality. Although impacts are adverse, it would not reach a threshold level of importance in the impact findings for water quality and are considered not significant. Implementation of the Action Alternative will not substantially cumulatively or synergistically interact with climate change and/or other cumulative effects.

6.4.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the No Action/Future Without Project Alternative and Action Alternative, would result in permanent habitat loss since it is a regulated shallow ('flats') area, but, only temporary and negligible impacts, otherwise. No significant impacts to water quality in the project ROI short term during construction or long-term post construction are expected.

Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, resulting in only temporary and negligible impacts. No significant impacts to water quality in the project ROI short term during construction or long-term post construction are expected.

6.5 Vegetation, Wetlands, and Submerged Aquatic Vegetation

6.5.1 No Action /Future Without Project Alternative

Existing maintenance dredging operations and navigation within the ROI would continue. These operations can cause minor turbidity, siltation, and boat wakes within the ROI. However, because there is no SAV in the ROI, much of the shoreline is developed, and because of the

substantial distance from the current dredging sites from any existing shoreline wetlands, no existing or future impacts to these resources resulting from dredging and dredged material placement operations are anticipated.

New York and New Jersey Port growth is anticipated to increase throughout the next 50 years, with increasing TEU over time, though fewer vessels may call due to increasing average container vessel size. Also, additional development may occur in the future, though the New York City area is almost entirely built out and redevelopment is more likely. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

The proposed projects should have No effect on local vegetation, including wetlands and SAV.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue in the future. Climate change impacts such as increased temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. In general, wetlands both inside and outside of ROI as well as SAV are at increased risk of damage and loss from potential increases in sea level rise and salinity shifts. The locations of these resources may shift in response to climate change and the ensuing sea level rise. Wetlands may erode further, or be at increased risk of becoming too inundated to support vegetation. As a result, they may transition into mudflats and/or subaqueous bottom. Alternatively, sea level rise may cause estuarine wetlands to retreat inland, by converting existing uplands to wetlands. In addition, higher salinity levels in waterways in combination with increased sea level may result in inundation of freshwater wetlands further upstream in the Hudson River and other waterways connecting to New York Harbor, or conversion to estuarine wetlands due to salinity shifts.

The ROI itself is already a highly developed city and port with substantial navigation and shipping operations, with few wetland areas and modest vegetative cover. Therefore, continuing maintenance dredging operations would not likely cause substantial shifts to these community types in future conditions.

The No Action/Future Without Project Alternative is not predicted to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects, including port growth. Therefore, with implementation of the No Action/Future Without Project Alternative, adverse impacts are temporary to permanent, and negligible.

6.5.2 Action Alternative

Similar to the No Action/Future Without Project Alternative, there would be no impacts to SAVs or shoreline wetlands with implementation of the Action Alternative, the Gravesend Hybrid Plan.

Extensive water quality modeling has been done (please see the affected environment section on water quality for details) and based on these findings, potential changes to water quality parameters would be negligible to minor. Therefore, we would not anticipate any potential impacts to water quality to result in an impact to shoreline wetlands. Slow moving dredging vessels and associated tugs should not cause a significant increase in damaging boat wakes that could increase erosion rates along any shorelines within the project ROI.

Although increased Port development and climate change have the potential to adversely impact vegetation in the ROI, implementation of either of Action Alternative is not anticipated to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects, including port growth. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

The proposed projects should have No effect on local vegetation, including wetlands and SAV.

6.5.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the No Action/Future Without Project Alternative and Action Alternative, would result in no impacts to SAVs or shoreline wetlands. Although the volume that would have been necessary to dredge is larger, impacts to vegetation would be similar due to the nature of the project.

The Gravesend 3,000 Ft. Anchorage Alternative, similar to the No Action/Future Without Project Alternative and smaller in size than the Action Alternative, would result in no impacts to SAVs or shoreline wetlands. No effect.

6.6 Benthic Fauna

6.6.1 No Action /Future Without Project Alternative

Existing maintenance dredging operations and navigation within the ROI would continue. Maintenance dredging is very infrequent and the benthic community reflects this, with the organisms present representing the climax community of a given benthic area. The organisms that colonize the benthos in the project ROI are typically a limited suite of small, opportunistic species with a relatively short life cycle, with few exceptions, such as longer-lived hard clams

(*Mercenaria mercenaria*) and blue crabs (*Callinectes sapidus*), and are adapted to sand to sand/silt bottom environments with frequent disturbance. Locally, the disturbance is due to strong currents and tidal action and the resultant scouring that occurs in the ROI, which is, in general, not a region where fine silts and clay sediments are deposited though there are areas where silts are the predominant sediment type. Monitoring in the general project area (USACE, 2011) indicated that within the Ambrose Channel, which consists primarily of sand sediments, blue mussels predominate in biomass and number, accounting for 86% of the total organisms found, followed by amphipods and polychaetes, with an average density of 3,696 animals/meters^2 . Further upriver, the Anchorage channel consisted of mostly polychaetes, with arthropods and molluscs following in abundance with few blue mussels found as would be expected in a more silt-dominated bottom habitat. Various annelid species (*Spio setosa*) were the most numerous, followed by amphipods and a small clam, the northern dwarf tellin (*Tellina agilis*) with an average density of 2,580 animals/meters^2.

Additionally, benthic organisms outside the dredging footprint could be impacted temporarily by increased levels of Total Suspended Solids and turbidity from some maintenance dredging. . The siltation of benthic organisms may prevent or reduce respiration and/or foraging for filter-feeding organisms. However, the sediment plume during dredging operations will likely not be significant enough to result in more than minor mortality of benthic life outside the channel, as quantities of Total Suspended Solids released should not result in burial of the benthos deep enough such that they will be unable to survive.

Dredging activities often generate no more increased suspended sediments than commercial shipping operations, bottom fishing or than those generated during severe storms (Parr et al. 1998). Furthermore, natural events such as storms, floods and large tides can increase suspended sediments over much larger areas and for longer periods than dredging operations (International Association of Dredging Companies, 2015). It is therefore often very difficult to distinguish the environmental effects of dredging from those resulting from natural processes or normal navigation activities (Pennekamp et al., 1996).

Maintenance dredging will cause minor, adverse impacts to the benthic community resulting from direct removal or entrainment of benthic organisms, strikes and crushing of benthic organisms, and turbidity/siltation effects that could include burial and potentially impact respiration of benthic organisms. The existing and projected future adverse impacts to the benthic community are temporary, minor and adverse.

6.6.2 Action Project Alternative

Impacts to the benthic community with implementation of the Gravesend Hybrid Plan, the Action Project Alternative would be to temporarily eliminate the benthic community within the immediate dredging footprint. Dredging will cause impacts to the benthic community resulting from direct removal or entrainment of benthic organisms, strikes and crushing of benthic organisms, and turbidity/siltation effects that could include burial and potentially impact respiration of benthic organisms. Species present within the Gravesend Hybrid Anchorage footprint proposed for dredging are expected to be similar to those in the adjacent Ambrose Channel. Monitoring in the area (USACE, 2011) indicated that within the Ambrose Channel, which consists primarily of sand sediments, blue mussels predominate in biomass and numbers, accounting for 86% of the total organisms found, followed by amphipods and polychaetes. There are more pollution-sensitive taxa in this region compared to areas further upriver, indicating that there is less contamination present (USACE, 2006). Overall average

density of organisms in the Ambrose Channel was 3,696/m^2 (USACE, 2011) an increase from 775/m^2 in 2005 (USACE, 2006) indicating that the benthic community has continued to increase in numbers post deepening over time. Re-colonization of the dredging footprint begins almost immediately post-dredging as small, r-selected species with short life cycles, such as polychaetes and amphipods, settle in the area, followed by larger, longer-lived species such as hard clams and blue mussels. Within the waters and sediments in the ROI, recovery of the benthic community could recover in approximately two years (Wilbur et al. 2008; Stickney and Perlmutter 1975) though more coarse sand habitats such as the Gravesend Hybrid Plan area may take a few years longer to fully recover to the previous species suite and abundance (USACE, 2006, 2011). Highly motile benthic species, such as blue crabs, will experience few losses as these species can crawl or swim out of the way of dredging operations and will return to the area shortly after the dredge leaves. The overall area to be dredged is relatively small, compared to the benthic acreage in the lower New York Bay. As re-colonization by benthic organisms begins immediately post dredging, it is expected that only the area dredged very recently (within a week) will actually be completely denuded of benthic organisms. Following implementation of the Action Alternative, there would be little change in the composition and abundance of the benthic community within a few years (USACE, 2006) with significant recovery occurring within a year post-dredging. Undredged areas nearby will provide recruits of the entire suite of benthic organisms to the denuded area and allow for natural recovery. The existing and projected future adverse impacts to the benthic community resulting from dredged material placement/disposal at HARS, which has been addressed via NEPA (USEPA, 1997) and will not be further discussed in this draft EA.

Overall, impacts to the benthic community are caused by implementing the Action Alternative, the Gravesend Hybrid Plan, are considered minor, adverse and temporary.

Cumulatively, continued development, shipping and other Port operations, and stormwater discharges, will continue to negatively impact water quality within the ROI and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, which may increase the number of vessels transiting New York Harbor. However, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

Continued development, shipping and navigation operations, and stormwater discharges/nutrient inputs will continue to impact the benthic community within the ROI and

adjacent coastal and estuarine waters. These projects should have no impact on the local benthic community in Gravesend Anchorage.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue. Predicted climate change impacts such as increased ocean temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns, have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. The pH within surface waters will likely drop as ocean acidification occurs. Climate change is anticipated to potentially increase winter and spring nutrient loading into the Hudson River watershed due to several additional inches of precipitation (Cornell, 2019). Higher temperatures, lower dissolved oxygen levels, and increased phytoplankton productivity may result in alterations to the local ecosystem but hypoxic conditions are not expected due to the high flushing rates and strong currents within the project ROI. Higher pH may negatively impact shell-forming benthos, as they will have increased difficulty forming their shells under a higher pH environment (Talmage et al., 2010), a negative impact to any shell-forming organism in the region that will also impact finfish, as their prey items change in abundance and distribution (Frank et al., 1990). Species distribution will likely change due to shifts in salinity and temperature (Kleisner, 2017) as water temperature warms, bringing into the local ROI more southern species and displacing local cold-water preferring species to the North.

The implementation of either the Action Alternative, No Action Alternative or Other Alternatives Considered are not predicted to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects. Therefore, effects to the benthic community from implementation of the Action Alternative are predicted to be adverse, temporary and minor in nature.

6.6.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to Action Alternative, would result in only temporary, minor and adverse impacts. The benthic community would recover as described for the Action Alternative.

Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, resulting in only temporary, minor and adverse impacts. The benthic community would recover as described for the Action Alternative.

6.7 Plankton Community

6.7.1 No Action/Future Without Project Alternative

Existing dredging operations, Port operations and navigation would continue. Temporary and negligible adverse impacts to the plankton community that result from current dredging include entrainment, burial/siltation, and reduced light levels that may affect phytoplankton productivity. Continued re-development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact plankton species composition and the local plankton community within the ROI. The Port of New York and New Jersey growth rate is expected to be positive throughout the next 50 years, with increasing TEU both imported and exported over time, though fewer vessels may call due to increasing average container vessel size. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the

shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

None of these activities are expected to have a significant impact on plankton communities within the project ROI.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue as a result of burning of fossil fuels and deforestation. Predicted climate change impacts such as increased ocean temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns, have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. Climate change is anticipated to potentially increase winter and spring nutrient loading into the lower New York Bay and may result in increased phytoplankton production (Najjar et al., 2010). The higher temperatures, lower dissolved oxygen levels, and increased phytoplankton productivity may result in more frequent hypoxic conditions (low dissolved oxygen conditions) in the water column. The anticipated higher temperatures and carbon dioxide levels in the New York Bay, similar to those expected for Chesapeake Bay further south, may result in increases in harmful algal blooms (Najjar et al., 2010). Decreasing pH (Kurihara, 2008; Iglesias-Rodriguez et al., 2009) due to ocean acidification related to increasing CO2 levels could inhibit the shell formation of plankton that rely on a calcium carbonate shell for survival. Climatic change has the potential to affect the plankton species composition and abundance of plankton populations within the ROI which in turn can affect higher level food chain composition and dynamics. The exact intensity and threshold to plankton populations resulting from climatic change is relatively uncertain but has the potential to substantially alter plankton populations in the ROI.

Although climate change has the potential to significantly alter the plankton community composition as well as abundance, implementation of any of the No Action Alternative/Future Without Project Alternative is not predicted to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects.

6.7.2 Action Project Alternative

Dredging construction of the Gravesend Hybrid Plan, implementation of the Action Project Alternative may cause temporary increases in Total Suspended Solids and turbidity. While increases in Total Suspended Solids and turbidity have been documented as lasting for a maximum duration of approximately 24 hours following the cessation of dredging if the sediments are largely comprised of fine grain material, currents are low and a clamshell mechanical dredge is utilized, because the sediments in the action area are likely comprised of large grain material, such as sand, with the potential for only a slight layer of silt overlay, it is likely that the resuspension of any small grain dredged materials would be negligible.

(https://www.nan.usace.army.mil/Missions/Navigation/New-York-New-Jersey-Harbor/Harbor-Program-Reports/).

Continued re-development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact plankton species composition and the local plankton community within the ROI. The Port of New York and New Jersey growth is expected to be positive throughout the next 50 years, with increasing TEU both imported and exported over time, though fewer vessels may call due to increasing average container vessel size. Also, additional development may occur in the future, though the New York City area is almost entirely built out and redevelopment is more likely. None of these activities are expected to have a significant impact on plankton communities within the project ROI. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

None of these activities are expected to have a significant impact on plankton communities within the project ROI.

Climate change may lead to increased ocean temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns and has the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. Climate change is anticipated to potentially increase winter and spring nutrient loading due to higher precipitation into the lower New York Bay (Levinton et al., 2011) may result in increased phytoplankton production similar to that expected in Chesapeake Bay in the future due to the same expected increases in seasonal rainfall (Najjar et al., 2010). The higher temperatures, lower dissolved oxygen levels, and increased phytoplankton productivity may result in more frequent hypoxic conditions (low dissolved oxygen conditions). The anticipated higher temperatures and carbon dioxide levels in the project ROI due to climate change may result in increases in harmful algal blooms (Najjar et al., 2010). Climatic change has the potential to affect the plankton species composition and abundance of plankton populations within the ROI, which in turn can affect higher level food chain composition and dynamics. The exact intensity and threshold to plankton populations resulting from climatic change is relatively uncertain but has the potential to substantially alter plankton populations in the ROI.

Although climate change has the potential to shift the plankton community composition as well abundance, implementation of any of action alternative is not predicted to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects. Therefore, adverse impacts to plankton populations from implementation of the action alternative are predicted to be temporary and negligible.

6.7.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the No Action/Future Without Project Alternative and Action Alternative, aside from direct impacts to shallow regulated ('flats') habitat, would result in only temporary and negligible impacts, otherwise. No significant impacts to plankton resources in the project ROI.

Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, resulting in only temporary and negligible impacts. No significant impacts to plankton resources in the project ROI are expected.

