2018 Ports Assessment: South Brooklyn Marine Terminal

Pre-front End Engineering Design Report

Final Report | NYSERDA Report Number 19-01 | January 2019

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2018 Ports Assessment: South Brooklyn Marine Terminal

Pre-front End Engineering Design Report

Final Report

Prepared for:

New York State Energy Research and Development Authority

Albany, NY

Prepared by:

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New York, NY

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Table of Contents

List of Figures

Acronyms and Abbreviations

BFE	Base Flood Elevation
cm	Centimeter
CoNED	Coastal National Elevation Database
CRS	Coordinate Reference System
CY	Cubic Yard
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
MHHW	Mean Higher High Water
MHW	Mean High Water
MLW	Mean Low Water
MLLW	Mean Lower Low Water
MSL	Mean Sea Level
NOAA	National Oceanic and Atmospheric Administration
NYC DCP	New York City Department of City Planning
OPC	Opinion of Probable Cost
PSF	Pounds per Square Foot
RSLR	Relative Sea Level Rise
SY	Square Yards
USACE	United States Army Corps of Engineers
WEA	Wind Energy Area

Executive Summary

The South Brooklyn Marine Terminal (SBMT) Pre-front End Engineering Design (Pre-FEED) is one of a series of targeted sites for Pre-FEED prepared on behalf of New York State as a part of the 2018 Ports Study. The 2018 Ports Study builds on the Assessment of Ports and Infrastructure [1] completed in support of the New York State Offshore Wind Master Plan [2]. The objective of the 2018 study is to identify the facilities with greatest feasibility for offshore wind use and develop concept designs of those facilities in order to illustrate their potential, while also developing a deeper understanding of activities, schedule, and costs required to develop each facility.

SBMT was selected by NYSERDA, after obtaining significant stakeholder input. The SBMT Pre-FEED is based on a combination of site characterization information provided by the terminal operator and publicly available information. While the SBMT site is a developed marine terminal, infrastructure improvement and/or rehabilitation may be required in order to support certain scopes of offshore wind operations. It should be noted there may be some scope of offshore wind operations that would not require significant infrastructure improvement and/or rehabilitation at the SBMT site.

The SBMT site is located along the eastern shore of the New York Harbor Upper Bay between 29th and 39th Streets in Brooklyn, NY. SBMT is an operational marine terminal, currently owned by the City of New York, under the jurisdiction of the New York City Department of Small Business and leased to the New York City Economic Development Corporation. The site is operated by several tenants. Sustainable South Brooklyn Marine Terminal, or SSBMT—a joint venture formed between Red Hook Container Terminal, LLC (RHCT) and Industry City—was recently selected as the operator of the 35th and 39th Street piers and associated upland areas. SSBMT stated its interest in offshore wind related operations in this area. The existing site hosts multiple parking lots, utility buildings, warehouses, and an operational railroad. The existing surface varies, though most is either asphalt or concrete pavements. The waterfront part of the site is protected by steel sheet pile bulkhead and revetment. Sims Municipal Recycling operates on the 29th Street Pier, which is not available for offshore wind use.

Approximately 63 acres of the total 88-acre site area is proposed for offshore wind. The site may potentially support staging and installation activities or manufacturing and fabrication activities, which would potentially include receiving, storing, outfitting and load out of components onto a transportation or installation vessel; fabricating foundation or offshore electrical service platform components; or manufacturing nacelles, towers, or blades.

The SBMT Pre-FEED is based on general preparation activities intended to facilitate a range of staging and installation, foundation fabrication, and substation fabrication activities. The scope and associated cost and schedule are subject to refinement depending on the ultimate use of the facility, as well as future stages of design. The Pre-FEED designs were intended to be conservative, yet realistic to address the needs of the supply chain, through the State's 2030 timeframe and beyond. Potential port developers should use the information and estimates in this report as it is relevant to their specific infrastructure needs. The following site development activities were identified, quantified, and incorporated into the Opinion of Probable Cost (OPC):

- Demolishing and disposing existing warehouses and utility buildings 36,860 m^2 (44,080 SY).
- Removing 214,560 m^2 (256,610 SY) of concrete/asphalt pavement.
- Reconstructing 517 m (1,700 ft.) of sheet pile bulkhead with a new steel pile supported relieving platform, with 30 MT/m^2 (6,000 PSF) of live load capacity and reconstructing an additional 704 m (2,310 ft.) of sheet pile bulkhead with a new relieving platform with 15 MT/m^2 (3,000 psf) of live load capacity.
- Rehabilitating and increasing the stability of 800 m (2,620 ft.) of existing revetment.
- Re-grading 63.7 acres of surface, consisting of gross excavation of 64,300 m^3 (84,110 CY), gross fill of 61,630 m^3 (80,610 CY), hauling, and placement.
- Procuring and installing 186,760 m^3 (244,270 CY) of crushed stone to cover 258,40 m^2 (309,040 SY) of surface.
- Dredging 91,850 m3 (120,140 CY) of sediment from the berth area.

The OPC to develop the SBMT site yields a total projected construction cost of approximately $297 million USD (2018-dollar value). The OPC includes both a $229 million estimate of primary activities, and a 30% design and construction contingency of $68 million due to the Pre-front End Engineering Design level of the design.

SBMT is air draft restricted by the Verrazano-Narrows Bridge at 60.3 m (198 ft.) MHW. SBMT is water depth restricted by the authorized depth of the Bay Ridge Channel at 12.2 m (40 ft.) MLLW as well as limited water depth at the SBMT berthing areas. The air and water drafts may potentially affect the vessels calling at the facility and the ability to transport some components in a vertical mode. Some components may need to be transported horizontally due to the air draft restriction.

The offshore wind industry in New York is poised for rapid expansion. In his 2019 State of the State Address, Governor Andrew M. Cuomo announced an expansion of the State's Clean Energy Standard from 50% to 70% renewable electricity by 2030. As part of that announcement, New York also increased its commitment to offshore wind from 2,400 MW by 2030 to 9,000 MW by 2035. Achieving this goal will require thoughtful planning, design, and construction of highly capable, modern, and dedicated port facilities. The undeveloped land of the SBMT site presents an opportunity to develop such offshore wind port facility. Developing SBMT would provide an enormous benefit to the offshore wind industry, by delivering a dedicated port facility, which will be critical to facilitating offshore construction, while also creating new jobs in Downstate New York.

1 Introduction

The South Brooklyn Marine Terminal (SBMT) Pre-front End Engineering Design (Pre-FEED) is one of a collection of targeted sites taken from the 2018 Ports Study specifically selected for Pre-FEED prepared on behalf of New York State. The 2018 Ports Study builds upon the Assessment of Ports and Infrastructure [1] completed in support of the New York State Offshore Wind Master Plan [2].

The objective of the 2018 study is to identify the facilities with the greatest feasibility for offshore wind use and develop Pre-FEED designs of those facilities in order to illustrate their potential, while also establishing a further understanding of the activities, schedules, and costs necessary to develop each facility. SBMT is one of the facilities selected by NYSERDA, inclusive of significant stakeholder input, for Pre-FEED.

The offshore wind industry in New York is poised for rapid expansion. In his 2019 State of the State Address, Governor Andrew M. Cuomo announced an expansion of the State's Clean Energy Standard from 50% to 70% renewable electricity by 2030. As part of that announcement, New York also increased its commitment to offshore wind from 2,400 MW by 2030 to 9,000 MW by 2035. Achieving this goal will require thoughtful planning, design, and construction of highly capable, modern, and dedicated port facilities. The undeveloped land of the SBMT site presents an opportunity to develop such offshore wind port facility. Developing SBMT would provide an enormous benefit to the offshore wind industry by delivering a dedicated port facility, which will be critical for facilitating offshore construction, while also creating new jobs in Downstate New York.

1.1 Site Description

SBMT is an operational marine terminal, currently owned by the City of New York, under the jurisdiction of the New York City Department of Small Business and leased to the New York City Economic Development Corporation. SBMT is located in Brooklyn, NY on the east bank of New York Harbor, as shown in Figure 1.

Figure 1. SBMT Vicinity Map

Source: Google, boroughs by Geofabrik

The site, operated by several tenants, consists of three piers (the 29th Street, 35th Street, and 39th Street Piers) and associated upland storage areas. The existing site hosts multiple parking lots, utility buildings, warehouses, and operational rail. The existing surface varies, though most is either asphalt or concrete pavements. The waterfront part of the site is protected by steel sheet pile bulkhead and revetment.

Since 2011, NYCEDC has worked to rehabilitate and reactivate SBMT by investing more than $115 million in terminal infrastructure improvements, site preparation, and dredging, including $20 million to extend freight rail infrastructure to SBMT.

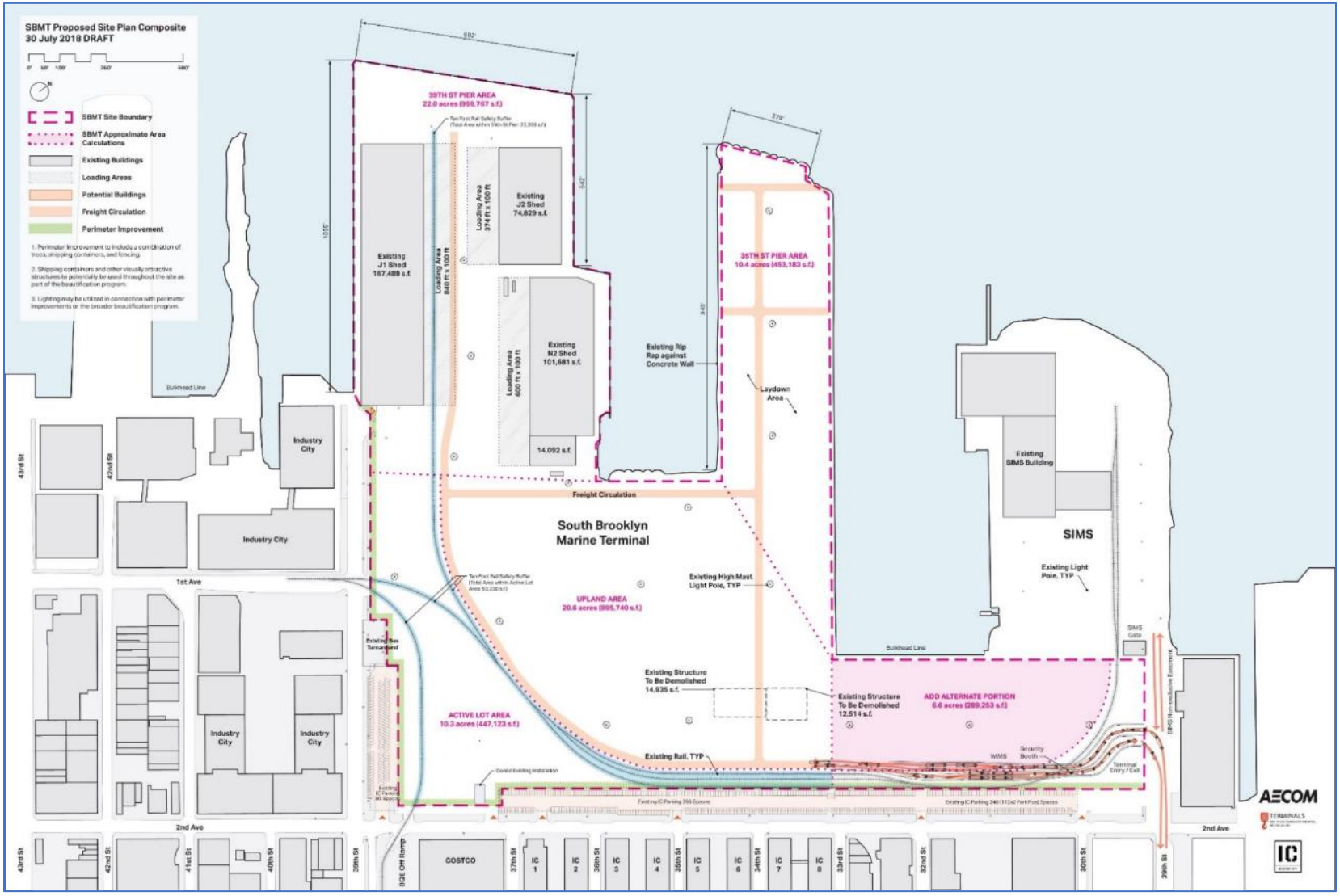
In 2018, NYCEDC announced Sustainable South Brooklyn Marine Terminal (SSBMT) as the master tenant of 35th Street Pier and 39th Street Pier; SSBMT will be primarily operated by Red Hook Container Terminals (RHCT) and Industry City. RHCT retained AECOM to complete a series of five reports to support the reactivation of SBMT. Those reports include the following:

- Book #1: Existing Conditions Report
- Book #2: Subsurface Exploration Report
- Book #3: Inspection to Verify November 2015 Survey Findings
- Book #4: Phase I Environmental Site Assessment
- Book #5: Asbestos and Lead Contained Materials Report

The area investigated by this Pre-FEED includes the available areas of the site (approximately 63.7 acres), as proposed by SSBMT; the available areas are shown in Figure 2. This study does not consider the use of the 6.6 acres of the "Add Alternate Portion," also shown in Figure 2.