6.8 Fish and Fish Habitat

6.8.1 No Action/Future Without Project Alternative

Existing maintenance dredging operations and navigation within the ROI would continue. Current dredging and navigation operations that may affect egg, larval, juvenile, and adult life stages of fishes within the ROI include direct removal or burial, turbidity/siltation effects, temporary shifts in dissolved oxygen during dredging operations, entrainment, visual and noise disturbances, and alteration of habitat. The impacts to fish resources would be negligible to minor and temporary.
Continued Port development, shipping and navigation operations, and stormwater discharges will continue to negatively impact water quality and fish health within the ROI and adjacent waters. PCB contamination in local sediments of the Hudson River may remain at high enough levels to negatively impact fish health, though a number of clean-up efforts have been done, planned or are underway to attempt to ameliorate this. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, however, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions.

These projects should have no significant impact on fish or fish habitat.

As a result of climate change, global temperatures and sea level are expected to rise in the foreseeable future. Predicted climate change impacts such as increased ocean temperatures, ocean acidification, sea level rise, and changes in currents, upwelling, and weather patterns all

have the potential to affect the nature and character of the estuarine and coastal ecosystem in the ROI.

Sea level rise may result in an increase in salinity in upstream areas that could affect breeding sites and survival of early life stages (eggs, larvae, and young of the year). There could be shifts in breeding habitat availability and timing, and the effects of this change on fish populations could be detrimental although relatively uncertain at this time. The shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability, which could also cause detrimental effects to fish resources and habitats. These impacts related to climate change, mainly warming waters, are being observed with regard to species range and distribution (Nye et al., 2009; Rose, 2005).

6.8.2 Action Alternative

Potential impacts to fish and fish habitat from the Action Alternative, the Gravesend Hybrid Plan, result from dredging vessels transiting to dredging locations, and dredging. Offshore disposal of dredged material at HARS and any impact it may have has already been addressed in prior NEPA documents (USEPA, 1997). Decreases in light penetration in the water column can result in behavioral responses from fishes due to the disturbance effect and also potentially limit visibility. Increased depths from dredging in estuarine environments also has the potential to alter salinity levels within the dredging footprint and can also potentially result in changes in Dissolved Oxygen levels. Prior water quality modeling, as noted in the water quality section of this NEPA document, indicated no significant changes to salinity or dissolved oxygen from much larger dredging projects in the ROI, and, therefore, we expect no significant impacts to fish due to changes in salinity or DO due to the dredging, either during or post-dredging. Dredging has the potential to release nutrients and/or contaminants from sediments, which can impact fishes, prey, and habitat. As most of the material is sand in nature, and nearby dredging has not found significant sediment contamination, it is expected that little contamination within the proposed dredging site is present. There should be negligible releases of contaminants and/or nutrients due to the proposed dredging. However, sediment contaminant testing has not been conducted to the planned depths of sediment dredging anticipated for this project. Therefore, additional testing will be done during the Preconstruction, Engineering, and Design Phase of the project to confirm the sediments are not contaminated and can be disposed of offshore at HARS. Fishes can also be impacted by potential strikes from dredging vessels/equipment. Fish may be impacted by noise disturbances which may cause species to flee the area of impact or potentially alter other behaviors, including foraging success. Fishes and their habitat could potentially be impacted by releases of MEC/UXO (munitions, explosives of concern or unexploded ordnance) during construction operations. There has been concern in the past regarding the occurrence of MEC/UXO in that, historically, chances for an encounter increases as the further south towards Raritan Bay and southward along the New Jersey coastline dredging occurs. Due to its location, we do not expect any MEC/UXO in the dredging footprint.

The temporary increase in Total Suspended Solids and turbidity in the water column at the dredging site has the potential to directly impact fishes and fish habitat. The impacts to fish species from Total Suspended Solids and turbidity are directly related to: the species tolerance, exposure rate, duration of the exposure, and life stage. Deposition of suspended sediments may induce impacts to fish eggs and larvae through deposition, abrasion, and or smothering, especially in the dredging and disposal areas (Wilbur and Clarke, 2001). However, in species, such as the white perch, the deposition of particulate matter on eggs does not demonstrate any adverse effects. White perch eggs can tolerate concentrations of 500 mg/L of particulate matter

without any adverse effects. Winter flounder, a local species which lays demersal eggs, is an EFH species and will be addressed in detail within the EFH assessment attached to this document. Winter flounder have been extensively studied by the USACE in the local region (USACE, 2000-2011, 2013, and 2015) and were found to spawn in shallow sand flats less than 20 ft. in depth. As none of the proposed dredging is less than 20 ft. in depth, we expect no significant impacts to winter flounder reproduction. For further details please see the EFH assessment for this and other EFH species. In addition, non-motile, sessile benthic prey species adjacent to the dredging footprint have the potential to be buried and smothered during dredging but these populations should recover quickly, as discussed in the benthic fauna section of this document. Increases in Total Suspended Solids and turbidity can impact prey species' predator avoidance response due to visual impairments caused by decreased water clarity (Gregory and Northcote, 1993; Wilbur and Clarke, 2001). Turbid waters can also visually impair predator species that rely on sight to forage. Increased Total Suspended Solids and turbidity alters the ability for light to penetrate the water column; this impairs both physical and biological processes in the affected area (Johnston, 1981; Wilbur and Clarke, 2001). Increased turbidity can impact primary productivity and respiration of organisms within the project area. By limiting light availability in the water column, the rate of primary productivity has the potential to drop, and as an effect of the reduction in primary productivity, there is an overall reduction in Dissolved Oxygen availability. If Dissolved Oxygen levels drop significantly, anoxic conditions may ensue, which can result in stress induced illness or mortality. However, dredging operations have occurred in the ROI and adjacent areas for many decades and no dredging operation has been recorded to result in an anoxic fish kill or harmful algal bloom, likely due to the primarily sand sediments in the local area as well as the strong currents which would tend to prevent anoxic conditions from occurring. Therefore, anoxic or hypoxic conditions, or harmful algal blooms and their associated negative impacts on local fish populations either during or following dredging operations is negligible with implementation of the Action Alternative.

The behavioral response of estuarine fish species to Total Suspended Solids and turbidity has been documented in a number of studies; it has been found that the suspension of fine particles hinders gas exchange with the water by coating the respiratory epithelia of juvenile and adult fish (Wilbur and Clarke, 2000). The larger suspended particles can be trapped in the gill filaments and fill the opercular cavity, which may lead to asphyxiation by prohibiting the passage of water through the gills (Johnston 1981; Wilbur and Clarke, 2000). Even so, increased sediment loading in the water column is predicted to be temporary and small in scale relative to the surface acreage and volume of local ROI waters, with the effects subsiding within hours of ceasing operations with a return to normal within a day or two at most, as the majority of the material to be dredged consists of fine sands, which settle quickly. Another behavioral response may be for fish and/or prey species to move away from the disturbance and visual effects. We anticipate that demersal species, especially those that could be foraging in the project area, such as flounder, red and silver hake, and other demersal fish to be most affected and leave the immediate dredging footprint.

While dredging operations could temporarily increase Total Suspended Solids and turbidity, these impacts will be minor when compared to background levels. The flushing rate (due to the water exchange and tidal fluctuations) within the ROI will minimize potential Total Suspended Solids/turbidity plumes and cause them to disperse quickly, minimizing long term impacts to water quality. The extent and duration of turbidity plumes is dependent on factors such dredge type, sediment composition, and hydrologic and environmental conditions in the Action Area. The dredge footprint of the New York and New Jersey Harbor Anchorage so Improvements Project is largely composed of coarse to silty sand. Sediments with larger grain sizes tend to

settle out of the water column at a faster rate than fine sediments, so it is predicted that turbidity plumes predominately composed of sands will settle faster than those with fine grained, muddy benthic sediments. The faster settling rate of suspended sands in the water column generally results turbidity plumes of lesser extents than plumes composed of fine grained sediments; the water column also returns to pre-dredging conditions quicker, thus minimizing adverse impacts to sensitive egg and larval life stages, although this is dependent on the hydrological and environmental conditions at the time of dredging and/or placement activities. TSS concentrations associated with mechanical clamshell bucket dredging operations have been shown to average approximately 210 mg/L in the water column (USACE 2001). In general, turbidity plumes generated by bucked dredges have been shown to dissipate to background levels within 600 feet of the source in the upper water column and 2,400 feet in the lower water column. Based on studies conducted by Burton (2003) and the USACE (2014), elevated suspended sediment concentrations at several hundreds of mg/L above background may be present in the immediate vicinity of a bucket, but would settle rapidly within at most a 2,000 foot radius of the dredge location, with sand settling much more rapidly than fines.

These factors combined with the operational controls on the dredge will help to minimize impacts to non-motile demersal species (Wilbur and Clarke, 2001). Overall, adverse impacts to fishes and fish habitat are predicted to be temporary in duration, and minor. Visual-reliant predatory fish will likely avoid the sediment plume while dredging is taking place. Concentrations of TSS that may adversely impact fishes range from 580 mg/L (for the most sensitive species) to 1,000 mg/L (Burton 1993). Increases in TSS and turbidity can impact the ability of prey species to avoid predators due to visual impairment caused by decreased water clarity (Gregory and Northcote 1993; Wilbur and Clarke 2001). Turbid waters can also visually impair predator species that rely on sight to forage, including coastal pelagic fishes, highly migratory fishes, and sharks. As noted, the mechanical dredges to be used for the proposed work produce the smallest sediment plumes with the lowest levels of increased TSS, which significantly reduce any TSS related impacts to local fish and fish resources. Direct removal of benthic substrate by dredging may impact fish habitat by removing important prey species (i.e. benthic organisms), food species (i.e. macroalgae), or by alteration of nursery and/or spawning areas. Re-colonization of the newly exposed substrate after dredging is not only a function of site-specific characteristics (i.e. bathymetry, tidal energy), but also of substrate requirements of the larvae of re-colonizing species (Rhoads and Germano, 1982). Any deviation from the existing benthic floor changes the habitat complexion for smaller species that utilize the area for foraging and living space. Additionally, some demersal species require specific substrates for foraging and spawning. Therefore, dredging and dredged material placement/disposal will likely result in the temporary loss of some fish habitat, including foraging grounds. Due to the depths already present at the proposed dredging site, no macroalgae is present and spawning of any fish is likely limited to surface waters, not the substrate itself.

It is anticipated that impacts to benthic habitats will involve the potential loss and displacement of non-motile benthic organisms at the dredging site. McCauley et al. (1977) documented that the total abundance of benthic organisms at a dredging site returned to pre-dredging levels seven to 28 days after dredging was completed. In a similar study conducted on the nearby James River, Diaz (1994) revealed that almost all species of benthic organisms had re-colonized the disturbed areas within three weeks after the dredging was completed. Diaz (1994) also demonstrated that benthic organisms continued to sustain pre-disturbance population densities three months after a dredging event.

Entrainment is defined as the direct uptake of aquatic organisms by the suction field generated at the suction intake. We are also referring to the capture of organisms that could occur with

mechanical dredging as entrainment. The project will utilize mechanical dredging methods, which is least likely to entrain marine life of any life stage other than sessile benthos. This is the only dredging method proposed for this project. The entrainment of fishes during dredging operations can lead to direct injury and/or death to the entrained fishes. During dredging, a possible impact to fish species is the entrainment of eggs, larvae, juveniles, and adult life stages. Life stages with limited or no swimming ability, especially eggs and larvae, have a higher potential to be entrained. Due to the depth of the proposed dredging site, demersal fish eggs should not be present. Active dredging operations have a higher potential to entrain adult and juvenile demersal fish species, such as flounder, hogchoker, hake, and sea robins, or species that spawn in or near the dredging area. Foraging, rearing, and spawning habitat preferences impact the potential for various species to be entrained, but other criteria also play an important role.

Egg, larvae, and juvenile entrainment is possible depending on the location and time or year that dredging occurs. Typically, major concerns of juvenile entrainment relate to fish below 200 mm (Hoover et al., 2005; Boysen and Hoover, 2009). Burton et al. (1992) used modeling software to predict the rate of entrainment of striped bass (*Morone saxatilis*), herring (*Alosa* spp.), and white perch (*Morone americana*) larvae. This simulation involved the continuous use of four hydraulic dredges to determine a conservative estimate of mortality and entrainment. Despite the large amount of material being dredged in this simulation, the authors concluded that less than one percent of the total larval fish population would be lost. Therefore, we expect the impacts to ichthyoplankton to be minor, adverse but not significant.

Juveniles and adults can also be entrained by dredge operations. One factor influencing potential entrainment for larger fish is based on the swimming stamina and size of the individual fish at risk (Boysen and Hoover, 2009). Swimming stamina is positively correlated with total fish length. Entrainment of larger finfish is unlikely due to the increased swimming performance and the relatively small size of the cutterhead opening. In a separate study on juveniles and adults involving 15 species of commercial and sport fish, entrainment rates varied from 0.001 to 0.135 fish per cubic yard for both cutterhead and hopper dredging operations. Out of the entrained fish, approximately 37.6 percent of the fish were mortally entrained. Over a four year period, Larson and Moehl (1990) observed entrainment rates ranging from less than 0.001 to 0.341 fish entrained per cubic yard of material dredged, distributed among fourteen species of fish. As expected, the majority of the fish entrained during this study were demersal species. Entrainment and mortality rates are anticipated to range from negligible to minor for all fish species, especially when fish mortality is compared to the amount of material dredged and duration anticipated.

Due to the open-water environment of the lower New York Harbor and the vast width of the Federal channels, the likelihood of vessel strikes to managed fish species and their prey is possible, but is not likely as it is not anticipated to be a substantial threat due to the limited amount of time the dredging vessels/equipment will be operating and the ability of motile fishes to move away from potential dredging impacts. Eggs, larvae, and species with limited swimming ability would be at highest risk of strike impacts. Effects to managed fish species and their prey from dredging vessel equipment/strikes is anticipated to range from negligible to minor and be temporary in duration and not significant.

Minor impacts due to noise on local fish populations are expected from mechanical dredging (USACE, 2012) and no blasting noise, which can be louder within a small radius around the blast zone (USACE, 2004) will be needed. Throughout the dredging process, low frequency

noise is produced, however, the highest level of noise occurs during the loading of dredged material onto the ship (Richardson et al. 1995) though the impact of a mechanical bucket on rock bottom can also be loud enough to be detectable for some distance by local fish populations (USACE, 2012) though not loud enough to damage hearing.

Underwater noise generated by dredging may impact fish species and the soundscape of the habitat in the project area, however, population-level impacts are not anticipated. Anthropogenic sources of underwater sound, and specifically dredging, have recently become the source of concern. However, despite these concerns, only a few studies have examined the sound levels of dredging equipment and the potential impacts these sound levels have on aquatic organisms. So, the influence of noise pollution on aquatic organisms, including fishes, is poorly understood. Research has predominantly looked at the potential impacts of dredging sound on marine mammals, with only a few documents examining potential impacts to fish species. However, preliminary research has provided valuable insight regarding the effect of disturbed marine soundscapes on spatially associated fish populations (USACE, 2012) and found minor impacts from the type of dredging proposed for the Acton Alternative, use of a mechanical bucket dredge.

Of the marine fish species studied, nearly all fall within the spectrum of auditory sensitivity from 20 – 1000 Hz (outliers can sense up to 4000 Hz); there is a considerable amount of spectral overlap between the noise produced from dredging activities and fish auditory sensitivity (Kasumyan, 2005; Nichols et al., 2015). Results from a study conducted by Nichols et al. (2015), provide evidence suggesting that random, intermittent noise, rather than continuous noise, produced by water craft raised the levels of cortisol – a stress hormone - in a variety of coastal fish species. Elevated cortisol levels in fishes, and especially in juvenile fishes, are correlated with negative effects, including increased susceptibility to infection, decreased growth rates, and reduced predator avoidance (Nichols et al., 2015; McCormick et al., 1998). Although the studies linking potential noise impacts to managed fish species from navigation, dredging, and dredged material placement/disposal are limited, implementation of the Action Alternative is not anticipated to substantially increase noise levels as they relate to impacts to managed fish species (USACE, 2012). Also, all impacts would be temporary in duration. Therefore, we would anticipate noise impacts to managed fish species or their prey to range from negligible to minor.

Once dredging is complete, impacted benthic areas will likely begin to re-colonize with organisms similar to those from adjacent non-impacted areas. However, benthic organisms and habitats are expected to recover to near pre-construction conditions following a dredging or dredged material placement/disposal event. Overall, the adverse effects fish and fish habitats are expected to be minor and range from temporary to permanent impacts, but not significant.

Considering cumulative impacts, continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact water quality within the ROI and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, however, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall

- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions.

These projects should have no significant impact on local fish populations.

Potential cumulative threats to managed species includes entrainment and exposure to contaminants. Another potential cumulative impact to consider is impacts that occur from fishery entanglement. While some of these threats have the potential to impact fish resources, implementation of the Action Alternative is not anticipated to significantly contribute cumulatively to injuries and mortalities.

Global climate change has the potential to affect fish populations that occur or could occur in the project area in the future. Sea level rise causes an increase in salinity in upstream areas that could affect breeding sites and survival of early life stages (eggs, larvae, and young of the year). There may be shifts in breeding habitat availability and timing and the effects of this change on fish populations could be detrimental although relatively uncertain at this time. The shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability which may also cause detrimental effects to fish populations. While continued development and climate change has the potential to impact fishes, implementation of the Action Alternative is not anticipated to substantially contribute cumulatively to injuries and/or mortalities resulting from these impacts.

Although climate change and continued use of the project has the potential to adversely affect fish and fish habitat (including EFH) in the ROI, implementation of the Action Alternative is not predicted to substantially cumulatively or synergistically interact with climate change, development, or other possible cumulative effects. Implementation of the Action Alternative is anticipated to result in negligible to minor adverse impacts to fish and fish habitat, including EFH. Impacts would range from mostly temporary impacts to some permanent impacts. However, no substantial adverse impacts to fish or fish habitat including EFH are anticipated and no impacts to the population level of any managed fish species or associated prey species are anticipated. The implementation of our proposed best management practices/mitigative measures will help to avoid and minimize impacts to fish species to the maximum practical extent.

6.8.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the No Action/Future Without Project Alternative and Action Alternative, would result in only temporary and negligible impacts. No significant impacts to local fish resources in the project ROI short term during construction or long-term post construction are expected.

Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, resulting in only temporary and negligible impacts. No significant impacts to local

fish resources in the project ROI short term during construction or long-term post construction are expected.

6.9 Wildlife

6.9.1 No Action/Future Without Project Alternative

Existing maintenance dredging operations, and navigation within the ROI would continue. Operation of vessels and dredging equipment may flush wildlife, such as waterfowl or other birds foraging or resting in the open waters of the project ROI out of the area. The increased Total Suspended Solids and turbidity resulting from dredging operations may temporarily disrupt foraging abilities for some wildlife. This results in temporary, negligible to minor, adverse impacts to wildlife.

New York and New Jersey Port growth is anticipated to increase throughout the next 50 years, with increasing TEU over time, though fewer vessels may call due to increasing average container vessel size. Also, additional development may occur in the future, though the New York City area is almost entirely built out and redevelopment is more likely. None of these activities are expected to significantly alter conditions for wildlife in the project ROI, so no effect.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue in the future. Climate change impacts such as increased temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. These impacts have the potential to affect the distribution and abundance of wildlife within the ROI. Loss of estuarine and ocean beaches is anticipated to occur with sea level rise, which would negatively impact local wildlife. The negative impacts to wildlife from continued development, continuance of storm water discharges, and navigation and shipping operations will have some negative impacts to wildlife. However, because the ROI is already a highly developed port with substantial navigation and shipping operations, these increased pressures would not likely cause substantial shifts to wildlife in future conditions. Shifts in salinity, temperature, and sea level all have the potential to result in shifts in prey species availability, which could also detrimentally impact wildlife. The potential loss of tidal wetlands and marsh islands with sea level rise may result in the general loss of nesting and foraging habitats for wildlife along the Atlantic seaboard.

The No Action/Future Without Project Alternative is not predicted to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects, including port growth. Therefore, with implementation of the No Action/Future Without Project Alternative, impacts are temporary to permanent, negligible to minor, and beneficial to adverse.

6.9.2 Action Project Alternative

Compared to current operations, operation of vessels and dredging equipment could temporarily flush additional wildlife out of the area. The increased Total Suspended Solids and turbidity resulting from additional dredging operations with implementation of the Action Project Alternative may disrupt foraging abilities for some wildlife. This would result in temporary, negligible to minor, adverse impacts to wildlife.

The dredging is anticipated to have a temporary, negligible to minor, adverse impact to benthic invertebrates and fish. This potentially impacts some of the prey species of birds. However,

because of the already disturbed nature of the majority of the ROI and the amount of other available habitat for prey species, current additional dredging and dredged material placement/disposal is not anticipated to have any substantial impact on any prey invertebrate or fish populations.

As described in the No Action/Future Without Project Alternative Section, potential cumulative impacts include increased development such as port growth, increased vessel calls, and climate change. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions

These projects should have no significant impact on local wildlife, post construction, and remediation of the Westshore Ave. Site would improve conditions for local wildlife.

Therefore, implementation of the Action Project Alternative is anticipated to result in wildlife impacts that would be temporary to permanent, negligible to minor, and adverse to beneficial.

6.9.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the No Action/Future Without Project Alternative and Action Alternative, would result in only temporary and negligible impacts. No significant impacts to wildlife resources in the project ROI are expected.

Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, resulting in only temporary and negligible impacts. No significant impacts to wildlife in the project ROI are expected.

6.10 Special Status Species

6.10.1 No Action/Future Without Project Alternative

Federally Endangered and Threatened Species

Existing dredging operations and navigation within the ROI would continue and are anticipated to continue for the next 50 years. There is no history of takes of sturgeon, whales or sea turtles due to navigational dredging in the New York Harbor. Adverse impacts to Federally listed species that range from no impact to minor, adverse impacts resulting from existing, though infrequent, dredging operations will continue. Adverse impacts to Federally listed species that occur with the No Action/Future Without Project Alternative would be similar and at the same

impact threshold to those that would occur with implementation of the Action Alternative but most impacts would be relatively less due to the temporary increase in dredging activity to construct the expanded anchorage. Impacts to state listed species, which do not include any additional species not already protected under the Federal ESA, would be at the same impact threshold as those described in the Action Alternative Section but would be relatively less. Cumulative impacts of the No Action/Future Without Project Alternative would be similar to those described with the Action Alternative. Substantial cumulative or synergistic impacts resulting from implementation of the No Action/Future Without Alternative with other cumulative impacts would not be not anticipated.

Marine Mammals

According to Todd et al. (2014), there are few studies on the effects of dredging on marine mammals due to dredging activities in isolation. In terms of direct effects, vessel collisions are possible, but improbable because dredges operate either in a stationary position or at low speeds. The risk of injury to marine mammals from collisions with dredge-related vessels is considered discountable considering the species mobility and slow speed of the dredge vessels (10 knots or less) and associated barges and scow. Also, trained personnel that know how to recognize the presence of threatened and endangered whale and sea turtle species are onboard at all times to help ensure that vessel interactions are avoided. No marine mammal strikes with dredge-related vessels has ever been reported to occur in the Action Area.

Within a noisy harbor area such as New York Harbor, ongoing exposure to underwater noise may cause causing a masking effect such that the noise of an oncoming vessel may not be detected. Marine mammals may habituate to the noisy harbor and simply not respond to an oncoming vessel as they are so adapted to the sound of vessels. In addition, the noise of the dredging vessel/equipment and also the vessels in the harbor itself has an adverse effect to listed whales in the Action Area and may interfere with their ability to communicate and forage for prey in addition to the vessel strike risks. Todd et al. (2014) noted that while dredging noise levels vary greatly and depend partly on the method and the material being dredged, limited data seem to indicate that dredging is unlikely to cause physiological damage to marine mammal auditory systems. In addition, effects of turbidity are often localized with minimal direct impact on marine mammals (Todd et al., 2014). No Level A or B harassment to marine mammals occurs with existing dredging and dredged material placement/disposal operations.

Todd et al. (2014) note that the indirect effects of dredging are more complex, and less understood. In general, literature has suggested that dredging can cause reductions in biomass and varying levels of prey availability, depending on the surrounding conditions. However, it is also noted that marine mammals can likely compensate for small-scale changes in prey by switching prey species or moving to other foraging areas (Todd et al., 2014).

Marine mammals that may occur in the ROI are accustomed to the busy harbor of which the ROI is a portion. They are also highly mobile and it is expected that they would move away from disturbance such as noise or equipment operations. The ROI is also limited relative to the surrounding area available for use; therefore the species are likely to move and forage elsewhere during the operation. Noise generated by dredge activities would not be expected to affect migration, nursing, breeding, feeding, or sheltering.

Overall, no Level A or Level B harassment to marine mammals from implementation of the Action Alternative is anticipated. Overall, no substantive disruption of behavioral patterns to migration, breathing, nursing, breeding, feeding or sheltering would be anticipated.

Potential cumulative threats to marine mammals include ship strikes and noise impacts from commercial and recreational vessels and exposure to contaminants such as oil spills. Another potential cumulative impact to consider is impacts that occur from fishery entanglement. While some of these threats have the potential to impact marine mammal populations, the No Action Alternative is not anticipated to substantially contribute cumulatively to injuries and mortalities resulting from these impacts.

Species Protected under the Migratory Bird Treaty Act of 1918 and Executive Order 13186 (EO) and Other State Listed Bird Species

Migratory birds have the potential to forage, rest, and/or migrate through the ROI. The noise and temporary turbidity plume caused by dredging actions may cause migratory birds to move away from the disturbance; however, this is a negligible to minor, and temporary impact that does not substantially impact their long-term foraging or breeding success. Dredging operations have a temporary, negligible to minor adverse impact to benthic invertebrates and fish. This potentially impacts some of the prey species of migratory birds. Future shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability which could also cause detrimental effects to migratory birds. However, because of the already disturbed nature of the majority of the ROI and the amount of other available habitat for prey species, current dredging operations, which are infrequent in the New York Harbor area, does not have any substantial impact on any prey invertebrate or fish populations.

The loss of barriers and beach nesting breeding and foraging habitat anticipated with sea level rise has the potential to impact migratory birds although the level of impact is relatively uncertain. However, substantial cumulative or synergistic impacts resulting from implementation of the No Action/Future Without Project Alternative with the impacts of climate change and other cumulative impacts is not anticipated.

6.10.2 Action Project Alternative

An assessment of the potential impacts of implementation of the Action Project Alternative, the Gravesend Hybrid Plan, on Federally listed species is provided in the NLAA documentation in Appendix E. The results of the impacts assessment are summarized there. Please note that best management practices/mitigation measures for Federally listed species are described in the NLAA found in Appendix E as well. Although minor adverse impacts to and the potential incidental take of Atlantic sturgeon, northern right whale, fin whale, and sea turtles (green, Kemp's ridley, leatherback, and loggerhead) are anticipated, these adverse impacts are not anticipated to jeopardize the continued existence of any Federally listed species. Impacts to these species are determined as: May Affect, Not Likely to Adversely Affect. For the shortnose sturgeon and listed birds, which include the piping plover, red knot, and reseate term, Impacts to these species are determined as: No Affect. No Affect on nesting sea turtles or seabeach amaranth is expected. Potential impacts to state listed birds would be the same as those described in the migratory birds section (Table 6-3).

Table 6-3: Federally Listed Species Conclusions (Within the Jurisdiction of the National Marine Fisheries Service)

Species / Resource Name	Endangered Species Act Section 7 Determination	Notes / Documentation
Atlantic sturgeon	May Affect, Not Likely to Adversely Affect	Entrainment is highly unlikely due to the expanse of area surrounding dredge operations. Collisions with dredging vessels, which care slow moving, would be unlikely and discountable. Dredging would result in a minor, temporary loss and impact to prey species.
Atlantic sturgeon Designated Critical habitat	No Affect	There is no critical habitat designated in nor adjacent to the action area.
Shortnose sturgeon	No Affect	Shortnose sturgeon are highly unlikely to be found in the proposed dredging footprint at Gravesend Anchorage or migrating through the local area.
Fin whale and North Atlantic right whale	May Affect, Not Likely to Adversely Affect	Collisions with dredging vessels would be unlikely. Dredging may impact prey species and cause whales to leave the Action Area due to noise disturbances. Effects would be insignificant and discountable.
Green sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle	May Affect, Not Likely to Adversely Affect	Turtles do not occur in the action area between fall and late spring. Dredging may impact prey species and cause sea turtles to leave the Action Area due to noise. No nesting locations are in the Action Area.

Federally Listed Species Conclusions (Within the Jurisdiction of the US Fish and Wildlife Service)

Species / Resource Name	ESA Section 7 Determination	Notes / Documentation
Piping plover, red knot, and roseate turn	No Affect	The project should not impact foraging or nesting habitat of any of these species.
Sea turtles: green, Kemp's ridley, leatherback, and loggerhead	No Affect (within the jurisdiction of the U.S. Fish and Wildlife Service)	There is no nesting habitat in the Action Area. The first ever observation of a Kemp's ridley nest, in the western section of Rockaway Peninsula in 2018, hatched successfully but is not in the Action Area or adjacent to it.
Seabeach Amaranth	No Affect; species not present.	Not found in Action Area nor is there suitable shoreline habitat adjacent to Action area.

Piping Plover, Red Knot, and Roseate Turn – Cumulative Effects

Continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact water quality within the ROI and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, however, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions.

These projects should have no significant impact on the piping plover, red knot or roseate tern.

The loss of dune barriers and beach nesting breeding and foraging habitat anticipated with sea level rise has the potential to impact these species although the level of impact is relatively uncertain. However, substantial cumulative or synergistic impacts resulting from implementation of the Action Alternative with the impacts of climate change is not anticipated. No substantive cumulative or synergistic impacts of implementation the Action Alternative with other past, present, or future projects are anticipated.

Atlantic Sturgeon – Cumulative Effects

Potential cumulative threats to Atlantic sturgeon include ship strikes from commercial and recreational vessels as well as dredging impacts and exposure to contaminants such as oil spills. Another potential cumulative impact to consider is impacts that occur from fishery entanglement. While some of these threats have the potential to impact Atlantic sturgeon populations, implementation of the Preferred Alternative is not anticipated to substantially contribute cumulatively to injuries and mortalities resulting from these impacts.

Continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact the ROI and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, however, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)

- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions.

These projects should have no significant impact on the Atlantic sturgeon.

Global climate change has the potential to affect all DPSs of the Atlantic sturgeon in the future, however, the threat may be greatest to the South Atlantic and Carolina DPSs. Sea level rise may cause a rise in salinity in upstream areas that could affect breeding sites and survival of early life stages (eggs, larvae, and young of the year). There could be shifts in breeding habitat availability and timing and the effects of this change on the Atlantic sturgeon could be detrimental although relatively uncertain at this time. The shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability which could also cause detrimental effects to the Atlantic sturgeon.