Figure 2. Facility Plan

Source: AECOM



1.2 Potential Use

Offshore wind requires the support of several different types of port facilities, ranging from fabrication to transport to operations and maintenance facilities. SBMT is potentially capable of serving multiple purposes over the lifetime of one or multiple offshore wind farms. The NYSERDA 2018 Pre-FEED concept for SBMT is based on general preparation activities, with the intention of being able to facilitate multiple potential uses. Accordingly, some aspects of the Pre-FEED may be overdesigned for some uses, while other aspects may be underdesigned, depending on the ultimate functionality and use of the facility. In general, the Pre-FEED is intended to facilitate a broad range of staging and installation, foundation fabrication, and substation fabrication activities. Within these scenarios, activities at the terminal may include the following:

- Receive raw materials (steel pipe, concrete, steel reinforcement, etc.)
- Fabricate concrete and/or steel foundations
- Fabricate offshore electrical substations
- Install secondary steel sections (boat landings, access ladders, etc.) onto foundation components
- Receive completed offshore wind components (e.g., foundations, nacelles, towers, blades) manufactured or fabricated at alternative location(s)
- Store components until sufficient quantity are prepared for offshore installation
- Pre-assemble and stage components to prepare for load out
- Load wind components onto a transportation vessel, for transit to the offshore site

The identified activities are an example of potential uses of SBMT. Additional offshore wind related uses beyond those identified are certainly possible at SBMT, but the Pre-FEED was focused on most appropriate uses while taking supply chain and stakeholder input and ideas into consideration.

Due to the air draft restriction below the Verrazano-Narrows Bridge of 65.5 m (215 ft) at center span, the latest generation of wind turbine installation vessels are not be able to sail below the bridge in order to reach the SBMT site. This scenario, therefore, requires the use of feeder vessels and assumes the feeder vessel may either take the form of a jack-up feeder vessel (with accommodating leg length) or of a floating inshore feeder barge.

1.3 Operational Characteristics

General facility characteristics were observed and published in the 2017 Ports Assessment [1]. Leveraging that previous work, NYSERDA solicited feedback from industry seeking to confirm or update general characteristics for the facilities that will be used to support New York's offshore wind goals. Based on consolidated industry responses, the Pre-FEED seeks to provide:

- Two berth areas with a length of 200 m (660 ft.) each, one berth for dedicated load out, one (or more) multipurpose load in and load out.

- Live load capacity of 30 MT/m² (6,000 PSF) of uniform distributed live load at the wharves and a staging area for approximately 100 m (330 ft) behind the wharf. The load rating is intended to allow for unrestricted movement of large crawler cranes and self-propelled modular trailers, as well as staging of assembled components.
- Live load capacity of 15 MT/m² (3,000 PSF) of uniform distributed live load within the staging areas of the site. The load rating is intended to allow for movement of self-propelled modular trailers and storage of components.
- Maximized area available for component laydown.

It should be noted that stakeholder input and responses varied widely depending on the stakeholder's role or interest. Some stakeholders had more comprehensive requirements while other stakeholder requirements were less significant. The Pre-FEED designs were therefore intended to be conservative, yet realistic needs of the industry, through New York's 2030 timeframe and beyond. Potential port developers should use the information and estimates in this report as it is relevant to their specific infrastructure needs.

1.4 Site Characteristics

Location	31th to 39st Streets in Brooklyn, NY 11232 Latitude: 40°39'33.5" N Longitude: 74°00'38.6" W
Owner	The City of New York (owner), Department of Small Business Services https://www1.nyc.gov/site/sbs/index.page] New York City Economic Development Corporation https://www.nycedc.com/
Significant Tenants	Red Hook Container Terminals: Info@RedHookTerminal.com (973) 522-0999 Sims Municipal Recycling: https://www.simsmunicipal.com/contact/ (347) 429-8097
Distance to Wind Energy Areas (WEAs), approximate water route lengths calculated using the GRS 1980 ellipsoid	Equinor Empire Wind Offshore Wind Farm: 81 km (51 mi) Hudson South Area: 127 km (79 mi) Hudson North Area: 132 km (82 mi) Fairway North Area: 189 km (118 mi) Fairway South Area: 145 km (90 mi) Deepwater Wind South Fork Windfarm: 274 km (170 mi)

Area	SBMT Total: 35.6 hectares (88 ac) Upland Area (above MHHW) included in Pre-FEED: 25.8 hectares (63.7 acres) Area below MHHW included in Pre-FEED: 4.0 hectares (10 acres)
Water Frontage	1,950 m (6,400 ft) available to offshore wind
Primary Wharf Length(s)	1 x 217m (710 ft.) @ 30 T/m² (6,000 PSF), southwest face of the 39th St Pier 1 x 200m (650 ft.) @ 30 T/m² (6,000 PSF), northwest face of the 39th St Pier **Due to the relieving platform construction method selected along the 39th Street Pier and the offshore face of the 35th Street Pier, several additional areas may be used as secondary berths, each with a capacity of 15 MT/m² (3,000 PSF)*
Wharf & Storage Area Live Load Capacity	30 T/m² (6,100 PSF) in staging/pre-assembly areas 15 T/m² (3,050 PSF) in storage areas
Navigable Depth	10.7m (35 ft.) at berth areas 12.2 m (40 ft.) MLLW federally authorized for Bay Ridge Channel
Limiting Air Draft Restrictions (from facility to unrestricted offshore area)	Verrazano-Narrows Bridge: 60m (198 ft) for the center 610m (2000 ft.) 65.5m (215 ft) maximum at the centerline
Intermodal Connections	On-site rail, Adjacent to I-278
Surrounding Land Use	Industrial, residential, commercial

2 Design Basis

The Pre-FEED Design Basis for SBMT is found in Appendix A of this Design Report.

3 Proposed Site Design

The SBMT Pre-FEED is an indicative design, with facility characteristics compiled and consolidated from industry input, and tailored to best suit available infrastructure. The proposed site design is intended to provide a uniform and level use area with appropriate capacity live load rating, as well as a heavy load wharf to support offshore wind components. The shoreline of the site will be protected from wave action and scoured by a bulkhead-revetment system.

Due to the site historically being a developed multi-purpose marine terminal, the existing infrastructure was incorporated into the Pre-FEED, where feasible. Key site improvements and major infrastructure items investigated for the proposed site design include:

- Demolish existing buildings and the rail spur on the 39th Street Pier in order to increase available laydown area and facilitate ground bearing capacity improvements.
- Install two 30 MT/m² (6,000 PSF) heavy load quays, including:
  - 213 m (700 ft) long along the northwest end of the 39th Street Pier
  - 200 m (660 ft) long along the southwest end of the 39th Street Pier
- Stabilize the 35th Street Pier Revetment to increase the load capacity.
- Grade existing site.
- Improve the ground bearing capacity across the site by placing crushed stone fill above existing grade. The thickness of crushed stone depends upon load rating desired. The crushed stone also provides the working surface treatment, so no additional work is required.
- Dredge berth areas to allow safe vessel access to the site.

These items are described in further detail and incorporated into the Opinion of Probable Cost (OPC) in section 5.

3.1 Demolition

Demolition is required to increase the available laydown area at SBMT, as well as provide access to complete ground bearing capacity improvements. The following items are scheduled for demolition:

- Existing structures, including the J1, J2, and N sheds, as well as several minor utility buildings, totaling approximately 36,860 m2 (44,080 SY) of existing buildings. Resulting debris material is assumed to be hauled offsite and disposed.
- The rail spur on the 39th Street Pier. The other remaining railroad lines, (e.g., those providing service to Sims Municipal Recycling Facility) are to remain as existing.
- Existing asphalt and concrete pavement. The existing surface is paved with asphalt and concrete layers with an assumed thickness of 15 cm (0.5 ft) and is assumed to be removed prior to

excavation operations. The demolished surface treatment materials are assumed to be disposed off-site.

A demolition plan is found in Pre-FEED Drawing D-01 (Appendix B).

3.2 Marine Structures

Several marine structures are proposed within the SBMT Pre-FEED. The purpose of the marine structures is to provide two heavy load capacity wharves for loading and unloading offshore wind components from vessels, as well as to stabilize the existing shorelines and structures along the water in order to provide laydown area for components. The SBMT Pre-FEED includes the marine structures detailed in the following sections. A plan view identifying the location and extent of marine structures is seen in Pre-FEED Drawing S-01 (Appendix B).

3.2.1 30 MT/m² Relieving Platform

Based upon industry input, two heavy load wharves are included in the SBMT Pre-FEED. The first is 213 m (700 ft) long along the northwest end of the 39th Street Pier; the second is 200 m (660 ft) long along the southwest end of the 39th Street Pier. Each heavy load wharf can support 30 MT/m² (~6,000 PSF). The heavy load wharves consist of new pile supported relieving platforms, which are constructed above and behind a new anchored sheet pile bulkhead.

The new bulkhead is located immediately offshore of the existing steel sheet pile bulkhead and cells to contain the upland soils and restore the service life of the wharf structure. The bulkhead is anchored through the new relieving platform. The relieving platforms consist of a heavily reinforced concrete slab supported by steel pipe piles. A tie rod and plate anchor system provides additional lateral restraint to both the bulkhead and relieving platform. Crushed stone is placed above the concrete slab and retained by a concrete seawall. The crushed stone reduces point loads on the concrete slab and provides a working surface that can be readily repaired if damaged by loads from heavy equipment. A cross-section showing a typical relieving platform bent is found identifying the location and extent of marine structures is seen in Pre-FEED Drawing S-03 (Appendix B). Bents are spaced every 2.7 m (9 ft) on center.

Mooring hardware and fendering systems were not designed within the Pre-FEED; however, for the purposes of the indicative Opinion of Cost, 100-ton mooring bollards and a continuous fender system with a rubber cell and steel panel are included along the faces of the heavy load wharves. Both systems are assumed to be installed every 20 m (65 ft) on center.