Fin, North Atlantic Right Whale – Cumulative Effects

Potential cumulative threats to whales include ship strikes and noise impacts from commercial and recreational vessels that occur throughout the entire range of the whales and exposure to contaminants such as oil spills. Another potential cumulative impact to consider is impacts that occur from fishery entanglement. While some of these threats have the potential to impact whale populations, implementation of the Action Alternative is not anticipated to substantially contribute cumulatively to injuries and mortalities resulting from these impacts.

Continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact the ROI and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, however, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions.

These projects should have no significant impact on local listed whale species.

Green Sea Turtle, Kemp's Ridley Sea Turtle, Leatherback, and Loggerhead Sea Turtle – Cumulative Effects

Potential cumulative threats to sea turtles include ship strikes from commercial and recreational vessels that occur throughout the entire range of the sea turtles and exposure to contaminants such as oil spills and exposure to PCBs while foraging on local benthos and fish, in particular the Kemp's ridley and loggerhead sea turtles. Another potential cumulative impact to consider is impacts that occur from fishery entanglement. While some of these threats have the potential to impact sea turtle populations, implementation of the Action Alternative is not anticipated to substantially contribute cumulatively to injuries and mortalities resulting from these impacts.

Continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact the ROI and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, however, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions.

These projects should have no significant impact on listed sea turtles.

Sea level rise may result in a loss of sea turtle beach nesting habitat. The future implications and amount of loss is uncertain at this time but pose an imminent threat to sea turtles who tend to return repeatedly to natal nesting locations. Impacts are further amplified by habitat loss that has occurred due to developing shorelines that also includes lighting impacts. Lighting along shorelines has the potential to disturb turtles from properly navigating to natal beach locations. However, there is only one, very recent record of sea turtles nesting in New York State waters, though climate change related increases in local water temperature could significantly increase local sea turtle nesting as their nesting range expands northward. There could also be shifts in foraging habitats as the aggregation off benthic communities and Submerged Aquatic Vegetation, the primary food source for adult green sea turtles in the local region, shift in response to sea level rise. Temperature shifts resulting from climate change have the potential to shift male/female proportions in sea turtle populations as temperature is a driving factor determining sex ratios at nesting sites. The shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability which could also cause detrimental effects to sea turtles. Overall, however, implementation of the Action Alternative is not anticipated to have substantial synergistic cumulative impacts with those caused by sea level rise.

Marine Mammals

According to Todd et al. (2014), there are few studies on the effects of dredging on marine mammals due to dredging activities in isolation. In terms of direct effects, vessel collisions with marine mammals are possible, but improbable because dredges operate either in a stationary position or at low speeds. We would anticipate the risk of vessel strikes is less with the Action Alternative because of the anticipated greater navigation efficiency compared to the future without Action Project Alternative. Because there are few local records of marine mammal mortalities where strikes have been implicated as the likely cause of death, it is difficult to estimate if strike mortality could increase with fewer, larger vessels calling at the Port. Because vessel speeds are not anticipated to increase with implementation of the Action Alternative we would not anticipate that the strike risk hazard to increase from increased vessel speed though it is possible that larger container vessels are more difficult for whales to avoid than smaller vessels but we cannot determine from the limited data available if this could occur.

The risk of injury to listed whales from collisions with dredge-related vessels is considered discountable considering the species mobility and slow speed of the dredge vessels (10 knots or less) and associated barges and scow. Also, trained personnel that know how to recognize the presence of threatened and endangered whale and sea turtle species will be onboard at all times to help ensure that vessel interactions are avoided. No marine mammal strikes with dredge-related vessels has ever been reported to occur in the Action Area and none are expected to occur during the proposed dredging within Gravesend Bay to expand the present Anchorage.

Within a noisy harbor area such as New York Harbor, ongoing exposure to underwater noise may cause causing a masking effect such that the noise of an oncoming vessel may not be detected. Whales may often habituate to the noisy harbor and simply not respond to an oncoming vessel as they are so adapted to the sound of vessels. According to Todd et al. (2014), there are few studies on the effects of dredging on marine mammals due to dredging activities in isolation. Todd et al. (2014) note that while dredging noise levels vary greatly and depend partly on the method and the material being dredged, limited data seem to indicate that dredging is unlikely to cause physiological damage to marine mammal auditory systems. They note that it is more likely to lead to temporary masking and behavioral disturbances. In addition, effects of turbidity are often localized with minimal direct impact on marine mammals (Todd et al., 2014).

In comparison of the future with and without implementation of the Action Alternative, we would anticipate the potential for noise related impacts to be relatively less with the Action Alternative because of the reduced movement of vessels due to the expanded Anchorage, which will increase local navigation efficiency, as compared to the future without project conditions. Noise generated by mechanical bucket dredge activities would not be expected to affect migration, nursing, breeding, feeding, or sheltering. Marine mammals that may occur in the ROI are accustomed to the busy harbor of which the ROI is a portion. They are also highly mobile and it is expected that they would typically move away from dredging operations and noise. We would not anticipate any Level A or Level B harassment to marine mammals from noise-related impacts caused by implementation of the Action Project Alternative.

In addition, effects of turbidity are often localized with minimal direct impact on marine mammals (Todd et al., 2014). Todd et al. (2014) noted that indirect effects are more complex, and less understood. In general, literature has suggested that dredging can cause reductions in biomass and varying levels of prey availability, depending on the surrounding conditions. However, it is

also noted that marine mammals can likely compensate for small-scale changes in prey by switching prey species or moving to other foraging areas (Todd et al., 2014). The ROI for this project is also limited relative to the surrounding area available for use; therefore the species are likely to move and forage elsewhere during the operation.

Potential cumulative threats to marine mammals include ship strikes from commercial and recreational vessels as well as bucket dredging impacts that occur throughout the entire range of the marine mammals, and exposure to contaminants such as oil spills and PCBs. Another potential cumulative impact to consider is impacts that occur from fishery entanglement. While some of these threats have the potential to impact populations of bottlenose dolphins, harbor porpoises, and harbor seals, implementation of the Action Alternative is not anticipated to substantially contribute cumulatively to injuries and mortalities resulting from these impacts.

The USACE has never documented a take of any marine mammals during its previous dredging operations in the ROI and no harassment is anticipated with the noise impacts generated by the implementation of the Project Action Alternative; therefore, an incidental take or harassment authorization in accordance with the MMPA is not anticipated. No further coordination under the MMPA is anticipated.

Species Protected under the Migratory Bird Treaty Act of 1918 and Executive Order 13186 (EO)

Migratory birds will have the potential to forage, rest, and/or migrate through the ROI. The noise and temporary turbidity plume caused by dredging and dredged material placement actions may cause migratory birds to move away from the disturbance; however, we would expect this to be a negligible to minor, and temporary impact that would not substantially impact their long-term foraging or breeding success. The dredging and dredged material placement operations will have a temporary, negligible to minor adverse impact to benthic invertebrates and fish. This could potentially impact some of the prey species of migratory birds. The shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability which could also cause detrimental effects to migratory birds. However, because of the already disturbed nature of the majority of the ROI and the amount of other available habitat for prey species, we would not anticipate the Action Alternative to have any substantial impact on any prey invertebrate or fish populations.

With implementation of the Action Alternative, dredging activity would temporarily increase during construction and disturbances to migratory birds could increase slightly. Therefore, if migratory birds were in the Action Area we would anticipate a slight increase in disturbance effects that would range from negligible to minor impacts (birds temporarily moving away from the impact area of the dredge vessel) from implementation of the Action Project Alternative.

Continued development, shipping and other navigation operations, and stormwater discharges will continue to negatively impact the ROI and adjacent areas. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, however, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. New York City is currently preparing a Comprehensive Waterfront Plan, to be released in 2020, an update on a prior version released in 2011. Several projects are planned for the shoreline in the local Gravesend area (southwest Brooklyn). Projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

It is unknown at this time if any of these projects will affect local water quality or other protected habitat, though it is likely that repair of the sea wall and clean-up of the Westshore Ave. site and addition of green infrastructure would tend to improve local environmental conditions.

These projects should have no significant impact on migratory birds.

The loss of dune barriers, wetlands and beach nesting breeding and foraging habitat anticipated with sea level rise has the potential to impact migratory birds although the level of impact is relatively uncertain. However, substantial synergistic impacts resulting from implementation of the Action Alternative with the impacts of climate change and other cumulative impacts is not anticipated.

6.10.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the No Action/Future Without Project Alternative and Action Alternative, resulting in only temporary and negligible impacts and the same findings with respect to all listed species, which range from May Affect, Not Likely to Adversely Affect to No Effect.

Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, resulting in only temporary and negligible impacts and the same findings with respect to all listed species, which range from May Affect, Not Likely to Adversely Affect to No Effect.

6.11 Air Quality

6.11.1 No Action/Future Without Project Alternative

The No-Action Alternative would result in maintenance dredging that would not be subject to General Conformity review because maintenance dredging is statutorily exempt. While emissions from this maintenance dredging may be lower overall than the temporary emissions from the RP, none of the benefits of the RP would be realized.

While the No-Action Alternative scenario may result in lower emissions in the short term, later maintenance dredging, which is not subject to General Conformity review, may produce higher emissions under this scenario. However, it is anticipated that neither the No-Action Alternative nor the RP would result in a significant change to air quality in the area.

6.11.2 Action Project Alternative (RP)

The RP will temporarily produce emissions associated with diesel fueled equipment relating to dredging, beach sand placement, and related landside construction activities. The project is anticipated to be conducted over a two-month period during calendar year 2020. The localized

emission increases from the diesel-fueled equipment will last only during the project's construction period (and only local to where work is actually taking place at any time), and then end when the project is over. Therefore, any potential impacts will be temporary in nature.

The RP will take place adjacent to Kings County, New York. The General Conformity applicability trigger levels in Kings County for 'marginal' ozone nonattainment areas are: 100 tons of NO_x per year (any year of the project) and 50 tons of VOC per year (40 CFR§93.153(b)(1)). In areas designated as 'maintenance' for $PM_{2.5}$, such as Suffolk County, the applicability trigger levels are: 100 tons per year each of direct $PM_{2.5}$ and SO_2 per year (40 CFR§93.153(b)(2)).

The General Conformity-related emissions associated with the project have been estimated as part of the General Conformity Review and are summarized in Table 6-4 below. Emission calculations are provided in Appendix E.

Table 6-4: General Conformity-Related Emissions per Calendar Year, tons

Pollutant	Tons per year
NO_x	85.3
VOC	2.9
$PM_{2.5}$	4.1
SO_x	0.05
CO	11.2

The emission levels do not exceed the General Conformity 'de minimis' trigger levels for any pollutant for the total project as a whole. Therefore, the project is presumed to conform with the General Conformity requirements and is exempted from Subpart B under 40CFR§93.153(c)(1). The Record of Non-Applicability (RONA) and associated emission estimates can be found in Appendix E.

6.11.1 Other Alternatives Considered

The Red Hook Anchorage Alternative, due to the much higher volume of material that would need to be dredged, would have very likely exceeded 'de minimus' trigger levels, and would have required mitigation, due to significant impacts to local air quality.

Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, conforming with the General Conformity requirements and is exempted from Subpart B under 40CFR§93.153(c)(1). The Record of Non-Applicability (RONA) and associated emission estimates can be found in Appendix E, this option would provide for fewer emissions that that of the Action Alternative.

6.12 Climate Change

6.12.1 No Action/Future Without Project Alternative

Existing dredging operations, dredged material placement, and navigation would continue in the ROI. Current maintenance operations would continue to generate emissions from the combustion of fuel used to operate vessels and equipment (e.g., dredge operation, pumps, transportation, and final dredged material placement/disposal).

Existing emissions-producing activities within the ROI (e.g., navigation and other transportation, industry, commerce, military, and recreation) would be expected to continue throughout the 50 year period of analysis. The following regional projects are assumed to be implemented under the No Action/Future Without Project alternative and would be expected to result in temporary, construction-related, increases in emissions within the ROI:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

Recent estimates of New York State's GHG emissions (2008) were 245 MMt and are forecast to increase to 268 MMt by 2030 if no action is taken (New York DEC, 2010). The Governor of New York has issued an executive order (No. 24) setting a goal to reduce GHG emissions by 80 percent below the level in 1990 by 2050, the order also created the New York State Climate Action Council with a directive to prepare a climate action plan to reach this goal. If actions from such a plan are implemented, New York's GHG emissions will likely be significantly lower than 2008 levels by 2050.

With implementation of the No Action/Future Without Project alternative, climate change would be predicted to continue and relative sea level rise would be expected to continue to rise over the 50-year period of analysis unless actions are taken to prevent it. As previously described in the Air Quality Section, implementation of the No Action/Future Without Project Alternative does have minor impacts to air quality but this would not substantively impact global-climatic air quality.

6.12.2 Action Project Alternative

Emissions resulting from combustion of fuel during construction operations could increase with implementation of the Action Project Alternative, the Gravesend 3,600 ft. Hybrid Anchorage, as compared to the No Action/Future Without Project Alternative because of the duration of construction operations.

With implementation of either the No Action/Future Without Project Alternative or the Action Alternative, the overall number of TEU imported and exported via container vessels at the Port is anticipated to increase over time. However, the anticipated number of vessel calls with implementation of the Action Alternative could be less than future conditions without implementation of the Action Alternative. This is because the existing, larger vessels in the fleet and, in the future, larger more efficient and cleaner vessels than at present, would transport the

same quantity of cargo in any given year in the future more efficiently (i.e., fewer trips to move the annual quantity of cargo) and cleaner, due to technological advances, than vessels at present. Therefore, in future conditions with implementation of the Action Alternative we would anticipate fewer gas emissions resulting from deep draft vessels as compared to future conditions without implementation of the Action Alternative.

Existing emissions-producing activities within the ROI (e.g., navigation and other transportation, industry, commerce, military, and recreation) would be expected to continue throughout the 50 year period of analysis. The Port of New York and New Jersey is forecast to experience growth in numbers of TEU transported through its facilities throughout the next 50 years. Also, additional development is planned as is described in the No Action/Future Without Project Alternative. The increased development could also be linked with increases in emissions from combustion of fuel associated with construction of development projects.

Per our coordination with the New York Department of Environmental Conservation and the Environmental Protection Agency (EPA) and review of the EPA Greenbook Non-Attainment Areas, the project ROI is in a region of non-attainment (for ozone and pm-10) and due to this, an air conformity analysis is required. Implementation of the Action Alternative would not substantively cumulatively or synergistically contribute to climate change-induced water quality effects as described in the Water Quality Section. It is likely to lower GHG emissions post-construction due to the increase in Port efficiency, which should reduce fuel consumption of vessels that call at the Port in the future, a minor but positive benefit that will help reduce impacts due to climate change.

6.12.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the Action Alternative, would not contribute to climate change-induced water quality effects. Similar to the Action Alternative, it is likely to lower GHG emissions post-construction due to the increase in Port efficiency, which should reduce fuel consumption of vessels that call at the Port in the future, a minor but positive benefit that will help reduce impacts due to climate change.

The Gravesend 3,000 Ft. Anchorage, similar to the Action Alternative, would not contribute to climate change-induced water quality effects. Similar to the Action Alternative, it is likely to lower GHG emissions post-construction due to the increase in Port efficiency, which should reduce fuel consumption of vessels that call at the Port in the future, a minor but positive benefit that will help reduce impacts due to climate change. Due to the smaller size of this Alternative, however, such benefits would likely be less than for the Action Alternative as the improvement in efficiency would be less with this Alternative.

6.13 Floodplains

6.13.1 No Action/Future Without Project Alternative/Action Alternative And Other Alternatives Considered

No Effect on floodplains. This was dismissed from detailed analysis due to lack of any impacts.

6.14 Noise and Vibration

6.14.1 No Action/Future Without Project Alternative

Existing dredging operations, dredged material placement, and navigation would continue in the ROI. Current maintenance operations would continue to generate construction related noise from vessels and equipment (e.g., dredge operation, pumps, transportation, and final dredged material placement/disposal). Recreational use of local ROI waters is also expected to continue, such as recreational fishing and cruise liners calling at local port facilities. The lower New York Harbor is a region of major shipping and recreational boat traffic and background noises, both in air and underwater, reflect this and current background noise from these activities are expected to continue.

The following regional projects are assumed to be implemented under the No Action/Future Without Project alternative may result in temporary, construction-related, increases in background noise within the ROI:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

With implementation of the No Action/Future Without Project alternative, noise levels are likely to remain relatively constant in the project ROI. Implementation of the No Action/Future Without Project Alternative does have minor impacts to noise due to expected regular and proposed construction but overall impacts to background noise are not significant.

6.14.2 Action Project Alternative

Local noise in the immediate construction area within the project ROI would increase with implementation of the Action Project Alternative, the Gravesend 3,600 ft. Hybrid Anchorage, as compared to the No Action/Future Without Project Alternative because of the increased duration of construction and maintenance operations required to do the proposed dredging. These impacts are expected to be temporary (they will only occur during construction of the anchorage), minor and not significant.

The following regional projects are assumed to be implemented under the No Action/Future Without Project alternative may result in temporary, construction-related, increases in background noise within the ROI:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

With implementation of either the No Action/Future Without Project Alternative or the Action Alternative, the overall number of TEU imported and exported via container vessels at the Port is anticipated to increase over time. Therefore, noise resulting from deep draft navigation at the New York and New Jersey Port and its associated navigation channels and anchorages could increase over time regardless of whether the Action Project Alternative is implemented. However, the anticipated number of vessel calls with implementation of the Action Alternative could be less than future conditions without implementation of the Action Alternative. This is because the existing, larger vessels in the fleet and, in the future, larger vessels than at present, would transport the same quantity of cargo in any given year in the future more efficiently (i.e., fewer trips to move the annual quantity of cargo) than vessels at present. Therefore, in future conditions with implementation of the Action Alternative we would anticipate less navigation-related noise from deep draft vessels as compared to future conditions without implementation of the Action Alternative, which would be positive though not directly related to construction of the proposed anchorage but rather to expected changes in the shipping industry.

Cumulatively, the proposed project should not interact with any of the proposed large-scale projects mentioned above and the proposed dredging in Gravesend Anchorage will not result itself in any cumulative increases in local noise levels post-construction.

6.14.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the Action Alternative, would result in temporary, minor and not significant increases in noise levels during project construction.

The Gravesend 3,000 Ft. Anchorage, similar to the Action Alternative, would result in temporary, minor and not significant increases in noise levels during project construction.

6.15 Occupational Safety and Health

6.15.1 Future Without Project Condition/No Action Alternative

With implementation of the No Action/Future Without Project Alternative, maintenance dredging would continue and existing, temporary safety risks described in the Affected Environment Section that are at a negligible to minor level of impact would continue. Existing safety risks would be mitigated to the maximum, extent practical through following a Work Safety Plan that incorporates standard work practices for handling MEC/UXO if necessary due to risk, avoidance of slip and fall hazards, handling contaminated sediment, and wearing appropriate Personal Protective Equipment (PPE). With implementation of the No Action/Future Without Project Alternative, there would be continued maintenance dredging, but this would be at a lower level of duration than implementation of an Action Project Alternative. Because maintenance dredging would be less disturbing to the sediment profile, there would be a lesser likelihood of encountering contaminated sediments or MEC/UXO than with implementation of the Action Project Alternative.

6.15.2 Action Project Alternative

Construction dredging is assumed to present similar occupational health and safety risks as maintenance dredging. However, the duration of exposure to occupational safety and health risks would increase with implementation of the Action Project Alternative as compared to the No Action/Future Without Project Alternative. The increased level of dredging and exposure to

occupational health and safety hazards would be mitigated to the extent practical through adherence to an approved Work Safety Plan that incorporates standard work practices for handling contaminated sediments, handling MEC/UXO if necessary, avoidance of slip and fall hazards, handling contaminated sediment, and wearing PPE. Hazards from MEC/UXO's can be mitigated through identification by reviewing magnetometer surveys of past and new archaeological surveys. Ordnance identified could then be avoided or disposed of with assistance of qualified explosive ordnance disposal personnel. Implementation of the Action Alternative as compared to the No Action/Future Without Project Alternative would have increased potential exposure to chemical and ordnance hazards should they be encountered, but to date all contaminated sediments and ordnance encountered by dredging in the area has been safely handled. In addition, based on existing MPRSA sediment testing conducted within portions of the ROI, no contaminated sediments are known to occur in the ROI nor is there any record of lost MEC/UXO in the local area of the proposed dredging. Although the Action Alternative has slightly higher durations of exposures to occupational safety and health hazards, entailing slightly more risk than the No Action/Future Without Project Alternative, the occupational safety and health risks would be very similar and remain at a temporary and negligible to minor level of impact.

6.15.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the Action Alternative, would result in temporary, minor and negligible increases in accident risk during construction. The Gravesend 3,000 Ft. Anchorage, similar to the Action Alternative, would result in temporary, minor and negligible increases in accident risk during construction.

6.16 Utilities

6.16.1 No Action/Future Without Project Alternative

Existing maintenance dredging operations and navigation within the ROI would continue. Existing utilities would remain intact and continued maintenance of the channel system should have no effect on utility infrastructure. No adverse impacts to the City of New York Utility Crossings, identified within NOAA Identified Cable Areas, are anticipated as a result of the No Action Alternative.

Continued development, shipping and other navigation operations will occur in the region that includes the project ROI. The Port of New York and New Jersey's growth is anticipated to increase throughout the next 50 years, however, the trend towards vessels with increasing TEU capacity is likely to continue, which would mean fewer, but larger vessels calling at the port with an overall increase in TEU over time. Several projects are likely to be constructed in the future, including but not limited to:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

Either of the latter two projects may require relocation of utilities, but such relocations are not related to local navigation.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue in the future. Climate change impacts such as increased temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. Erosion and loss of estuarine and ocean beaches is anticipated to occur with sea level rise, which could expose or damage currently buried utility lines that are nearshore. Over the course of time, more landforms may become submerged, and other areas may become lower-lying and flood more frequently, particularly within the coastal physiographic province in which this project is located. This may disrupt utilities and/or require upgrades and relocations of utilities, but this is not related to navigation.

The No Action/Future Without Project Alternative is not predicted to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects. Therefore, no effect to utilities from implementation of the No Action/Future Without Project Alternative is anticipated.

6.16.2 Action Project Alternative

Impacts to Utilities in the ROI with implementation of Action Alternative, would be similar to those described for the No Action/Future Without Project Alternative. Although some utilities were found in the ROI, there are no known utilities within in the Gravesend Hybrid Anchorage dredging footprint based on current information. If any are found to be during the PED phase, mitigation, such as relocation, may be necessary. A recent survey (Morrison, 2005) done for PANYNJ has been consulted.

Sanitary sewer outfalls in the City of New York are within the project area, but are outside the limit of disturbance for the expanded anchorage, as noted in the water quality section of this document. The proposed project will have no effect on these sewer utility crossings.

As described in the No Action/Future Without Project Alternative Section, potential cumulative impacts include increased development such as port growth, increased shipping traffic, and climate change. Implementation of the Action Alternative is not anticipated to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects, including port growth.

6.16.3 Other Alternatives Considered

The Gravesend 3,000 Ft. Anchorage, would have impacts to utilities similar to the Action Alternative (Figure 6-1).

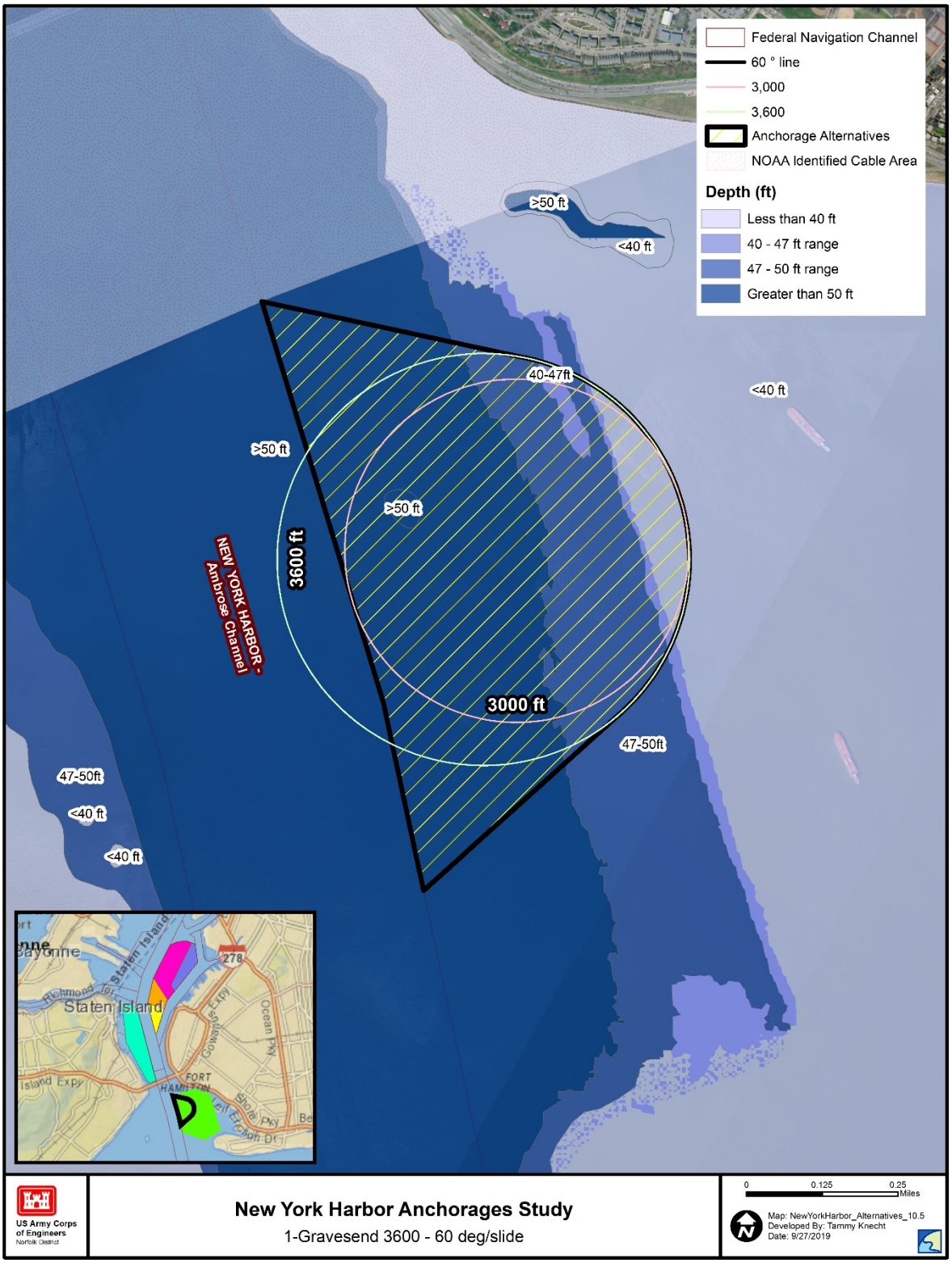


Figure 6-1: Identified Utility Crossing Areas in the Project ROI

The Red Hook Anchorage Alternative, would have impacts to utilities similar to the Action Alternative (Figure 6-2).

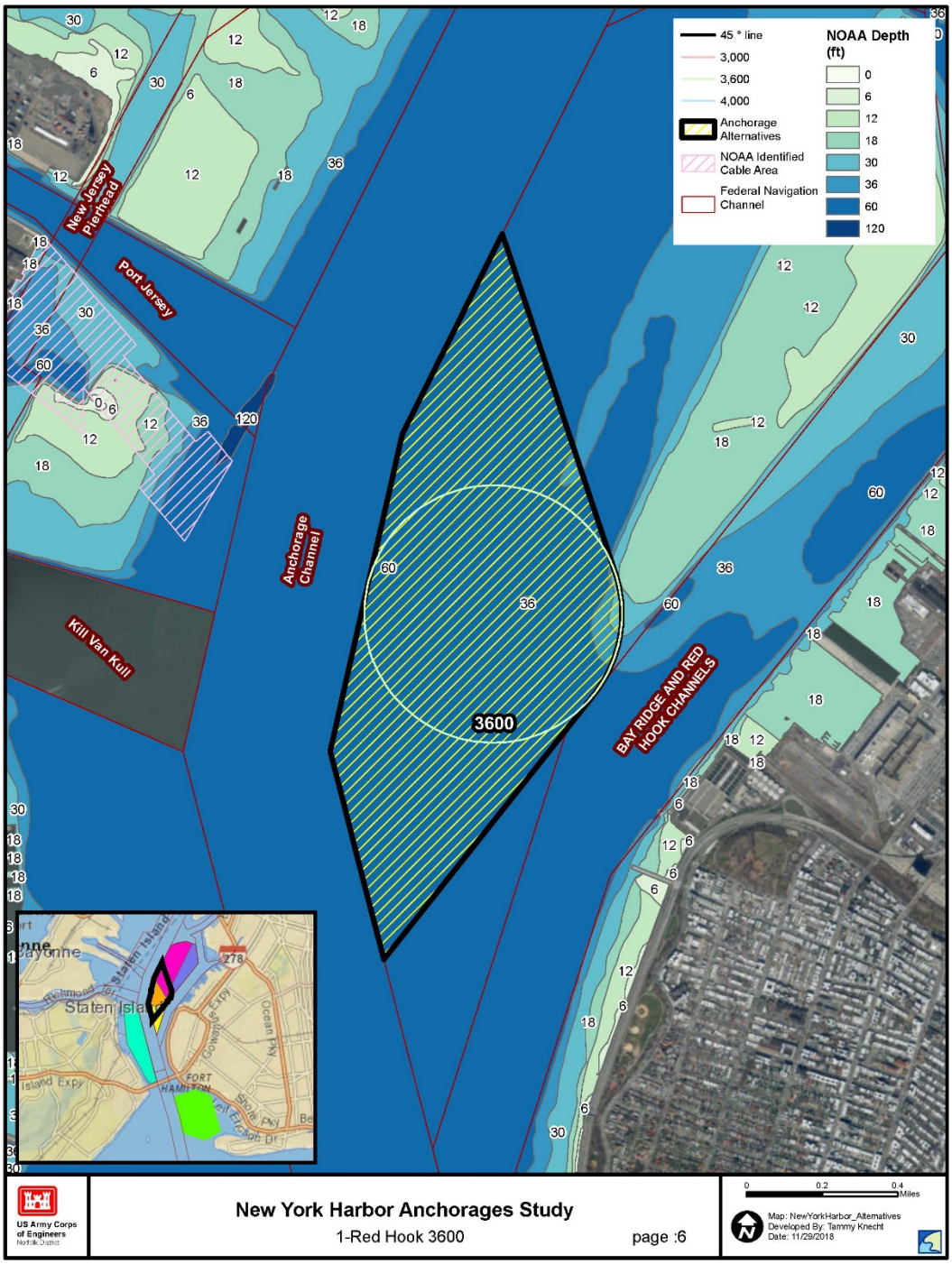


Figure 6-2: Identified Utility Crossing Areas in the Project ROI

6.17 Cultural Resources

6.17.1 No Action/Future Without Project Alternative

Terrestrial archaeological and architectural historic properties would not be affected whether a project is constructed or not. Submerged archaeological properties would be less subject to effects without the project. Currently, no significant submerged archaeological resources have been identified in the APE of the project, but these areas remain unsurveyed except margins near the channels. In the future without project condition, unidentified sites might still be subject to effects from maintenance dredging, although that potential is less than dredging for deeper or expanded channels. The future without project could subject unidentified submerged archaeological sites to damage from ship strikes, groundings, and prop wash.