3.2.2 15 MT/m² Relieving Platform

A series of 15 MT/m² (3,000 PSF) relieving platforms are proposed along the remaining edges of the 39th Street Pier and the offshore edge of the 35th Street Pier. This results in another approximately 125 m (410 ft) along the southwest face of the 39th Street Pier, 298 m (980 ft.) along the northeast face of the 39th Pier, 108m (350 ft) between the 39th and 35th Street Piers, and 111 m (360 ft) along the offshore end of the 35th Street Pier. The primary purpose of the relieving platforms is to increase the

load capacity of the piers to allow for laydown area and movement of equipment throughout the storage area. As a significant secondary benefit, the areas with the 15 MT/m² (3,000 PSF) relieving platform may be used as secondary berthing area.

The 15 MT/m² (3,000 PSF) relieving platform construction is similar to the heavier alternative; excepting fewer piles and increase spacing between bents. A cross-section showing a typical relieving platform bent is found identifying the location and extent of marine structures is seen in Pre-FEED Drawing S-02 (Appendix B). Bents are spaced every 4.1 m (13 ft) on center.

3.2.3 Revetment

The existing shoreline along the northeast and southwest sides of the 35th Street Pier consists primarily of a stone revetment; a series of steel sheet pile cells form the offshore end of the pier. Rehabilitating the existing revetment and installing a stone "bench" in the revetment slope is proposed to increase both the load capacity and available laydown area at the 35th Street Pier.

The stone "bench" concept provides additional slope stability to the revetment through the addition of stone in the center of the revetment slope. Rehabilitation consists of regrading the slope, where necessary, and providing an additional layer of dumped armor stone.

Given the existing marine structures and assuming the crushed stone fill described in Section 3.4, it is possible to achieve 15 MT/m² (3,000 PSF) live load capacity for component storage if the loads are set back at least 10 m (33 ft) inshore of the crest of the existing revetment. The setback effectively results in a loss of approximately 20% of the area of the pier for component storage. The revetment improvements will allow storage loads to be placed up to the crest of the revetment slope.

3.3 Earthwork and Ground Improvement

3.3.1 Design Platform Elevation

As discussed in the Design Basis (Appendix A), the design platform elevation was investigated through comparison of several guidance, but ultimately determined based on minimization of material (fill) cost. To get as close to a net zero fill value as possible, with inclusion of the proposed surface treatment (see Section 3.4), the design platform elevation was determined to be 2.95 m (9.70 ft.) NAVD88.

3.3.2 Grading

The existing platform elevation of SBMT is relatively flat. However, regarding the site is proposed as part of the process to prepare for ground bearing capacity improvements. The existing pavements that were demolished will be placed and compacted as part of the grading process. A layer of crushed stone, which functions as both bearing capacity improvement and surface treatment, is placed on top of the graded site and is discussed further in sections 3.3.3 and 3.4.

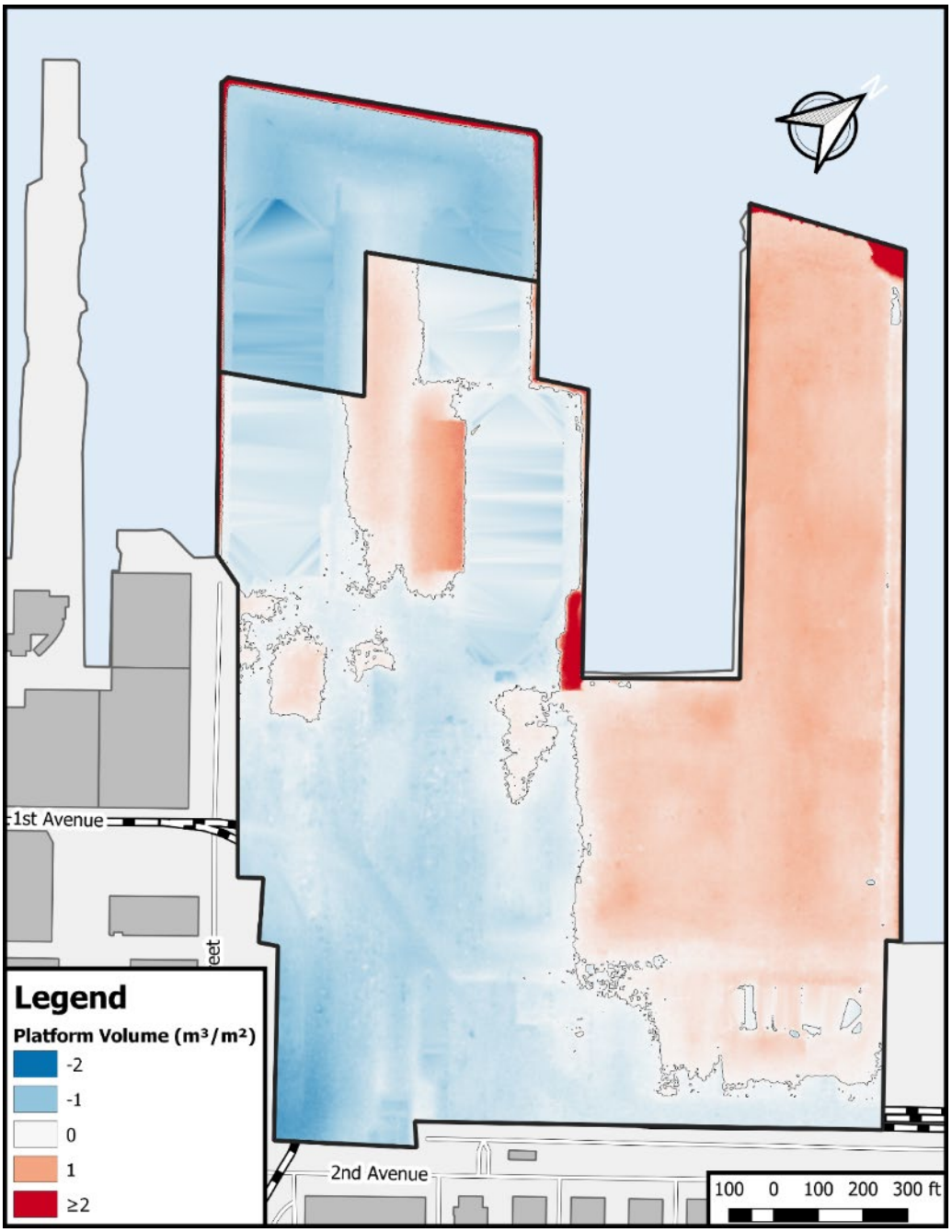
Since the proposed surface treatment thickness is dependent upon required load capacity (Section 3.4), the design grade elevation per area is also area specific. The design grade elevation for the 30 MT/m²

(6,000 PSF) area is 1.75 m (5.74 ft) NAVD88, and the design grade elevation for the 15 MT/m² (3,000 PSF) area is 2.35 m (7.71 ft) NAVD88.

Grading SBMT to the design grading elevation results in a net fill volume of approximately 2,680 m^3 (3,510 CY). The net volume is derived from an anticipated gross cut volume of approximately 64,310 m^3 (84,110 CY) and a gross fill volume of approximately 61,630 m^3 (80,610 CY); this design assumes that cut material is of sufficient quantity to be re-used on site. The areas designated for cut and fill are shown in Figure 3.

Figure 3. Proposed Earthwork Volume

Source: NYC Department of City Planning (NYC DCP)



3.3.3 Ground Improvement

A ground improvement campaign is required for the solid fill areas of SBMT to support the vertical live loads due to the offshore wind components. By calculation, it was found that a crushed stone fill, above the regraded site, is anticipated to be sufficient to distribute loads to the soils below.

The crushed stone fill in the staging and pre-assembly areas behind the primary wharves is approximately 1.2m (4 ft) thick. The crushed stone fill in the storage areas is approximately 0.6m (2 ft) thick. The thicknesses of crushed stone were applied over the defined pre-assembly/staging and storage areas to determine the quantity of crushed stone required.

Compacted bank run stone, similar to what is used in roadway applications, was assumed to serve this purpose. Due to the quantities required, the surface treatment material is anticipated to be delivered to the site by barge.

3.4 Surface Treatment

The crushed stone fill, described in Section 3.3.3, is used for the dual purpose of improving the ground bearing capacity of the site, as well as providing a surface treatment for operations. Should the crushed stone become damaged or displaced by equipment, it is readily repairable by minor grading or fill with new crushed stone (the loading areas are not sensitive to minor settlements). There is no additional crushed stone material here, beyond what is already described in Section 3.3.3.

3.5 Dredging

3.5.1 Berth Dredging

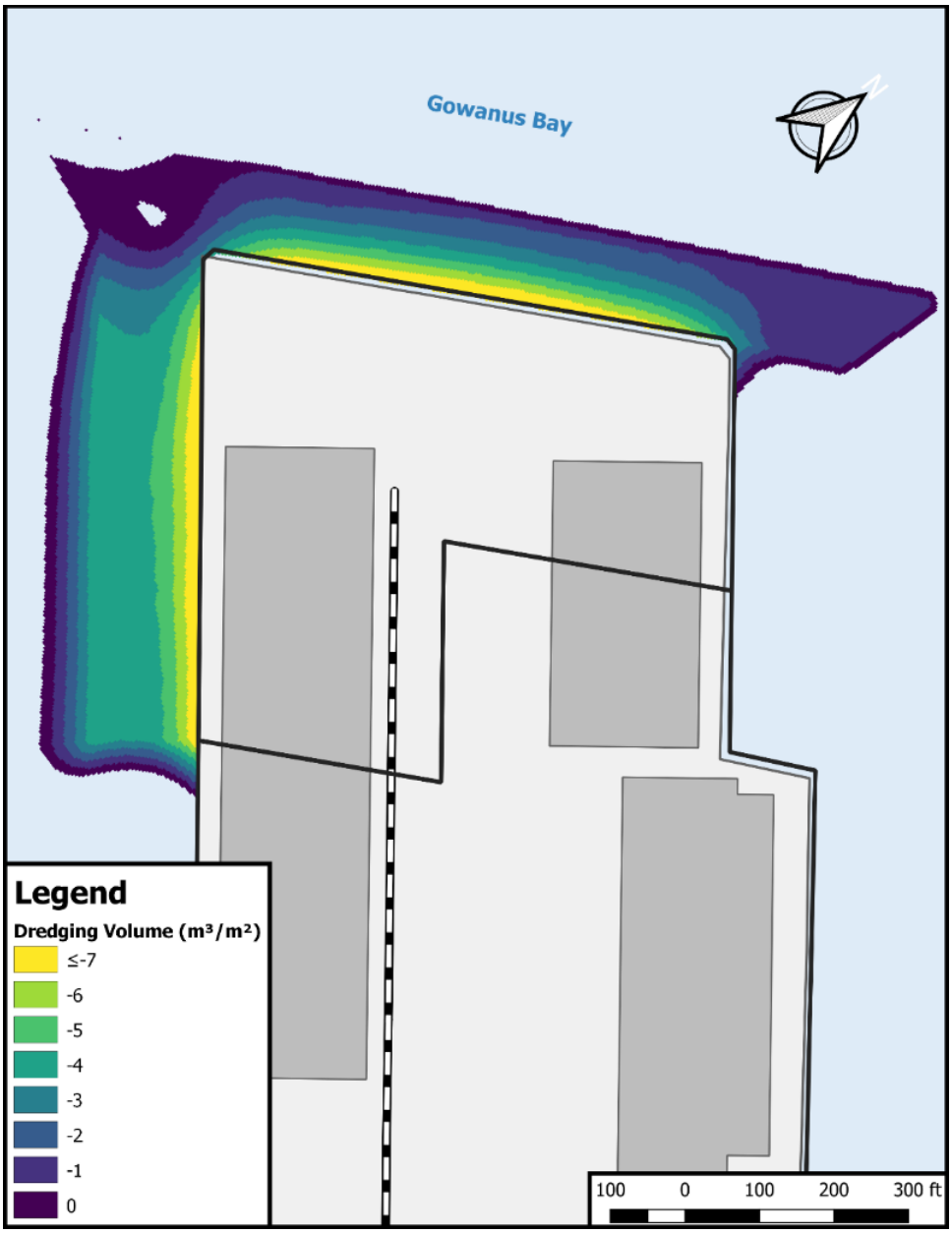
Vessels are anticipated to berth at two locations, the northwest and southwest faces of the 39th Street Pier adjacent to the Bay Ridge Federal Navigation Channel. Dredge footprint extents for the SBMT site are based upon those that are existing and permitted (see Drawing D-01, Appendix B). The proposed dredge footprint along the northwest face of the 39th Street Pier will match the full extents of what is permitted; at approximately 307m (1,007 ft.) in length and up to the Bay Ridge Federal Channel extents. The dredge footprint also includes 45-degree angle flares extending from the berthing line to the offshore extents of the footprint to accommodate the maneuvering of approaching vessels.

The dredging footprint along the southwest face of the 39th Street Pier extends along 200 m (656 ft.) of the total 300 m (984 ft.) length of the existing dredging footprint and approximately 45m (148 ft.) in width to accommodate the berthing of design vessels at the site. The design dredge elevation matches the permitted dredging footprints at SBMT, at -11.5 m (-37.8 ft.) NAVD88 (including 0.6 m or 2 ft. of over depth). See Pre-FEED Drawings S-01, S-02, and S-03 (Appendix B) for information on proposed dredging conditions.

Dredge volumes were calculated using the design dredge extents and difference between the planned dredge elevation and the site's existing bathymetry. The resulting berth dredge volume was found to be approximately 91,850 m3 (120,140 CY). Figure 4 shows the dredging volume per area.

Dredging is anticipated to be completed by mechanical means (crane with clamshell bucket, excavator, etc.) with upland disposal. If future site characterization activities determine the material to be of acceptable quality, it may be used for site grading and filling operations, potentially resulting in a significant cost savings to both dredging and grading costs.

Figure 4. Proposed Dredging Volume
Source: NYC DCP



3.5.2 Channel Dredging

The authorized depth of the Bay Ridge Federal Channel (-13.0 m or -42.8 ft. NAVD88) is the responsibility of the U.S. Army Corps of Engineers (USACE) [3]. Therefore, existing depths in the project site vicinity were considered to be sufficient for design vessel operations without the need for channel dredging. It will be important to coordinate closely with USACE to understand the frequency or likelihood of channel maintenance dredging.

4 Site Analysis, Benefits, and Challenges

4.1 Navigation Considerations

To access the site from offshore, a vessel must navigate through New York Harbor. This navigation route includes travel beneath the Verrazano-Narrows Bridge. The controlling air draft restriction posed on the SBMT site is due to the Verrazano-Narrows Bridge having a clearance of 60 m (198 ft).

4.2 Environmental Permitting

Port facilities will likely require either upland or shoreline improvements, or both, in order to support OSW development. As such, the port developer or the port facility owner will be required to obtain all necessary federal, State, and local permits to undertake the required improvements. Further, in accordance with New York State environmental regulations, the site improvements will be subject to an environmental review (State Environmental Quality Review or City Environmental Quality Review). The environmental review and permitting process typically involves a public participation component and developers must be prepared to address public concerns.

Port developers need to account for both the time and cost for completing the environmental review and permitting processes. In addition, port developers may need to account for additional costs associated with the review process, such as providing compensatory mitigation for project impacts.

Pre-application meetings with all involved federal, State, and local permitting agencies are always recommended to ensure port developers have a full understanding of all potential environmental issues related to the development of the port facility. For State-level permitting, the New York State Department of Environmental Conservation (DEC) is an excellent initial point of contact regarding the environmental review and permit processes. The DEC can facilitate preapplication meetings and will often include the other State and federal agencies in the initial meetings to provide port developers a comprehensive picture of the environmental review and permitting processes.

The federal and State agencies likely to have jurisdiction or an interest in the port development—though some may be added or subtracted as plans develop—are listed as follows:

Federal
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
NOAA/NMFS

State
NYS Department of Environmental Conservation
NYS Office of Parks, Recreation & Historic Preservation
NYS Office of General Service
NYS Department of State

The DEC has provided the following information to inform potential development at SBMT:

Permitting Considerations
Federally Regulated Wetlands and Other Waters of the U.S.
Tidal Wetlands
Shoreline improvements will require appropriate mitigation to compensate for habitat loss

Other Considerations
Existing developed site with minimal environmental impacts if designed appropriately

Figure 5. Potential Development at SBMT
Source: NYS DEC

4.3 Benefits

- Significant area available for offshore wind (25.8 hectares or 63.8 acres).
- Underutilized facility; new site operator has expressed interest in supporting offshore wind and other breakbulk and project cargo opportunities.
- Proximity to other facilities; potential for joint operation.

- On-site rail access.
- 12.2m (40 ft) authorized water depth at channel and 10.7m (35 ft) design water depth at berth, along with high limiting air draft, compared to the other offshore wind sites.
- Proximity to offshore wind farm sites.
- Design platform elevation proposed close to existing average elevation to reduce earthwork and grading effort.

4.4 Challenges

- Potential challenges associated with integration of existing waterfront structures (revetment and bulkhead) in the site development due to unknown level of deterioration.
- Potential regulatory challenges due to the adjacent commercial and residential areas.
- Potential limitations imposed by the Verrazano-Narrows Bridge, air draft of 60.3 m (198 ft).
- Bay Ridge Channel may require maintenance dredging in order to ensure depth in the channel is at authorized limit.
- Unknown subsurface conditions (existing foundations, cables, etc.) may pose risk during piling operations.
- Ground conditions at the 39th Street Pier are not well investigated, which introduces an uncertainty for the geotechnical design of the structures at the pier.

4.5 Optimizations

For a detailed design of the port site, the following may provide room for optimization of the geotechnical structures:

- Currently only boreholes with SPT measurements are available. Hence, the soil parameters have been determined conservatively based on literature recommendations for correlating SPT measurements and soil classification to soil parameters. The soil parameters for design have been determined conservatively, considering the uncertainty in the SPT correlations. It is recommended that further site investigations are performed for a more accurate determination of soil parameters.
- The Pre-FEED design has been performed based on three representative soil profiles. A detailed design considering the local stratigraphy and soil parameters may open for a more optimized design.
- For the bulkhead structures with relieving platforms, two-dimensional finite element modelling may provide room for optimization of the structures as such a model can shed better light on the interaction between sheet pile wall and pile supported relieving platform.

5 Opinion of Probable Cost

An opinion of probable cost (OPC) was prepared for the key infrastructure improvements identified in Section 3. As noted in Section 1.2, the Pre-FEED is intended to facilitate multiple potential offshore wind related uses. Therefore, depending on the ultimate use of the facility, some infrastructure improvement activities included within the Pre-FEED may be overdesigned, while other aspects may be under designed. Accordingly, the ultimate cost to complete offshore wind related infrastructure improvements may vary significantly, based upon the ultimate use of the facility and the improvements needed to facilitate that use.

The OPC for the SBMT Pre-FEED was developed using similar methods as marine contractors. COWI develops OPC's using much the same methodology that contractors do. Most of the work items were estimated by preparing a detailed estimate of the materials, labor, and equipment anticipated to be used in execution of the work, with the exception of a few work items in which unit pricing was used. Direct wage rates and fringe benefit rates for all labor are consistent with current Prevailing Wage rates for New York City as published by the Office of the New York City Comptroller. COWI leveraged unit costs professional experience with waterfront construction in and around New York State as well as published cost data resources.

The OPC was prepared in accordance with AACE International 18R-97 guidelines for a Class 3 Estimate. Class 3 estimates are used for budget authorization, where the current project definition is between 10% and 40% of full project definition with actual costs typically falling within 30% above to as little as 20% below the estimate.

The OPC Summary is found in Table 1. The unit cost data presented in the summary are developed based upon a detailed breakdown on construction activities, which can be found in Appendix C.

Published bare unit cost data (materials, labor and equipment) were obtained in 2018-dollar values from published cost data references, marked up for general conditions (8%), overhead (10%), and profit (10%). Unit costs based on observed cost data of waterfront construction projects in the Northeast U.S. within the past 10 years were escalated to 2018 dollars; general conditions, overhead, and profit are included within observed costs and no additional markups were applied. A uniform contingency is applied to the project subtotal.

The authors of this report have no control over the cost of labor, materials, equipment or services furnished by others, or over competitive bidding or market conditions. The OPC provided are made based on best judgment as experienced and qualified professional engineers, familiar with the construction industry. The authors cannot and do not guarantee that actual project or construction costs will not vary from this OPC.

Table 1. OPC Summary Table

WORK ITEM DESCRIPTION		QTY	UNITS	UNIT PRICE	TOTAL
MOBILIZATION AND DE-MOBILIZATION					
	Mobilization and Demobilization	1	Lump Sum	$1,686,000.00	$1,686,000.00
DEMOLITION, CLEARING, AND GRUBBING					
	Demolition: Warehouses	36,860	Square Meter	$138.82	$5,117,000.00
	Demolition: Rail Spur	550	Linear Meter	$67.27	$37,000.00
	Demolition: Pavement	214,560	Square Meter	$46.39	$9,953,000.00
MARINE STRUCTURES					
	30T/m² Relieving Platform	7,990	Square Meter	$11,370.21	$90,848,000.00
	15T/m² Relieving Platform	11,350	Square Meter	$5,973.66	$67,801,000.00
	Revetment Armor	800	Linear Meter	$20,943.75	$16,755,000.00
EARTHWORK AND GROUND IMPROVEMENT					
	Upland Excavation above MHW	64,310	Cubic Meter	$18.02	$1,159,000.00
	Upland Fill above MHW	61,630	Cubic Meter	$5.86	$361,000.00
SURFACE TREATMENT					
	Gravel 30T/m² Staging Area	32,140	Square Meter	$168.11	$5,403,000.00
	Gravel 15T/m² Storage Area	226,260	Square Meter	$86.06	$19,471,000.00
DREDGING					
	Berth Dredging	91,850	Cubic Meter	$111.19	$10,213,000.00
SUBTOTAL					**$228,804,000.00**
			Design and Construction Contingency	30%	$68,641,200.00
TOTAL					**$297,446,000.00**

5.1 Exclusions

The following line items are excluded from the design and OPC:

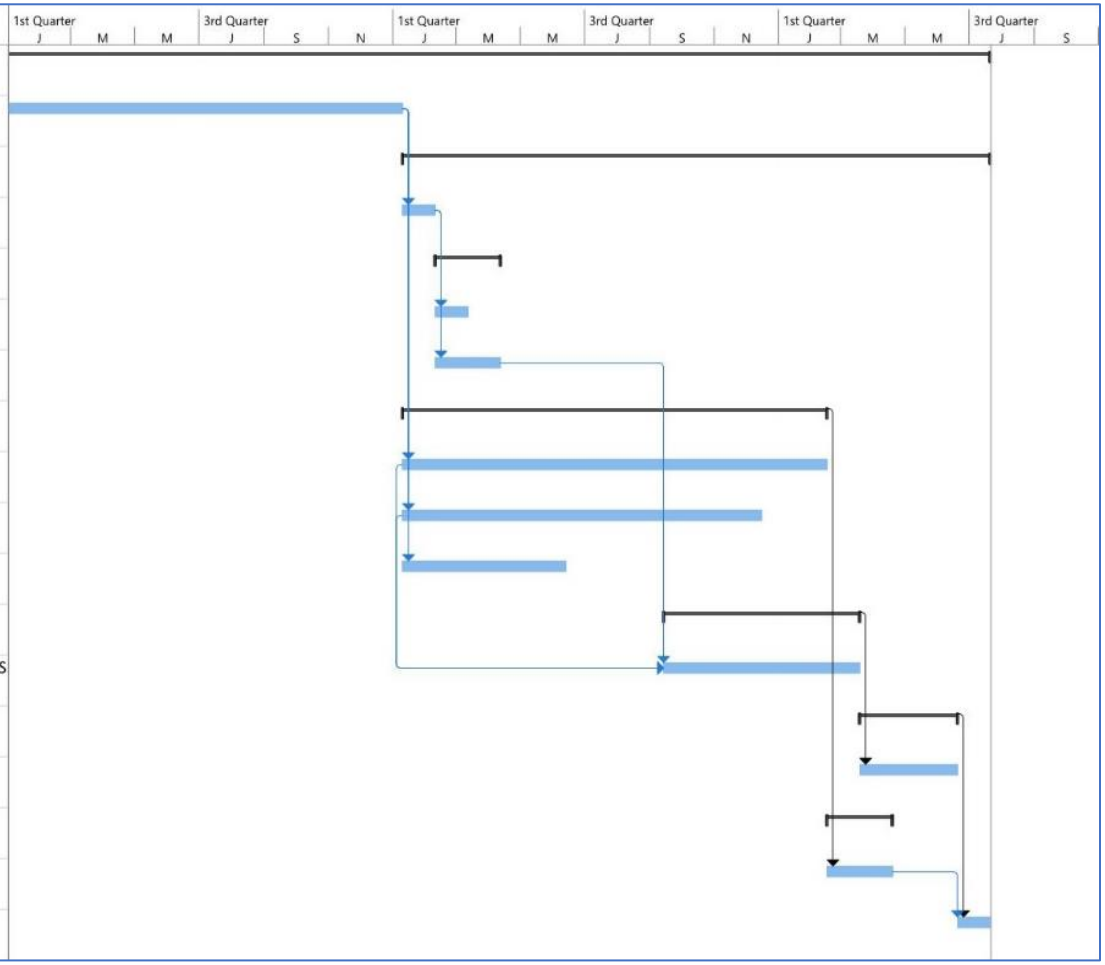
- Utilities
- Public Access
- Operating Infrastructure and Equipment
- Site Acquisition Costs
- Permits and Permit Acquisition Fees
- Professional Services (Design, Regulatory, Legal, etc.)
- Construction Management fees
- Environmental Mitigation/Remediation

6 Schedule

An estimate schedule was prepared for the key improvements developed for the Pre-FEED. As noted in Sections 1.2 and 5, the Pre-FEED is intended to facilitate multiple potential offshore wind related uses. Accordingly, the schedule to complete offshore wind related infrastructure improvements may vary significantly, based on the ultimate use of the facility and the improvements needed to facilitate that use. The schedule presented in Figure 5 assumes a traditional design-bid-build project delivery. Alternative delivery methods, (e.g., design-build) may reduce the time required to develop the site.

Figure 6. Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	**PROJECT TOTAL**	**36 mons**	**Sun 7/1/18**	**Wed 7/21/21**	
2	**Planning, Engineering and Permittin**	18 mons	**Sun 7/1/18**	**Fri 1/10/20**	
3	**Construction Phase**	**18 mons**	**Fri 1/10/20**	**Wed 7/21/21**	
4	**Mobilization**	1 mon	**Fri 1/10/20**	**Mon 2/10/20**	**2**
5	**Demolition, Clearing**	**2 mons**	**Mon 2/10/2(**	**Sun 4/12/20**	
6	Demo Warehouses	1 mon	Mon 2/10/2(	Thu 3/12/20	4
7	Demo Pavement & Rail Spur	2 mons	Mon 2/10/2(	Sun 4/12/20	4
8	**Marine Structures**	**13 mons**	**Fri 1/10/20**	**Tue 2/16/21**	
9	30 MT/SM Relieving Platform	13 mons	Fri 1/10/20	Tue 2/16/21	2
10	15 MT/SM Relieving Platform	11 mons	Fri 1/10/20	Wed 12/16/20	2
11	Revetment	5 mons	Fri 1/10/20	Sat 6/13/20	2
12	**Earthwork & Ground Improveme**	**6 mons**	**Mon 9/14/2(**	**Fri 3/19/21**	
13	Grading	6 mons	Mon 9/14/2(	Fri 3/19/21	9SS+8 mons,10S
14	**Surface Treatment**	**3 mons**	**Fri 3/19/21**	**Sun 6/20/21**	
15	Gravel 30- & 15 MT/SM Staging	3 mons	Fri 3/19/21	Sun 6/20/21	12
16	**Dredging**	**2 mons**	**Tue 2/16/21**	**Mon 4/19/21**	
17	Berth Dredging	2 mons	Tue 2/16/21	Mon 4/19/21	8
18	**Demobilization**	1 mon	Sun 6/20/21	Wed 7/21/21	14,17



7 References

[1] COWI, "Assessment of Ports and Infrastructure," COWI, New York, 2017.

[2] NYSERDA, "New York State Offshore Wind Master Plan," NYSERDA, New York, 2017.

[3] USACE, "Controlling Depth Reports and Surveys," 2018. [Online]. Available: https://www.nan.usace.army.mil/Missions/Navigation/Controlling-Depth-Reports/. [Accessed October 2018].

[4] NOAA, "Datums for 8518750, The Battery NY," 15 10 2013. [Online]. Available: https://tidesandcurrents.noaa.gov/datums.html?id=8518750.

[5] FEMA, "FLOOD INSURANCE STUDY, CITY OF NEW YORK," FEMA, New York, 2013.

[6] NYSERDA, "Climate Change in New York State (ClimAID)," NYSERDA, New York, 2014.

[7] USGS, "Topobathymetric Elevation Model of New England," 22 November 2017. [Online]. Available: https://topotools.cr.usgs.gov/coned/new_england.php.

[8] NOAA, "NOAA RNC Viewer," 2018. [Online]. Available: https://nauticalcharts.noaa.gov/rnconline/rnconline.html.

[9] Gordian, "RSMeans Data," Rockland , 2018.

Appendix A. Pre-FEED Design Basis

Appendix A: Table of Contents

List of Figures

List of Tables

1 Project Description

1.1 Key Infrastructure Improvements

In order prepare the site for use as a staging and installation facility, the following key infrastructure improvements are proposed within the Pre-FEED:

- Demolish existing concrete pavement and structures on site, including the J1, J2, and N2 sheds as well as the Graffiti, Tower and utility buildings as shown in Figure 1, to provide access for ground bearing capacity improvements and maximize available lay down area. The remainder of the recently installed rail line is proposed to remain operational in order to service the Sims facility on Pier 29 and potentially provide an alternative mode to receive OSW components.
- Reconstruct or rehabilitate marine structures along the waterfront edges of the site, to provide at least two heavy load wharves to load and unload components. The top elevation of marine structures will match the design platform elevation (Section 4.10). The bottom elevation of structures will be based upon the design dredge elevation in berthing areas and the existing elevation in non-berthing areas. At SBMT, proposed marine structures include the following:
    - Reconstruct or rehabilitate steel sheet pile bulkhead and cells near the primary OSW berthing areas. A relieving platform founded on steel pipe piles is to be reconstructed to increase the live load capacity at the quay. The vertical face of the sheet piling will provide vessel access to the pier and to provide structural capacity to the retained upland material for the design surcharge load. Steel pipe piles will carry most of the vertical load to more competent soil layers below, while also partially relieving lateral loads on the bulkhead. The reconstructed bulkhead will be installed seaward of the existing bulkhead along the perimeter of Pier 39, the face of Pier 35, and a section of the staging area between Piers 39 and 35 and Piers 35 and 29. Surcharge load applied to the bulkhead varies based on location of the site. Proposed structures and load capacities at SBMT can be seen in Figure 4.
    - Rehabilitate and improve the load capacity of the existing stone revetment. Overlaying the existing revetment will rehabilitate any local failure areas and increase the stability of the shoreline close to the edge of the pier and staging areas. Revetment to be rehabilitated/regraded exists along the north and south faces of pier 35, and a section of the staging area between Piers 39 and 35, as shown in Figure 4. It should be noted that the existing condition of revetment was not available at the time of this analysis; therefore, an armorstone overlay was assumed and may not be necessary under further investigation. To allow for an increased live load to be placed near the crest of the revetment a stone bench of granular material and armourstone overlay is to be installed.
- Improve the ground bearing capacity and regrade areas within the terminal (26.3 hectare or 65 acres). Ground bearing capacity improvements provide a compact base for the proposed surface treatment to meet the required load capacities associated with different areas on site (see Section 2.4). Grading provides a level working surface to then install the surface treatment

across the site. The method to complete ground improvements will be determined during the Pre-FEED.

- Install surface treatment within laydown areas of the terminal. Crushed stone will be used as surface treatment to accommodate the weight of components and to reduce maintenance costs. Surface treatment design may vary depending on the live load requirement.
- Dredge proposed berthing areas to provide sufficient depth for design vessels to safely access the terminal. Vessels are anticipated to berth at two locations, the northwest and southwest faces of Pier 39 adjacent to the Bay Ridge Channel Federal Navigation Channel. The design depth for dredging is discussed in Section 4.11. Dredge footprint extents for the SBMT site are based upon those that are existing and permitted, as shown in Figure 3. The depth associated with the permitted dredging footprints at SBMT, including 0.6 m (2 ft.) of over depth, is -11.5 m (-37.8 ft.) NAVD88. It should be noted that not all the existing dredge footprint on the southwest face of Pier 39 will be used.

The authorized depth of the Bay Ridge Federal Channel (-13.0 m or -42.8 ft. NAVD88) is the responsibility of the U.S. Army Corps of Engineers (USACE) and is not considered by this Pre-FEED. In 2014 the USACE dredged a section of the Bay Ridge Channel adjacent to SBMT Pier 39 in 2014 to a depth of -11.8 m (-38.8 ft., including 0.6m or 2 ft. of over depth) NAVD88 to provide access to SBMT Pier 39. The 2014 dredging did not extend east to Pier 35. The minimum depth of the Bay Ridge Channel Reach B is approximately -7.6 m (-25 ft.) NAVD88 per the USACE, March 2018, Controlling Depth Report. The minimum depth near SBMT at Pier 39 is -9.8 m (-32 ft) NAVD88 and at Pier 35 is -8.2 m (-27 ft) NAVD88 per the USACE January 2018 survey.

Figure 1. Proposed Demolition Plan

All pavement will also be demolished although it is not shown for image clarity.