6.17.2 Action Project Alternative

The New York State Cultural Resources Information System was consulted, and it holds no previously recorded archaeological sites in the direct Area of Potential Effects (APE). No effect to terrestrial architectural cultural resources are expected. Noise and visual effects from dredging would be transitory and distant from land areas. This and changes to navigation, the addition of larger vessels, would be a negligible effect. Terrestrial archaeological resources along shorelines and submerged archaeological resources away from the anchorage sites would not suffer from effects from increased wakes because vessels would not be travelling at wake producing speeds in spite of the potential increase in vessel size. The USACE, in consultation with the SHPO, has determined that the historic properties within the indirect APE will not be adversely affected by visual and noise effects of the project and subsequent use by shipping (Appendix E, Programmatic Agreement, Whereas #5).

A survey is needed for undredged sections of the potential anchorage deepening and expansion areas. No submerged archaeological resources have been recorded within the Area of Potential Effect (APE) for dredging. Archaeological sites may exist within unsurveyed parts of the APE. Surveys will be conducted for these areas during the Preconstruction Engineering and Design stage after the appropriation of funds for this project. A Programmatic Agreement with the State Historic Preservation Office has been drafted which will allow the surveys to be deferred and allow a Finding of No Significant Impact (FONSI). The agreement sets forth procedures conducting archaeological surveys and evaluations, and for mitigating adverse effects to historic properties if any are identified. The direct effects of construction on submerged archaeological resources are unknown at this time, but the Programmatic Agreement signifies compliance with Section 106 of the National Historic Preservation Act. Avoidance and minimization of effects would be attempted, and mitigation of adverse effects implemented for any NRHP eligible sites that may be identified in the APE.

Due to the timing and budget limitations of the Project, the USACE is currently unable to identify and evaluate submerged archaeological resources to determine effects of the RP on historic properties prior to completion of the environmental assessment. Therefore; pursuant to 54 U.S.C. 306108 and § 800.4(b)(2), the Corps is deferring final identification and evaluation of historic properties until after Project approval, additional funding becomes available, and prior to construction by executing a programmatic agreement with the SHPO and PANYNJ.

In addition to the New York SHPO, the USACE reached out to the Advisory Council on Historic Preservation (ACHP), the Delaware Nation, the Delaware Tribe of Indians, the Shinnecock

Tribe, the Stockbridge Munsee Community of Wisconsin, the New York City Landmarks Preservation Commission (NYCLPC), and the Naval History and Heritage Command (NHHC), to consult on the Project with regard to Section 106 of the National Historic Preservation Act.. The Delaware Nation, New York City Landmarks Commission, and the Naval History and Heritage Command elected to participate, the Advisory Council on Historic Preservation declined, and the others did not respond. Following review by the SHPO, the draft programmatic agreement was sent to the other consulting parties for review. The Delaware Nation and NYCLPC responded that they found the draft programmatic agreement acceptable, and the NHHC had minor edits on the stipulation regarding sunken military craft.

6.17.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the Action Alternative, would result in no effect to terrestrial archaeological and architectural historic properties whether a project is constructed or not. No submerged archaeological resources have been recorded within the Area of Potential Effect (APE) for dredging. Archaeological sites may exist within unsurveyed parts of the APE. Had this site been selected, additional survey work would be necessary to ensure no impacts to archaeological resources.

The Gravesend 3,000 Ft. Anchorage, similar to the Action Alternative, would result in no effect to terrestrial archaeological and architectural historic properties whether a project is constructed or not. No submerged archaeological resources have been recorded within the Area of Potential Effect (APE) for dredging. Archaeological sites may exist within unsurveyed parts of the APE. A survey, similar in scope for the Action Alternative, would have been necessary to fully assess the area for archaeological resources.

6.18 Aesthetics

6.18.1 No Action/Future Without Project Alternative

Under the No Action/Future Without Project alternative, there would be no modifications to Gravesend Bay to create an anchorage capable of supporting large container vessels to anchor at the site that require up to a 3,000 ft. swing diameter. Routine USACE maintenance of the existing Federal channels of New York and New Jersey Harbor, including Ambrose channel which runs adjacent to Gravesend Bay is assumed to require dredging only during 2025 of the 50 years in the period of analysis. Over that period, dredging actions would remove dredged material that would be placed into HARS, upland landfills if contaminated, or used beneficially depending on the type of the material being generated in a given dredging event, though it is assumed that all material from the proposed project will be placed at HARS. Under the No Action/Future Without Project alternative, the maintenance dredging actions that would take place (e.g., dredge operation, pumps, tug/truck transportation, and final placement) would be consistent with the continued use of the river as a working waterfront along with nearby neighborhoods (Brooklyn and Staten Island) within the ROI that have a view of Gravesend Bay.

Under the No Action/Future Without Project alternative, existing navigational uses within the project area (industry, commerce, military, and recreation) would continue and the view sheds and vistas would reflect the continued industrial land use within the area. Over time, deep draft navigation would likely increase slightly with the predicted growth in commodity movement assumed to occur over the 50-year period of analysis.

Within the ROI, there are a number of larger-scale construction projects that would be expected to generate short-term, localized increases in construction under the No Action/Future Without Project condition including:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

These projects would have positive impacts to local aesthetics, though at this time it is not possible to fully assess their effects.

Implementation of the No Action/Future Without Project alternative would result in no predicted changes to the visual resources within the ROI; the aesthetic environment of the ROI would continue to be that of a working waterfront with a mix of industrial, commercial, naval, marine, and urban shoreline uses.

6.18.2 Action Project Alternative

Initial construction of the RP would require deepening the Gravesend Anchorage site to 50 ft. The initial construction would be as a result of the operation of mechanical dredges, which would be consistent with the character of the working river and working waterfront.

Once construction to the new depth is completed, the new anchorage would continue to need to be routinely maintained over the 50-year period of analysis, but as this anchorage required only one maintenance dredging event in the past 40 years, there are no maintenance plans for the expanded and deepened anchorage.

Implementing the Action Alternative would result in temporary negligible effects on the visual resources within the ROI over the several months of anchorage modification construction. There would be no change to the aesthetic environment of the ROI as it would continue to be that of a working waterfront with a mix of industrial, commercial, highway transport, naval, marine, and urban shoreline uses. Vessels using the anchorage are of the same type of container transport ships heavily utilizing the adjacent channel and port facilities and their presence in the anchorage will not significantly alter the view shed of this highly commercial waterway that has regular calls of such vessels.

During initial construction, dredging equipment and equipment used for material placement would be operating within the ROI view shed. The temporary view shed impacts resulting from dredging operations with implementation of the Action Alternative as compared to the No Action/Future Without Project Alternative would increase because of the initial dredging duration. As such, the presence of the equipment within the view shed would not represent any new feature in the visual landscape that is not already present under the No Action/Future Without Project alternative. Potential cumulative effects would be similar to those described in the No Action/Future Without Project Alternative. Therefore, the effect of implementing Action Project Alternative on the aesthetic resources within the ROI would be adverse, temporary and negligible.

6.18.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, would have impacts to utilities similar to the Action Alternative. The Gravesend 3,000 Ft. Anchorage, would have impacts to utilities similar to the Action Alternative.

6.19 Recreation

6.19.1 No Action/Future Without Project Alternative

Existing maintenance dredging operations, dredged material placement/disposal, and navigation within the ROI would continue. These operations can cause minor turbidity, siltation, and boat wakes within the ROI. None of these temporary and minor impacts would have any effect on recreational resources in the project ROI. Due to the substantial distance from the current dredging and dredged material placement/disposal sites from any existing shorelines and associated parks and beaches, no existing or future impacts to these recreational resources resulting from dredging and dredged material placement operations are anticipated.

New York and New Jersey Port growth is anticipated to increase throughout the next 50 years, with increasing TEU over time, though fewer vessels may call due to increasing average container vessel size. Also, additional development may occur in the future, though the New York City area is almost entirely built out and redevelopment is more likely. Existing parks and recreational facilities are likely to remain where they are and continue with their present uses. Fishing and boating opportunities will still be available, and it is likely that cruise liners will continue to call at New York City. Additional development could cause impacts to recreational resources but such impacts would not be related to the proposed project in any way. Within the ROI, there are a number of larger-scale construction projects that would be expected to generate short-term, localized increases in construction under the No Action/Future Without Project condition including:

- Support repairs and reconstruction of existing path and sea wall
- Support remediation as condition of possible development (Westshore Ave. Site)
- Eco-dock for kayakers and boaters
- Construction of green infrastructure to better manage stormwater runoff in the Gravesend Bay watershed

The first three projects would have positive impacts to local recreation.

Climatic changes such as sea level rise and increasing global temperatures are predicted to continue in the future. Climate change impacts such as increased temperatures, ocean acidification, sea level rise, and changes in currents, upwelling and weather patterns have the potential to cause changes in the nature and character of the estuarine ecosystem in the ROI. In general, as sea level rises, shoreline recreational sites, including parks and beaches, may become inundated unless preventative actions are taken to maintain elevation over time. Alternatively, sea level rise may cause estuarine wetlands to retreat inland, by converting existing uplands to wetlands, altering the use of shoreline parks that are currently upland vegetation.

The ROI itself is already a highly developed city and port with substantial navigation and shipping operations, with few nearshore parks and a beach on the western shore of lower New York Bay. Continuing maintenance dredging operations would not cause any significant impacts to these recreational resources.

The No Action/Future Without Project Alternative is not predicted to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects, including port growth. Therefore, with implementation of the No Action/Future Without Project Alternative, adverse impacts to recreational resources are temporary to permanent, and negligible.

6.19.2 Action Project Alternative

Similar to the No Action/Future Without Project Alternative, there would be no significant impacts to local recreational resources with implementation of the Action Alternative, the Gravesend Hybrid Plan. There may be minor, temporary and negligible impacts to recreational resources in the project ROI during construction, due to the presence of dredging vessels and any support vessels during construction. Recreational fishermen may need to move their vessels from the immediate vicinity of dredging vessels due to vessel noise and localized turbidity, which will temporarily disturb fish in the local area as described in the noise and fishery sections of this EA. While the parks provide a view of the project ROI, the proposed project would have no effect on these parks as they are all some distance from the proposed Anchorage(s) and navigation channel, which have frequent commercial vessel traffic. The closest park, Bensonhurst, is approximately one mile from the proposed project construction area, which abuts the navigation channel. No significant impact to recreational resources as a result of project implementation are expected.

As described in the No Action/Future Without Project Alternative Section, potential cumulative impacts include increased development such as port growth, increased shipping traffic, and climate change. Although increased development and climate change have the potential to adversely impact recreational resources in the ROI, implementation of the Action Alternative is not anticipated to substantially cumulatively or synergistically interact with climate change and/or other cumulative effects, including port growth. No effect.

6.19.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, similar to the No Action/Future Without Project Alternative and Action Alternative, would result in no significant impacts to recreational resources in the project ROI. Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative, so no significant impacts to recreational resources in the project ROI are expected.

6.20 Socioeconomics

6.20.1 No Action/Future Without Project Alternative

The socioeconomic impacts of not implementing the project would be negative. Without deeper, expanded anchorage larger “Post Panamax” ship might divert to other ports and result in a decline in volume at the Port of New York and New Jersey.

6.20.2 Action Project Alternative

Implementation of the Action Project Alternative would result in improved safety and efficiency in shipping at the Port of New York and New Jersey, though not an increase in shipping volume. This positive economic impact due to improved shipping efficiency would be beneficial for the metropolitan area as a whole.

Dredging durations and frequencies as compared to implementation of the No Action/Future Without Project Alternative and would result in a temporary, beneficial increase in the local economy within the ROI. There would be no substantive predicted influx of new people hired, no substantive changes in local employment, and no substantive changes to income within the ROI.

Regional Economic Development benefits would be anticipated to be beneficial and temporary and in relation to the dredging cycle. The improved anchorage would allow safer and more efficient movement of cargo.

Compliance with Executive Order 12898 on Environmental Justice (EJ) requires an evaluation of the nature of the proposed actions and the human context into which those actions would be undertaken. In order to have potential EJ impacts, a proposal must have potential for disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Native American tribes. Implementation of the Action Project Alternative would not result in measurable changes to environmental resources that individuals involved in subsistence fishing or hunting utilize and would not create disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Native American tribes.

Potential cumulative effects would be similar to those described in the No Action/Future Without Project Alternative Section. None of these actions would be expected to individually or cumulatively substantively change the demographic, socioeconomic, or EJ community trends that are present within the ROI; the effect on the socioeconomic character of the ROI from implementing the Action Alternative would be beneficial and minor. Because the project area is in the harbor and .6 to one mile from the nearest residential area, no direct environment effects would occur to socially or economically disadvantaged populations.

6.20.3 Other Alternatives Considered

The Red Hook Anchorage Alternative, were it implemented, would result in similar temporary impacts as the Action Alternative, but would result in permanent impacts to the regulated ‘flats’ areas. Similarly, the Gravesend 3,000 Alternative would result in similar effects as the Action Alternative.

7 SUMMARY OF BEST MANAGEMENT PRACTICES/MITIGATION MEASURES

Impact evaluations conducted during preparation of this EA have determined that no significant impacts would result from implementation of the Recommended Plan (also referred to as the Action Alternative or Preferred Alternative). This determination is based on a thorough review and analysis of existing resource information and coordination with knowledgeable, responsible personnel from the USACE and relevant local, state, and Federal agencies. No onsite compensatory wetland or other type of mitigation, including for air emissions due to the finding that emissions for the proposed dredging is below *de minimus* levels, is anticipated to be required for this project. Below is a listing of planned and potential best management practices/mitigation measures that are impact avoidance and minimization measures that would be implemented with the Action Alternative to the maximum, practical extent. Best management practices will be implemented during dredging to minimize disturbances to the environment.

- To minimize air emissions associated with dredging vessels and dredge-related equipment, vessels and equipment will not be allowed to run idle and will be shut off to the extent practical when not in use.
- The NMFS Protected Resources Division (PRD) will be contacted three days prior to the commencement of any dredging operations to ensure all appropriate ESA reporting forms will be used. A trained observer for ESA listed species will be on board during dredging.
- A seasonal restriction (No Work) proposed by NMFS EFH Habitat Conservation Division (HCD) will be implemented between 1 March and 30 June of any year of construction so as to be protective of anadromous fin fish that may be transiting the area. Other time of year restrictions recommended by regulatory agencies may also be considered.
- All dredge operators will be trained on measures of dredge operation that will minimize the take of sea turtles and Atlantic sturgeon. All personnel performing dredging operations will be notified of the potential presence of sea turtles and Atlantic sturgeon and the need to avoid collisions with protected species. All personnel are responsible for observing water-related activities for the presence of these species. All personnel shall be notified that there are civil and criminal penalties for harming, harassing, or killing listed or other protected species.
- Any collision with and/or injury to a sea turtle or Atlantic Sturgeon shall be reported within 24 hours to the NMFS's Protected Resources Division and formal consultation will be initiated.
- Exposure to occupational health and safety hazards would be mitigated to the extent practical through adherence to an approved Work Safety Plan that incorporates standard work practices for handling contaminated sediments, handling UXO, avoidance of slip and fall hazards, handling contaminated sediment, and wearing PPE.