Source: USGS

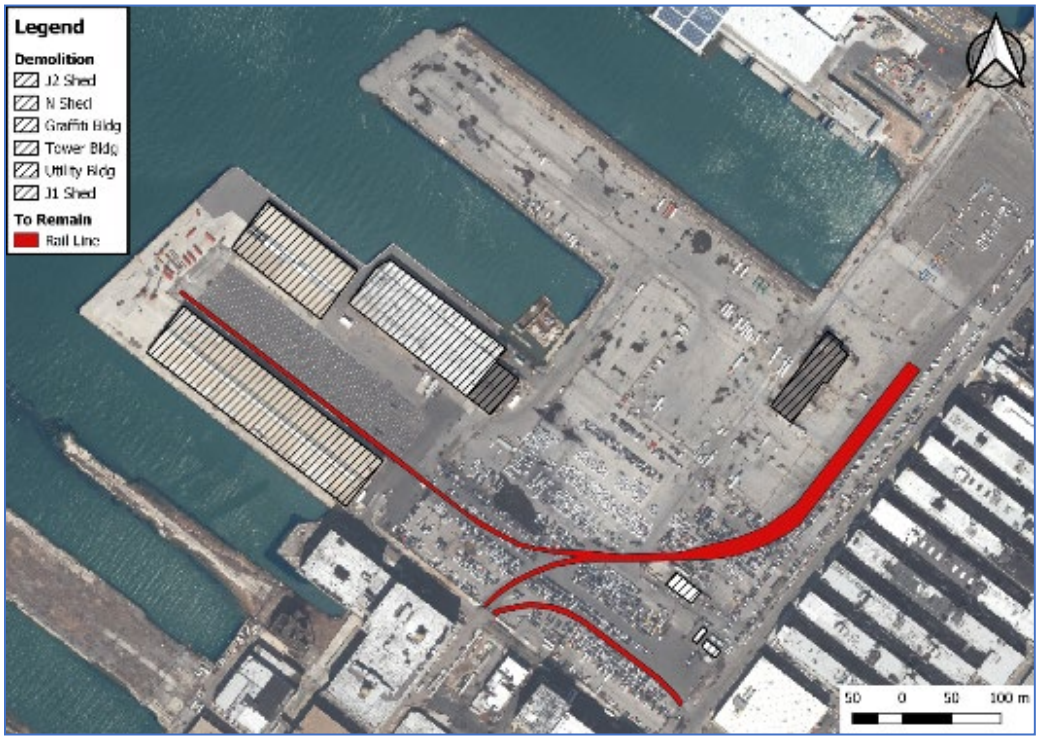
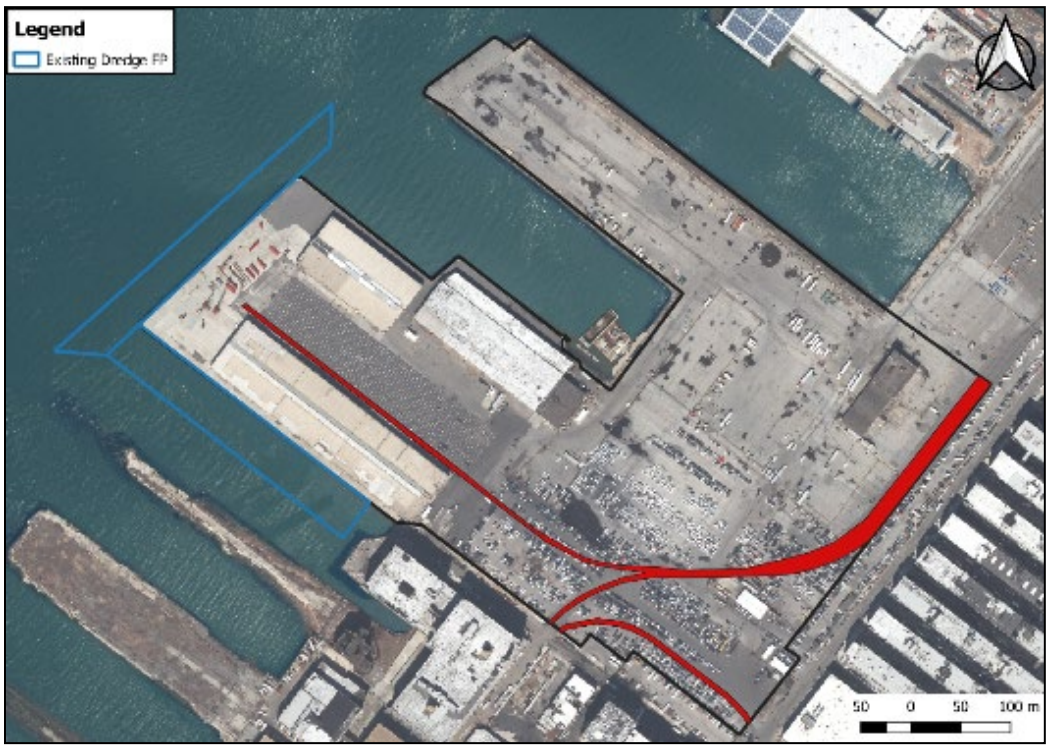


Figure 2. Pier 39's Existing Dredge Footprints

Source: USGS

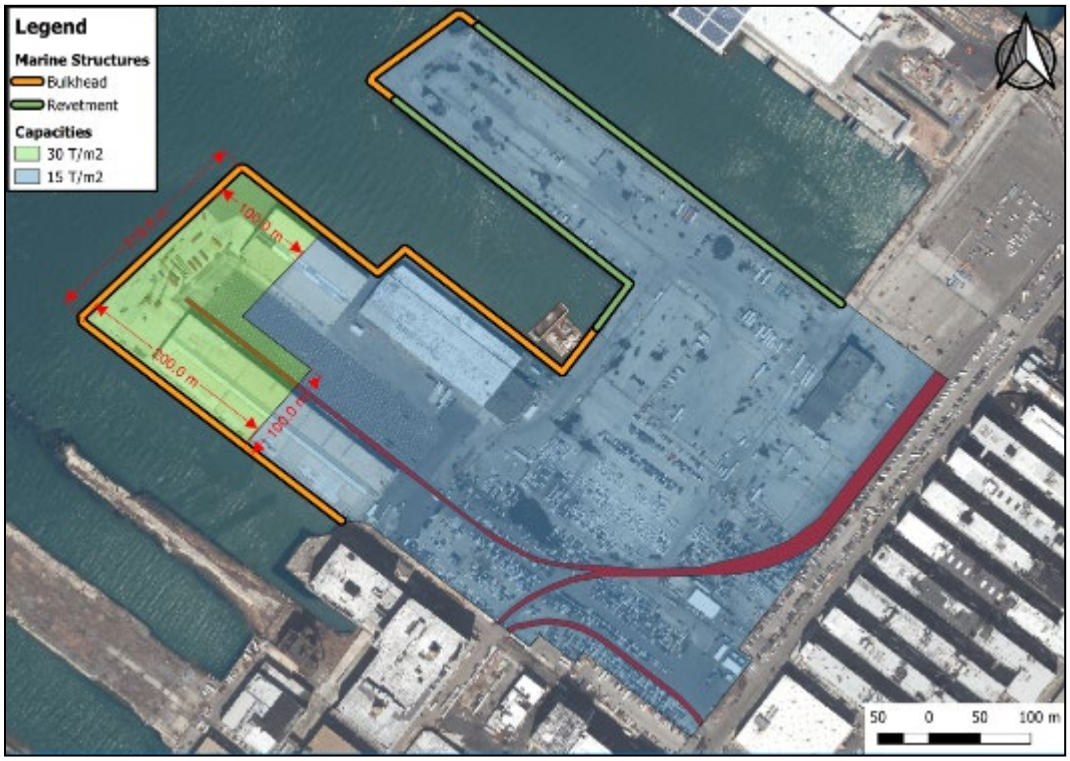


1.1 Definition of Load Areas

The heavy load wharf area will be placed along the northwest and southwest faces of Pier 39 and will have 30 MT/m² (6,000 PSF) capacity to support the on-loading/offloading and pre-assembly of components, as well as the required equipment. The rest of the site will have a 15 MT/m² (3,000 PSF) capacity to support staging activities and required equipment. Figure 3 provides an overview of the proposed load areas.

Figure 3. Proposed Structures and Load Areas

Source: USGS



2 Project Definition

2.1 Service Life

The design service life of facilities proposed in this project is 50 years, from 2020 to 2070.

2.2 Codes and Design Guidelines

The codes and guidelines used for the design of the proposed key improvements at the site are as follows:

- Dredging
    - United States Army Corps of Engineers Engineering Manual 1110-2-1611, "Layout and Design of Shallow-Draft Waterways," dated December 31, 1980
    - United States Army Corps of Engineers Engineering Manual 1110-2-1613, "Hydraulic Design of Deep Draft Navigation Projects," dated May 31, 2006
- Marine Structures
    - Unified Facilities Criteria (UFC), "Geotechnical Engineering," UFC 3-220-01, dated November 1, 2012
    - Unified Facilities Criteria (UFC), "Design: Piers and Wharves," UFC 4-152-01, dated January 24, 2017
    - American Society of Civil Engineers, "Minimum Design Loads and Associated Criteria for Buildings and Other Structures," ASCE/SEI 7-16
    - Specifications for Structural Steel Buildings, ANSI/AISC 360-16
    - American Concrete Institute, "Building Code Requirements for Structural Concrete," ACI 318-14
    - American Society of Civil Engineers, "Seismic Design of Piers and Wharves," ASCE/COPRI 61-14
    - United States Army Corps of Engineers Engineering Manual 1110-2-2504, "Design of Sheet Pile Walls," dated March 31, 1994
    - United States Army Corps of Engineers Engineering Manual 1110-2-2503, "Design of Sheet Pile Cellular Structures, Cofferdams, and Retaining Structures," dated September 29, 1989
- Coastal Revetments
    - United States Army Corps of Engineers Coastal Engineering Manual 1110-2-1100, dates vary
    - The Rock Manual, "The use of rock in hydraulic engineering (2nd edition)," dated to 2007

2.3 Horizontal and Vertical Control

The horizontal datum for this project is the North American Datum of 1983 (NAD83). The coordinate reference system (CRS) for this project is the projected coordinate system NAD83/UTM Zone 18N, EPSG 26918, with horizontal units being meters.

The vertical reference datum for this project is the North American Vertical Datum of 1988 (NAVD88). See Table 1 for conversions between NAVD88 and local tidal datums.

2.4 Units

Designs for this project will be completed using SI units, unless otherwise specified. Conversions to U.S. customary units will be provided where appropriate.

3 Site Characterization

3.1 Topographic and Hydrographic Data

Topographic and hydrographic data obtained via publicly-available resources will be used to establish existing site elevations, to prepare infrastructure design, and to estimate dredging and earthwork quantities for the purpose of material and cost estimation. The Topo-Bathymetric Elevation Model of New England, a part of the Coastal National Elevation Database (CoNED) project by the USGS [2], will be used to establish existing SBMT site elevations. The CoNED elevation model excludes buildings and vegetation and, therefore, provides bare earth elevations required to develop facility design and to prepare cost estimates.

3.2 Tidal Datums

Tidal datums for the SBMT site were obtained from the National Oceanic and Atmospheric Administration (NOAA) Station 8518750 the Battery, NY, [3] located approximately 4.5 km (2.8 mi) north of the project site. These tidal datums are used in defining the design platform elevation as well as the design dredge elevation.

Table 1. Tidal Datums, 1983–2001 Tidal Epoch

Tidal Datum	NAVD 88	MLLW
Mean Higher High Water (MHHW)	0.69 m (2.28 ft.)	1.54 m (5.05 ft.)
Mean High Water (MHW)	0.60 m (1.96 ft.)	1.44 m (4.73 ft.)
NAVD '88	0.00 m (0.00 ft.)	0.84 m (2.77 ft.)
Mean Sea Level (MSL)	-0.06 m (-0.20 ft.)	0.78 m (2.57 ft.)
Mean Tide Level (MTL)	-0.09 m (-0.30 ft.)	0.75 m (2.47 ft.)
Mean Low Water (MLW)	-0.78 m (-2.57 ft.)	0.06 m (0.20 ft.)
Mean Lower Low Water (MLLW)	-0.84 m (-2.77 ft.)	0.00 m (0.00 ft.)

3.3 Relative Sea-Level Rise

Relative sea-level rise (RSLR) was calculated for each site, as part of the design platform elevation analysis. RSLR calculations used NOAA data to account for RSLR from 1992–2002 and Climate Change in New York State by NYSERDA (ClimAID) [4] data for Region 4 (New York City) to account for RSLR from 2002-2070. The 2002-2070 RLSR value was determined by applying cubic spline interpolation to the ClimAID data. Year 1992 is the baseline for the RSLR calculation because it is the middle of the current tidal epoch (1983–2001). Low (10th percentile), middle (50th percentile), and high (90th percentile) estimates were considered within the design berth elevation analysis (see Table 2). The RSLR value chosen for this project is the ClimAID high estimate.

Table 2. Relative Sea-Level Rise

RSLR	1992–2002a	2002–2070	1992–2070
Low Estimate	0.03 m (0.10 ft)	0.29 m (0.96 ft)	0.32 m (1.06 ft)
Middle Estimate		0.62 m (2.03 ft)	0.65 m (2.12 ft)
High Estimate		1.23 m (4.05 ft)	1.26 m (4.14 ft)

Table notes:

[a] As per mean relative sea-level trend provided by NOAA for Station 8518750, The Battery, NY; b.93 mm/yr. [3]

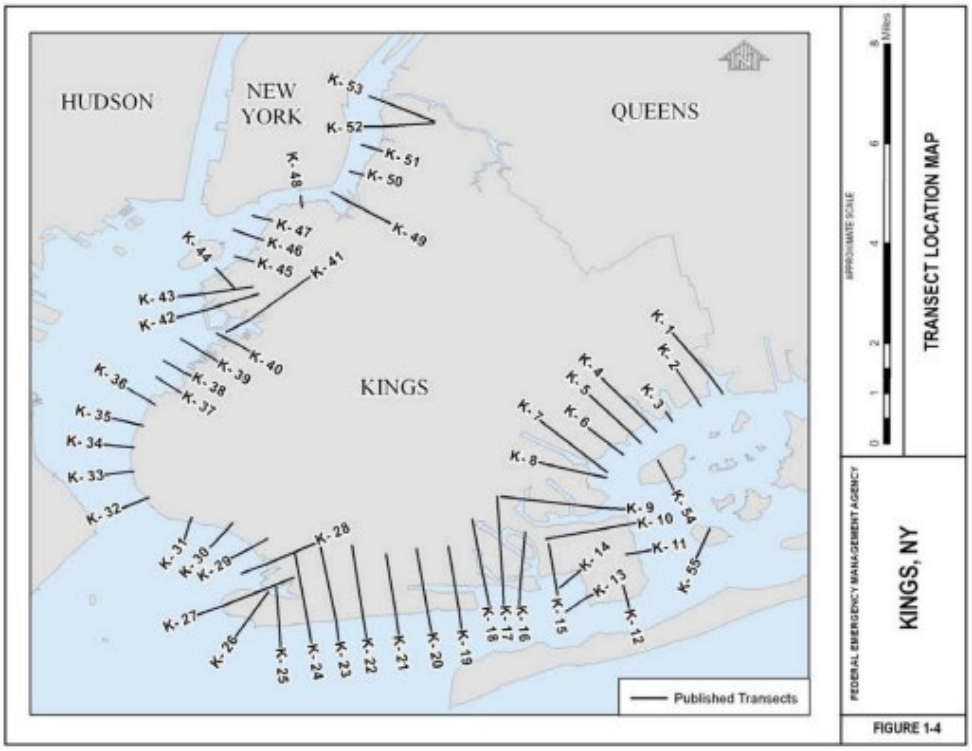
3.4 Waves

Wave activity will inform the design platform elevation as well as the design of revetment. Wave data was obtained from the regionally applicable FEMA Flood Insurance Study (FIS), Transect K-40 [5], see Figure 4:

- Significant wave height $H_s = 0.8\ m\ (2.64\ ft)$
- Peak wave period $T_p = 3.11\ s$

Figure 4. Preliminary FEMA Flood Insurance Study (FIS) for the City of New York.

Source: Federal Emergency Management Agency (FEMA)



3.5 Current

Currents do not typically control the design of marine structures included in this Pre-FEED. Revetment design uses significant wave height as the controlling parameter.

The nearest current station is the "The Narrows" NOAA Station n03020, which is located approximately 6.6 km (4.1 mi) south of SBMT. Due to the shape of the New York harbor, these currents are not assumed to be indicative of currents at SBMT.

The nearest current prediction station is the Bay Ridge Channel NOAA prediction station ACT3626, based on readings at a depth of 11 m (36 ft.). Average currents, based on one year of data (2018), that can be used as a point of reference for typical conditions are:

- ebb: -0.37 knots
- flood: 0.64 knots

3.6 Wind

The location and elevation of the structures are such that the wind load on the structures will have no significant impact on the structures' capacities; therefore, wind load on structures will not be considered in this analysis.

The Applied Technology Council [6] provides an online resource that can be used to identify wind speeds for design. As a point of reference, the 100-year mean recurrence interval (MRI) wind speed (3-second gust, at 10m or 33 ft. above ground) at SBMT is 42.9 m/s (96 mph).

3.7 Snow and Ice

Vertical loads due to snow and ice loads do not typically control the design of marine structures in the vicinity of New York Harbor and are not considered in this Pre-FEED.

The Applied Technology Council [6] provides an online resource that can be used to identify ground snow loads for design. As a point of reference, a ground snow load at SBMT is 0.1 MT/m² (20 PSF).

3.8 Seismic activity

Seismic design is not considered in this Pre-FEED. The seismic performance of structures will be confirmed in later phases of design.

The Applied Technology Council [6] provides an online resource that can be used to identify basic seismic parameters and can be used as a point of reference if sought out in later phases.

3.9 River Ice

River ice does not affect the pre-FEED design of infrastructure improvements at the site, though may affect day-to-day operations depending on the ultimate end use.

NOAA provides air freezing index (AFI) values [7] that can be used to predict ice loads. As a point of reference, the 100-year AFI for SBMT is 521-degree F-Days.

3.10 Design Platform Elevation

Several alternative methods of determining the design platform elevation have been reviewed, including estimates of existing platform/terrain elevation, FEMA base flood elevation [8], and the United Facilities Criteria formula [9]. These values were used to inform the final decision, when selecting an optimal platform elevation for the site, and are summarized in Table 3.

Table 3. Design Platform Elevation Alternatives

Method	Elevation (NAVD88)
Existing Land Elevation, Average	2.44 m (8.00 ft.)
UFC Guidance	3.71 m (12.18 ft.)
FEMA Base Flood Elevation (BFE)	3.66 m (12.00 ft.)

In order to reduce the scope of improvements associated with cut/fill volumes, the Pre-FEED will use a platform elevation that considers the site's average elevation and the designed surface treatment thickness (based on geotechnical conditions and design loads).

Note that the design platform elevation will primarily be determined based on minimization of material (fill) cost; the design platform elevations will be compared to UFC and FEMA guidance.

3.11 Design Vessel

The design depth is based upon the design vessel for the site, which is dependent on its intended use, as well as under keel clearance (0.6 m or 2 ft.) and allowable overdepth for dredging (0.6 m or 2 ft.).

As a staging and installation facility, SBMT may have several types of vessels berthing at the site. Table 4 provides the list of potential vessels and their associated characteristics.

Table 4. Design Vessel Characteristics

	Jack-Up Feeder Vessela	Heavy Lift Cargo Vesselb	Transport Bargec	Inshore Feeder Barged
LOA	70.5m (231 ft.)	152.6m (501 ft.)	91.4m (300 ft.)	122m (400 ft.)
Beam	38m (125 ft.)	27.4m (90 ft.)	17.1m (56 ft.)	36.6m (120 ft.)
Operational Draft	7.9m (19 ft.)	8.1m (27 ft.)	3.7m (12 ft.)	8m (27 ft.)

Note(s):

a Based on the jack-up feeder vessel provided in the "U.S. Jones Act Compliant Offshore Wind Turbine Installation Vessel Study" prepared by GustoMSC in October 2017.

b Based on the JUMBO heavy lift cargo vessel HLV Fairmaster, K3000 Class.

c Based on typical intracoastal barges used for inshore waterways in the U.S.

d Based on the inshore feeder barge provided in the "Inshore Feeder Barge Conceptual Feasibility Study" prepared by COWI in 2018.

3.12 Design Depth

The existing design depth at SBMT is -11.5m (-37.8 ft.) NAVD88; this corresponds to -10.1m (-33.0 ft.) design depth with 0.6 m (2 ft.) of over depth allowance for dredging.

Based on a comparison between the design vessel draft requirements and the existing design depth, the existing depth is greater than required for the design vessels. In order to maintain the existing depth and serviceability at the terminal, the existing design depth of -11.5 m (-37.7 ft.) NAVD88 will be used for new structures.

3.13 Geotechnical Conditions

Subsurface characteristics were provided by NYC EDC. Characteristics were obtained from AECOM [10]. The subsurface exploration performed by AECOM consists of the following:

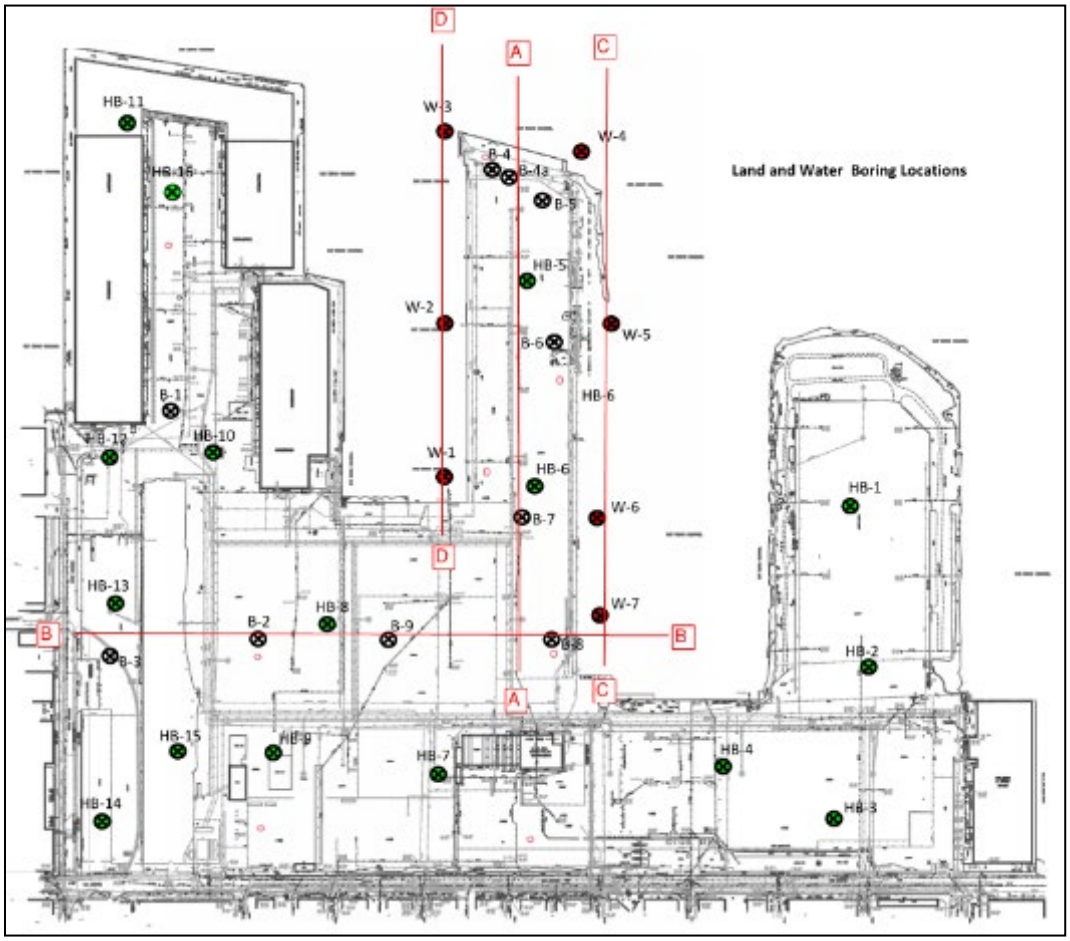
- Five deep borings along 35th Street Pier to a depth of 21.9 m (72 ft) to 31.1 m (102 ft) below ground surface.
- One deep boring along the 39th Street Pier to a depth of 21.9 m (72 ft) below ground surface.
- Four shallow borings in the upland area to a depth of 6.7 m (22 ft) below ground surface.
- Seven deep water borings along the north and south side of the 35th Street Pier to a depth of 25.0 m (82 ft) to 28.0 m (92 ft) below seabed.