8 ENVIRONMENTAL COMPLIANCE

Compliance with the following environmental laws (and implementing regulations) and Executive Orders is required for the project alternatives under consideration (Table 8-1) (note: this is not necessarily an exhaustive list of all applicable environmental requirements).

8.1 Table of Environmental Compliance, Executive Orders, and Permitting Requirements

Table 8-1: Environmental Compliance

Title of Law	U.S. Code	Compliance Status
Abandoned Shipwreck Act of 1987	43 United States Code (U.S.C.) 2101	Full Compliance
American Bald and Golden Eagle Protection Act of 1962, as amended	16 U.S.C. 668	Full Compliance
American Indian Religious Freedom Act of 1978	Public Law No. 95-341, 42 U.S.C. 1996	N/A
Anadromous Fish Conservation Act of 1965	16 U.S.C. 757 a et seq.	Full Compliance
Archaeological and Historic Preservation Act of 1974	Public Law 93-291 and 16 U.S.C.469-469c	Full Compliance, with execution of PA with SHPO in FEB 2020
Archaeological Resources Protection Act of 1979	16 U.S.C. 470aa–470mm,	N/A
Clean Air Act of 1972, as amended	42 U.S.C. 7401 et seq.	Full Compliance
Coastal Barrier Resources Act of 1982	Public Law 114-314	The project is not located in a designated coastal barrier zone and therefore, no coordination is necessary.
Clean Water Act of 1972, as amended	33 U.S.C. 1251 et seq.	Pending, water quality certification support letter received in FEB 2020. Full compliance is achieved upon receipt of water quality

Title of Law	U.S. Code	Compliance Status
		certification, will be obtained during PED
Coastal Zone Management Act of 1972, as amended	16 U.S.C. 1451 et seq.	Full compliance, NYSDOS agreed with our findings of no significant impacts to CZMA, coordination completed. Correspondence is in the Environmental Appendix.
Comprehensive Environmental Responses, Compensation and Liability Act of 1980	42 U.S.C. 9601	Full Compliance
Deepwater Port Act of 1974, as amended	33 U.S.C. 1501	Full Compliance
Emergency Wetlands Resources Act	16 U.S.C. 3901-3932	N/A
Endangered Species Act of 1973	16 U.S.C. 1531	Full Compliance NMFS jurisdictional species, Full Compliance with FWS.
Estuary Protection Act of 1968	16 U.S.C. 1221 et seq.	N/A
Fish and Wildlife Coordination Act of 1958, as amended	16 U.S.C. 661	Full Compliance, receipt of Final USFWS coordination document on 3 March 2020.
Flood Control Act of 1970	33 U.S.C. 549	Full Compliance
Land and Water Conservation Act	16 U.S.C. 460	Full Compliance
Magnuson-Stevens Fishery Conservation and Management Act	16 U.S.C. 1801	EFH assessment findings concurred with by NOAA, full compliance.
Marine Mammal Protection Act of 1972, as amended	16 U.S.C. 1361	Full Compliance

Title of Law	U.S. Code	Compliance Status
Marine Protection, Research, and Sanctuaries Act of 1972	33 U.S.C. 1401	Full Compliance
Migratory Bird Conservation Act of 1928, as amended	16 U.S.C. 715	Full Compliance
Migratory Bird Treaty Act of 1918, as amended	16 U.S.C. 703	Full Compliance
National Environmental Policy Act of 1969, as amended	42 U.S.C. 4321 et seq.	Full compliance, upon signature of the FONSI
National Historic Preservation Act of 1966, as amended	54 U.S.C. § 300101	Full Compliance, with execution of PA with SHPO
Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. 3001	Full Compliance
Noise Control Act of 1972, as amended	42 U.S.C. 4901	Full Compliance
Resource Conservation and Recovery Act of 1976	42 U.S.C. 6901 et seq.	Full Compliance
River and Harbor Act of 1888, Section 11	33 U.S.C. 608	Full Compliance
River and Harbor Act of 1899	33 U.S.C. 401 et seq.	Full Compliance
Safe Drinking Water Act of 1974, as amended	42 U.S.C. 300	Full Compliance
Submerged Lands Act of 1953	43 U.S.C. 1301 et seq.	Full Compliance
Toxic Substances Control Act of 1976	15 U.S.C. 2601	Full Compliance

Table 8-2: Executive Orders

Title of Executive Order	Executive Order Number	Compliance Status
Protection and Enhancement of Environmental Quality	11514/11991	Full Compliance
Protection and Enhancement of the Cultural Environment	11593	Full Compliance
Floodplain Management	11988	Full Compliance
Protection of Wetlands	11990	Full Compliance
Federal Compliance with Pollution Control Standards	12088	Full Compliance
Offshore Oil Spill Pollution	12123	Full Compliance
Federal Compliance with Right-to-Know Laws and Pollution Prevention	12856	N/A
Federal Actions to Address Environmental Justice and Minority and Low-income Populations	12898	Full Compliance
Protection of Children from Environmental Health Risks and Safety Risks	13045	Full Compliance
Invasive Species	13112	Full Compliance
Marine Protected Areas	13158	N/A
Consultation and Coordination with Indian Tribal Governments	13175	Full Compliance
Responsibilities of Federal Agencies to Protect Migratory Birds	13186	Full Compliance
Facilitation of Cooperative Conservation	13352	N/A

Planning for Federal Sustainability in the Next Decade (2015)	13693	Full Compliance

Table 8-3: Permitting Requirements

Law	**Agency Responsible**	**Permit, Agreement, Authorization, or Notification Required**
Comprehensive Environmental Responses, Compensation and Liability Act of 1980, as amended	U.S. Environmental Protection Agency (USEPA)	Full Compliance
Clean Water Act, Section 401*	NYSDEC	401 Water Quality Certification, will be obtained during PED
Coastal Zone Management Act (CZMA)	NYDOS	CZMA Federal Consistency Concurrence concurred with by NYSDOS, Full Compliance
Endangered Species Act of 1973	NMFS	NLAA program verification form/BA (Informal Consultation) completed, Full Compliance
Endangered Species Act of 1973	FWS	Full Compliance NMFS jurisdictional species, Full Compliance with USFWS.
Fish and Wildlife Coordination Act (FWCA)	FWS	FWCA Report document
Magnuson-Stevens Fishery Conservation and Management Act	NMFS	Notification of any noncompliance; none anticipated, EFH assessment concurred with by NOAA/NMFS

Law	Agency Responsible	Permit, Agreement, Authorization, or Notification Required
Marine Mammal Protection Act of 1972, as amended	NMFS	No Incidental Take Authorization anticipated
Marine Protection, Research, and Sanctuaries Act of 1972*	USEPA	Concurrence documentation with the USEPA
Migratory Bird Treaty Act of 1918, as amended	FWS	"Take" permit; no take permit is required
National Historic Preservation Act of 1966, as amended	NYSDPRHP	Programmatic Agreement in place
Noise Control Act of 1972	USEPA	Notification of any noncompliance; none anticipated
Resource Conservation and Recovery Act of 1976	USEPA, NYSDEC	Testing, quantification, and notification for any hazardous materials.
N/A = Not Applicable; NYSDEC = New York State Department of Environmental Conservation; NMFS = National Marine Fisheries Service; NYSDPRHP = New York State Department of Parks, Recreation and Historic Preservation; USEPA = U.S. Environmental Protection Agency; FWS = U.S. Fish and Wildlife Service		

8.2 National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321 *et seq.*

The NEPA requires that all Federal agencies use a systematic, interdisciplinary approach to protect the human environment. This approach promotes the integrated use of natural and social sciences in planning and decision-making that could have an impact on the environment. NEPA requires the preparation of an environmental impact statement (EIS) for any major Federal action that could have a significant impact on quality of the human environment and the preparation of an Environmental Assessment (EA) for those Federal actions that do not cause a significant impact but do not qualify for a categorical exclusion. The NEPA regulations issued by CEQ provide for a scoping process to identify and the scope and significance of environmental issues associated with a project. The process identifies and eliminates from further detailed study issues that are not significant. As previously stated, the USACE used this process to comply with NEPA, and based on coordination with Federal and State regulatory agencies as well as our own findings, withdraw a Federal Register Notice of Intent to write an EIS for this study and, instead, reduce the effort to an EA based on the lack of identified significant, major environmental impacts. The study was focused on an Integrated General Reevaluation

Report/EA (GRR/EA) on those issues most relevant to the environment and the decision making process. For a description of the agency, tribal, and public coordination completed to date and information on the NEPA scoping that was completed, please refer to the Section 1-11, National Environmental Policy Act Scoping and Public, Resource Agency, and Tribal Coordination. A 30-day agency, tribal, and public review of the Draft GRR/EA will be completed after DQC and simultaneous with ATR in summer 2019. All comments/edits will then be addressed in the Final GRR/EA and the comment responses will be provided in the Final GRR/EA. The Final GRR/EA, including all appendices and supporting documentation fulfills the requirements of the NEPA for the New York and New Jersey Harbor Anchorage General Reevaluation Report. Upon completion of the Final GRR/EA, which is signified by the signing of the Finding of No Significant Impact, the project will be in full compliance with the NEPA.

8.3 Clean Water Act

The USACE will obtain a Water Quality Certification from the State of New York pursuant to the Clean Water Act (CWA) during PED. This GRR/EA contains sufficient information to demonstrate that the recommended plan is in compliance with the CWA. All dredged material placement actions will comply with State of New York water quality standards. Prior to commencement of construction, dredged material will undergo evaluation procedures including chemical and biological testing in accordance with Federal guidance and regulations to provide information to reach a factual determination concerning Clean Water Act, Section 404 requirements (40 CFR 230.11) and applicable state water quality standards. A water quality certification support letter was received on 19 February 2020.

8.4 Wetlands

Section 404 of the CWA and 33 C.F.R. 336(c)(4) and 33 C.F.R. 320.4(b) require the USACE to avoid, minimize, and mitigate impacts to wetlands. No direct or indirect impacts to jurisdictional wetlands are anticipated with implementation of this project.

8.5 Federal Coastal Zone Management Act, 16 U.S.C. 1451 *et seq.*

The Federal Coastal Zone Management Act (CZMA) requires each Federal agency activity performed within or outside the coastal zone (including development projects) that affects land or water use, or natural resources of the coastal zone to be carried out in a manner which is consistent to the maximum extent practicable, i.e. fully consistent, with the enforceable policies of approved state management programs unless full consistency is prohibited by existing law applicable to the Federal agency.

To implement the CZMA and to establish procedures for compliance with its Federal consistency provisions, the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), promulgated regulations which are contained in 15 C.F.R. Part 930. As per 15 CFR 930.37, a Federal agency may use its NEPA documents as a vehicle for its consistency determination.

The State of New York's Coastal Management Program was established under the guidelines of the national Coastal Zone Management Act (1972) as a state-Federal partnership to comprehensively manage coastal resources. The NYSDOS is the designated state coastal management agency and is responsible for the implementation of the state's Coastal Management Program. Implementation includes the direct regulation of impacts to coastal

resources within the critical areas of the state including coastal waters, tidelands, beaches and beach dune systems; and indirect certification authority over Federal actions and state permit decisions within the eight coastal counties.

The goals of New York's Coastal Management Program are attained by enforcement of the policies of the State. "Policy" or "policies" of the State of New York Coastal Management Program means the enforceable provisions of present or future applicable statutes of the State of New York and related Federal regulations. The statutes cited as policies of the Program were selected because they reflect the overall program goals of developing and implementing a balanced program for the protection of the natural resources, as well as promoting sustainable economic development of the coastal area. In accordance with the CZMA, it has been determined that the proposed expansion and deepening of the Gravesend Anchorage would be carried out in a manner that is fully consistent with the enforceable policies of the New York CMP (The Federal Consistency Determination with the CZMA is provided in Appendix E).

8.6 Clean Air Act, as amended, 42U.S.C. 7401 *et seq.*

There will be minor, temporary increases in air emissions from operation of construction equipment during construction and maintenance operations. The King's County, New York State Region is marginal for ozone and not in attainment, which triggers the requirement to conduct a detailed analysis of air emissions, which for any given project have the following limitations: 100 tons of Nitrogen Oxide (NOx) per year (any year of the project) and 50 tons of Volatile Organic Carbon (VOC) per year (40 CFR§93.153(b)(1)). These emissions, which were calculated for the Action Alternative due to the project ROI's status of non-attainment due to ozone, were found to be below *de minimis* levels. A Record of Non-Applicability (RONA) was developed and the signed document is located in Appendix E. The emissions calculations used to determine a RONA was appropriate can be seen in Appendix E.

8.7 U.S. Fish and Wildlife Coordination Act, 16 U.S.C.661-666(c)

Coordination with the U.S. Fish and Wildlife Service and the State of New York is complete. A Fish and Wildlife Coordination Act Report report was received on 3 March 2020.

8.8 Endangered Species Act

Coordination with the FWS and the NMFS pursuant to Section 7 of the ESA for the species provided in Table 8-5 below. Section 7 consultation has been concluded with the NMFS concurrence with USACEs Not Likely to Adversely Affect (NLAA) Determination. Consultation with FWS is also informal. A FWCAR (Fish and Wildlife Service Coordination Act Report) which concluded coordination with FWS to include Threatened and Endangered Species (TES) and other species under their jurisdiction was received on 3 March 2020.

Effects to Federally listed species are all either no affect or may affect, not likely to adversely affect determinations and the analysis and findings are described in detail in the Special Status Species Section of this draft EA.

Table 8-4: Federally Listed Species Known or with the Potential to Occur in the Action Area

Under the Jurisdiction of the National Marine Fisheries Service

Taxonomic Category/Common Name	Scientific Name	Status	Critical Habitat	Affect Determination
Fish				
Atlantic sturgeon (New York Bight DPS)	*Acipenser oxyrinchus oxyrinchus*	E	N*	May Affect, Not Likely to Adversely Affect
Shortnose Sturgeon	*Acipenser brevirostrum*	E	N	No affect
Mammals				
Fin whale	*Balaenoptera physalus*	E	N	May Affect, Not Likely to Adversely Affect
North Atlantic right whale	*Eubalaena glacialis*	E	N*	May Affect, Not Likely to Adversely Affect
Reptiles				
Green sea turtle (North Atlantic DPS)	*Chelonia mydas*	T	N*	May Affect, Not Likely to Adversely Affect
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	N	May Affect, Not Likely to Adversely Affect
Leatherback sea turtle	*Dermochelys coriacea*	E	N*	May Affect, Not Likely to Adversely Affect
Loggerhead sea turtle (Northwest Atlantic DPS)	*Caretta caretta*	T	N*	May Affect, Not Likely to Adversely Affect
DPS = Distinct Population Segment; T = Threatened; E = Endangered; Y = Yes; N = No; ^Species status is reported as it pertains to the DPS/Action Area; *Critical Habitat not located in Action Area				

Table 8-5: Federally Listed Species Known or with the Potential to Occur in the Action Area

Under the Jurisdiction of the U.S. Fish and Wildlife Service

Taxonomic Category/Common Name	Scientific Name	Status	Critical Habitat	Affect Determination
Birds				
Piping Plover	*Charadrius melodus*	T	N*	No Affect
Red Knot	*Calidris canatus rufa*	T	N	No Affect
Roseate Tern	*Sterna dougallii*	E	N	No Affect
Reptiles				
Green sea turtle (North Atlantic DPS)	*Chelonia mydas*	T	N*	No Affect
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	N	No Affect
Leatherback sea turtle	*Dermochelys coriacea*	E	N*	No Affect
Loggerhead sea turtle (Northwest Atlantic DPS)	*Caretta caretta*	T	N*	No Affect
DPS = Distinct Population Segment; T = Threatened; E = Endangered; Y = Yes; N = No; ^Species status is reported as it pertains to the DPS/Action Area; *Critical Habitat not located in Action Area				

8.9 Magnuson-Stevens Fishery Conservation and Management Act (MSA), 16 U.S.C.1801 *et seq.*

This Act requires Federal action agencies to consult with the National Marine Fisheries Service (NMFS) if a proposed action may affect Essential Fish Habitat (EFH). The USACE evaluated potential project impacts on NMFS-managed fish species and their Essential Fish Habitats (Appendix E). Negligible to minor, adverse impacts to some EFH is anticipated, however no impacts are anticipated to substantively impact EFH. Coordination with the NMFS and NOAA is completed.

8.10 Anadromous Fish Conservation Act, 16 U.S.C. 757, *et seq.*

The project considered habitat impacts to the anadromous fish listed below in Table 8-6. Mitigation would not be required for the negligible to minor, adverse effects on these species due to water quality changes and/or habitat displacement. Coordination with the NMFS regarding federally listed species and with NOAA regarding EFH species and their habitat is completed.

Table 8-6: Anadromous Fish

Common Name	**Scientific Name**
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*
Shortnose sturgeon	*Acipenser brevirostrum*
Alewife	*Alosa pseudoharengus*
American shad	*Alosa sapidissima*
Blueback herring	*Alosa aestivalis*
Hickory shad	*Alosa mediocris*
Striped bass	*Morone saxatilis*
Rainbow smelt	*Osmerus mordax*
Atlantic tomcod	*Microgadus tomcod*

8.11 Marine Mammal Protection Act, 16 U.S.C. 1631 et seq.

The Marine Mammal Protection Act (MMPA) prohibits the take of marine mammals including the West Indian manatee, and all cetaceans found in the ROI. The project is being coordinated with FWS and NMFS. No Incidental Take Authorization from the NMFS is anticipated with implementation of the Preferred Alternative.

8.12 Section 106 and 110(f) of the National Historic Preservation Act, 16 U.S.C. 470 *et seq.*

The National Historic Preservation Act (NHPA) applies to properties listed in or eligible for listing in the National Register of Historic Places (NRHP); these are referred to as “historic properties.” Historic properties eligible for listing in the NRHP include prehistoric and historic sites, structures, buildings, objects, and collections of these in districts. Section 106 of the NHPA and its implementing regulations at 36 CFR Part 800, require the lead Federal agency to assess the potential effects of an undertaking on historic properties that are within the proposed project’s Area of Potential Effect (APE), which is defined as “the geographic area or areas within which

an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist" (36 C.F.R. § 800.16[d]).

The USACE evaluated the potential for adverse impacts to archaeological or historic resources. No submerged archaeological resources have been recorded within the APE for the proposed dredging. Archaeological sites may exist within unsurveyed parts of the APE. As per a Programmatic Agreement with the New York State Historic Preservation Office surveys will be conducted for these areas during the Preconstruction, Engineering, and Design (PED) Phase of the Project. The procedures for any mitigation if adverse effects to NRHP eligible properties are identified are also described in the Programmatic Agreement (Appendix E). The New York Department of Parks, Recreation and Historic Preservation (SHPO) concurred that no adverse effects to historic properties would result from visual or noise effects of construction, and this is also documented in the Programmatic Agreement. (PA). The Delaware Nation, the City of New York Landmarks Preservation Commission, and the Naval History and Heritage Command were invited to be consulting and concurring parties to the PA, and they accepted. The PA was signed by the USACE on 5 December 2019, and by the SHPO on 3 February 2020.

8.13 Resource Conservation and Recovery Act, as amended, 42 U.S.C. 6901 *et seq*.

The Resource Conservation and Recovery Act (RCRA) RCRA controls the management and disposal of hazardous waste. "Hazardous and/or toxic wastes", classified by the Resource Conservation and Recovery Act (RCRA), are materials that may pose a potential hazard to human health or the environment due to quantity, concentration, chemical characteristics, or physical characteristics. This applies to discarded or spent materials that are listed in 40 CFR 261.31-.34 and/or that exhibit one of the following characteristics: ignitable, corrosive, reactive, or toxic. Radioactive wastes are materials contaminated with radioactive isotopes from anthropogenic sources (e.g., generated by fission reactions) or naturally occurring radioactive materials (e.g., radon gas, uranium ore). No radioactive waste is expected to be encountered during the proposed dredging.

Dredging within the ROI of the proposed project is not anticipated to generate material with chemical contamination based on historical testing data from the proposed dredged area in Gravesend Bay.

8.14 Comprehensive Environmental Response, Compensation and Liability Act

42 U.S.C. 9601 *et seq*.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund) governs the liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous substance disposal sites.

There are CERCLA/Superfund sites near (and upriver, including the Hudson River itself), but not within, the ROI. However, contamination from these sites may be present within the dredging limits of the ROI, mainly PCBs. If so, it will be handled as described in Part 6.12 above and as described in the HTRW Section, which recommends contaminated material be disposed of at upland disposal sites able to safely handle and store such material. This would only be used if the contamination exceeds limits for disposal at the offshore HARS site.

8.15 Marine Protection, Research and Sanctuaries Act

The Act has two essential aims: to regulate intentional ocean disposal of materials, and to authorize any related research. While the MPRSA regulates the ocean dumping of waste and provides for a research program on ocean dumping, it also provides for the designation and regulation of marine sanctuaries.

Ocean dredged material placement is regulated under Section 103 of the Marine Protection Resources and Sanctuaries Act of 1972, Public Law 92-532 (MPRSA). The law states that any proposed placement of dredged material into ocean waters must be evaluated through the use of criteria published by the USEPA in Title 40 of the Code of Federal Regulations, Parts 220-228 (40 CFR 220-228). The primary purpose of Section 103 of the MPRSA is to limit and regulate adverse environmental impacts of ocean placement of dredged material. Dredged material proposed for ocean placement must comply with 40 CFR 220-228 (Ocean Dumping Regulations) and 33 CFR 320-330 and 335-338 (USACE Regulations for discharge of dredged materials into waters of the U.S.) prior to being issued an ocean placement permit. The technical evaluation of potential contaminant-related impacts that may be associated with ocean placement of dredged material is conducted in accordance with 40 CFR 220-228, the Ocean Testing Manual, and the Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore.

All dredged material will be tested as established by the MPRSA. Materials from dredge activities from the proposed dredging are expected to be placed at HARS offshore dredged material disposal site. All required testing for placement at HARS, which has its own management plan (USACE and USEPA, 2010) will be followed and confirmed during PED.

8.16 Executive Order 11988, Floodplain Management

This EO states that Federal agencies shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out agency responsibilities. The proposed project has no effect on floodplains.

8.17 Executive Order 11990, Protection of Wetlands

This EO directs all Federal agencies to minimize the destruction, loss, or degradation of wetlands; and preserve and enhance the natural beneficial values of wetlands in the conduct of the agency's responsibilities. No direct or indirect impacts to jurisdictional wetlands are anticipated with implementation of this project.

8.18 Executive Order 13112, Invasive Species

Under this EO, the introduction of invasive species has been evaluated in Section 6.22. The project would not induce the introduction or spread of invasive species to the project area.

8.19 Executive Order 12898, Federal Actions to Address Environmental Justice

In accordance with this EO, the USACE has determined that no group of people would bear a disproportionately high share of adverse environmental consequences resulting from the proposed work.

8.20 Executive Order 13045, Protection of Children from Environmental and Safety Risks

This EO ensures that all Federal actions address the unique vulnerabilities of children. In accordance with this EO, the USACE has determined that no children would bear a disproportionately high share of adverse environmental consequences resulting from the proposed work and there should be no effect on children.

8.21 Migratory Bird Treaty Act, 16 U.S.C. 703 *et seq.*; Executive Order 13186

Responsibilities of Federal Agencies to Protect Migratory Birds

This Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations. Negligible to a minor level of impact are expected on local migratory birds, no significant impacts to migratory birds is expected as a result of project implementation.

8.22 LIST OF PREPARERS

The project delivery team for the study was extensive. It comprised team members from District's in the USACE North Atlantic and South Atlantic Division (Norfolk, New York, and Mobile Districts) (Table 8-7). The team members listed below provided substantial text to the Integrated Feasibility Report/Environmental Impact Statement.

Table 8-7: List of Preparers

Name	Contribution/Education	Affiliation	Years of Experience
John Haynes	Cultural Resources/MA, Anthropology	USACE	28
Alicia Logalbo	Environmental Analyst/MS, Biology	USACE	18
Chris Dols	BS, Civil & Environmental Engineering	USACE	10
David Schulte	Environmental Analysis/MS, Marine Science	USACE	18
Todd Nettles	Economic Analysis/BS, Economics	USACE	17
Julie McGuire	Economic Analysis/BS, Economics	USACE	15
Tammy Knecht	GIS Analysis/B.S. Environmental Biology	USACE	13

Name	Contribution/Education	Affiliation	Years of Experience
Chris Rowley	Volume Calculations/A.S. Civil Engineering	USACE	43
Joseph McMahon	Survey Data Analysis/B.S. Civil Engineering	USACE	1
Dan Hughes	Plan Formulation/Ph.D. Applied Anthropology	USACE	27
Steve Powell	Navigation Design/B.S. Civil Engineering	USACE	30
Rachel Haug	Plan Formulation/B.S. Environmental Policy and Planning	USACE	8

9 AGENCIES, TRIBAL GOVERNMENTS AND PERSONS CONSULTED

Table 9-1 list the Agencies consulted with during this project. Consultation will be ongoing through the length of this study.

Table 9-1: Agencies consulted.

Agency/Government	Name of Contact People
Advisory Council on Historic Preservation (ACHP)	Christopher Daniel
U.S. Coast Guard (USCG)	Jeffery M. Yunker
National Marine Fisheries Service (NMFS), ESA	Edith Carson-Supino
U.S. Environmental Protection Agency (USEPA)	David Kleusner, Daniel Birkett
U.S. Fish and Wildlife Service (FWS)	David Stillwell, Steve Papa
National Oceanic and Atmospheric Administration (NOAA), (EFH)	Karen Greene
New York Department of Environmental Conservation	Steve Zahn
New York City Landmarks Commission	Amanda Sutphin, Gina Santucci
New York Department of State	Jennifer Street, David Newman
National Park Service	Patricia Rafferty
New Jersey Department of Environmental Protection	Angela Skowronek, Gary Nickerson, Suzanne Dietrick
New York State Parks Recreation & Historic Preservation, Division of Historic Preservation	Phillip Perazio,
Delaware Nation	Kimberly Penrod
Delaware Tribe of Indians	Susan Bachor
Shinnecock Indian Nation	Brian Polite
Stockbridge Munsee Community	Shannon Holsey

10 RECOMMENDATIONS

I concur with the findings presented in this report. The Recommended Plan (RP) developed is technically sound, economically justified, and socially and environmentally acceptable.

I recommend that the existing deep-draft navigation project at New York and New Jersey Harbor be modified to provide for implementation of a Federal project for an improved anchorage in accordance with the RP selected herein, with such further modifications thereto as in the discretion of the Chief of Engineers, may be advisable. Based on a review of existing data and coordination with Federal, state, and local agencies, there is no environmental mitigation required for construction of the RP. No relocation of aids to navigation would be required. For the purpose of calculating the Section 902 limit, the estimated first cost of the project is $25,250,000 (FY 20 costs) including an estimated Federal share of $16,412,500 and an estimated non-Federal share of $8,837,500. The average annual costs are $938,000 (FY 20 Costs). Average annual benefits are $210,000 (FY 20 Costs) with a benefit to cost ratio of 1.2 (FY 20 Costs).

The RP conforms to the essential elements of the U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and complies with other Administration and legislative policies and guidelines on project development. If the project were to receive funds for Federal implementation, it would be implemented subject to the cost sharing, financing, and other applicable requirements of Federal law and policy for navigation projects including WRDA 1986, as amended; and would be implemented with such modifications, as the Chief of Engineers deems advisable within his discretionary authority. Aids to navigation are to be funded by the U.S. Coast Guard. Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with Federal laws and policies, including but not limited to:

1. Provide, during the periods of design and construction, funds necessary to make its total contribution for commercial navigation equal to:

- 25 percent of the cost of design and construction of the general navigation features (GNFs) and mitigation (including mitigation LERR);

2. Provide all lands, easements, and rights-of-way, including those necessary for the placement of dredged material, and perform or assure the performance of all relocations, including utility relocations, all as determined by the Federal government to be necessary for the construction or operation and maintenance of the GNFs, all in compliance with applicable provisions of the Uniform Relocation and Assistance and Real Property Acquisition Policies Act of 1970, as amended (42 U.S.C. 4601-4655) and the regulations contained in 49 C.F.R. Part 2.

3. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the GNFs, an additional amount equal to 10 percent of the total cost of construction of the GNFs less the amount of credit afforded by the Government for the value of the lands, easements, rights-of-way and relocations (LERRs), including utility relocations, as provided by the sponsor for the GNFs. If the amount of credit afforded by the Government for the value of LERRs, including utility relocations, provided by the sponsor equals or exceeds

10 percent of the total cost of construction of the GNFs, the sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of LERRs, including utility relocations, in excess of 10 percent of the total cost of construction of the GNF

4. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;

5. Provide, operate, and maintain, at no cost to the Government, the local service facilities in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and state laws and regulations and any specific directions prescribed by the Federal government.

6. Accomplish all removals determined necessary by the Federal government other than those removals specifically assigned to the Federal government;

7. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the Sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating and maintaining the GNFs.

8. Hold and save the United States free from all damages arising from the construction or operation and maintenance of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors.

9. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence are required, to the extent and in such detail as will properly reflect total cost of the project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20.

10. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601–9675, that may exist in, on, or under LERR that the Federal government determines to be necessary for the construction or operation and maintenance of the GNFs. However, for lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigations unless the Federal government provides the sponsor with prior specific written direction, in which case the sponsor shall perform such investigations in accordance with such written direction.

11. Assume complete financial responsibility, as between the Federal government and the sponsor, for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under LERR that the Federal

government determined to be necessary for the construction or operation and maintenance of the project.

12. Agree, as between the Federal Government and the non-Federal Sponsor, that the non-Federal Sponsor shall be considered the operator of the local service facilities for the purpose of CERCLA liability.

13. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA.

14. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, (42U.S.C. 1962d-5b) and Section 101(e) of the WRDA 86, Public Law 99-662, as amended, (33 U.S.C. 2211(e)) which provide that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

15. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended, (42 U.S.C. 4601-4655) and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way necessary for construction, operation, and maintenance of the project including those necessary for relocations, the borrowing of material, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

16. Comply with all applicable Federal and state laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)).

17. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project.

18. Not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the sponsor's obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that such funds are authorized to be used to carry out the project.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to the Congress, the State of New York, the State of New Jersey and the New York and New Jersey Port Authority (the non-Federal Sponsor), interested Federal agencies, and other parties will be advised of any significant modifications and will be afforded an opportunity to comment further.

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