Standard Penetration Tests (SPT) have been performed in all boreholes. In the subsurface exploration report [10] borehole logs from a total of 16 historical boreholes are attached. These historical boreholes were performed in 2002 and to a depth of 3.0 m (10 ft) to 12.2 m (40 ft) below ground surface. SPTs have been performed in all historical boreholes.

The location of the boreholes is shown on Figure 6, after Reference [10]. It is evident that four of the historical boreholes (HB-1, HB-2, HB-3 and HB-4) fall outside the project area.

Figure 5. Overview of Borehole Locations

Historical boreholes are marked with green color and denoted HB-xx, water boreholes are marked with red color and denoted W-xx and new boreholes on land are marked without color fill and denoted B-xx. [10]



To simplify the ground conditions for the current phase of the project (pre-FEED design), the boreholes have been grouped based on location and based on the SPT measurements. Three area groups have been defined:

- In the bay (W-1, W-2, W-3, W-4, W-5, W-6, W-7)
- 35th Street Pier and 39th Street Pier (B-1, B-4, B-4a, B-5, B-6, B-7, HB-5, HB-6, HB-10, HB-11, HB-12, BH-16)
- Upland area (B-2, B-3, B-8, B-9, HB-7, HB-8, HB-9, HB-13, HB-14, HB-15)

For each of the area groups, a representative borehole log has been selected. Borehole W-5 has been selected as representative borehole for the bay, borehole B-4 has been selected for 35th Street Pier and 39th Street Pier and borehole HB-9 are considered representative for the upland area. In Figures 6, 7, and 8, the measured SPT N-values are presented for each of the representative boreholes and compared against the remaining boreholes within each group. Based on comparison of the SPT N-values from the representative boreholes with the remaining boreholes in the three areas, it is considered the selected representative boreholes provide a reasonably conservative representation for the three areas.

From Figures 6 and 7, SPT-N values of zero are observed for a few layers at elevations between 12 m (-40 ft) and 23 m (-75 ft). These zero values are found primarily in layers classified as silt. The low SPT N values are expected to be caused by uncertainties in the SPT method for these materials (drilling disturbances). The strength properties may indeed be low for these layers, but the measured zero values at these elevations are not considered to be representative for the properties of the soil material.

Figure 6. SPT N-Values from Boreholes Performed in the Bay

Borehole W-5 is selected as representative borehole.

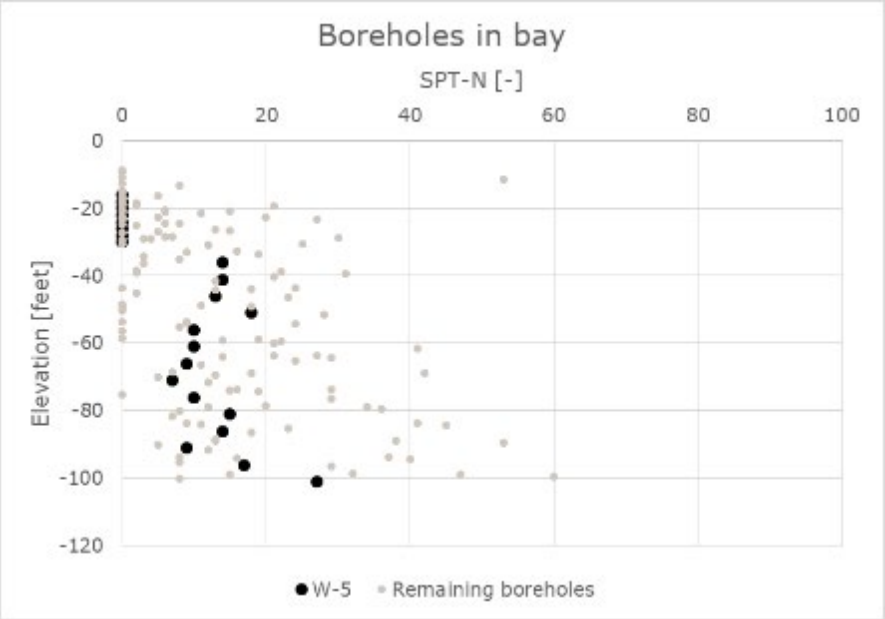


Figure 7 shows a graph of the SPT N-values from new boreholes performed on land at the 35th Street and 39th Street Piers, using borehole B-4 as the representative borehole. Borehole SPT N-values vary from 0-100 down to a depth of approximately -30.5 m (-100 ft.) below ground level.

Figure 7. SPT N-Values from Boreholes Performed at 35th Street Pier and 39th Street Pier
Borehole B-4 is selected as representative borehole.

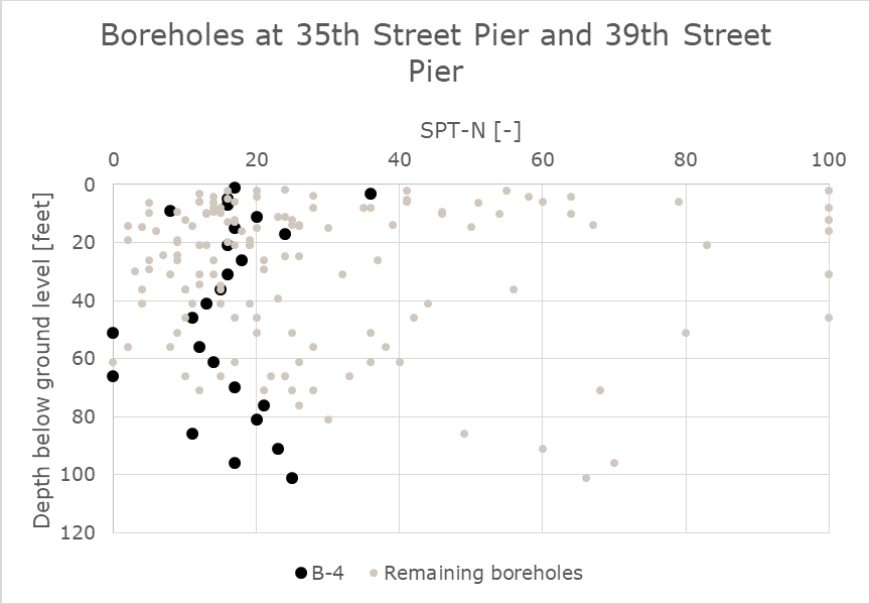
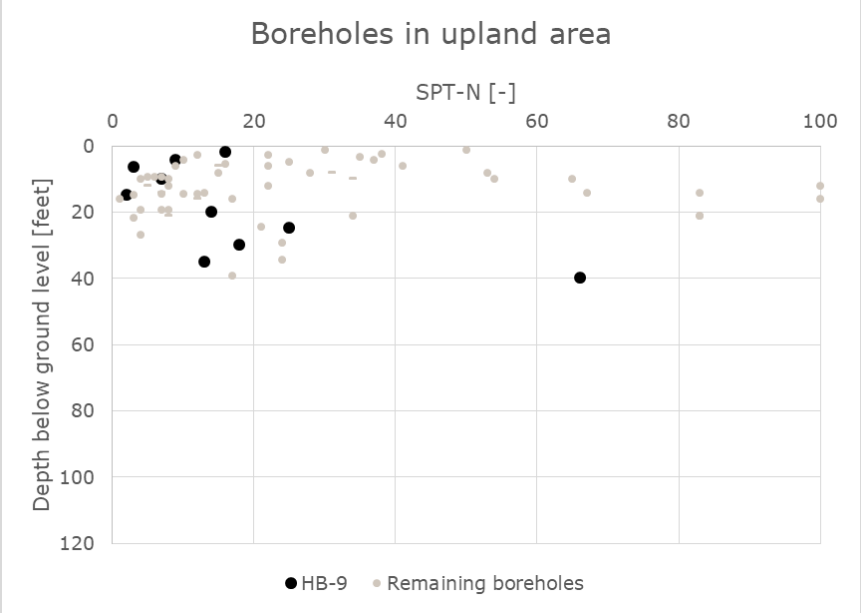


Figure 8. SPT N-Values from Boreholes Performed in the Upland Area
Borehole HB-9 is selected as representative borehole.



Soil profiles for design with characteristic soil properties are presented in Table 5, Table 6, and Table 7 for the bay area, for 35th Street Pier and 39th Street Pier, and the upland area, respectively. The pre-FEED design will be performed applying these soil profiles and soil parameters. The characteristic soil parameters are derived based on the SPT measurements and the correlations in Kulhawy and Mayne (1990), [11], relating SPT-N value to undrained shear strength and peak internal angle of friction.

Water levels in the historical boreholes seem to indicate that the ground water level is in general equilibrium with the mean sea level. Fluctuations due to seasonal reasons (e.g., high amount of rainfall) and tidal variations can be expected but the Pre-FEED design can be conducted with above-mentioned consideration.

For the boreholes at 35th and 39th street piers and for the boreholes in the upland areas localized zones of sand fill with low SPT-N values have been found. These layers are found in boreholes spread across the site and the layers are primarily found at depths between 2.5 m (8 ft) and 5 m (17 ft). The SPT-N values are for some of these layers are so low that liquefaction is probable for a 500-year earthquake, based on the criteria set up by the NYC building code (Appendix F of Reference [10]).

Table 5. Representative Soil Profile for the Bay Area with Characteristic Soil Parameters
Based on soil profile W-5.

Depth below ground, top of layer	**Depth below ground, bottom of layer**	**Layer description**	**SPT-N, representative value**	**Bulk/ effective unit weight, γ/γ'**	**Undrained shear strength, su**	**Peak internal angle of friction, ϕ'**	**Effective cohesion, c'**
m (ft)	m (ft)		-	kN/m³ (pcf)	kPa (psf)	°	kPa (psf)
0 (0)	3 (10)	Black sand/silt, clayey, mud	0	15/5 (95/30)	5 (100)	25	0 (0)
3 (10)	5 (16)	Grey/black/brown sand/silt, clayey	0	15/5 (95/30)	-	27	0 (0)
5 (16)	12 (39)	Grey/brown sand, clayey, silty	14	19/9 (120/55)	-	34	0 (0)
12 (39)	19 (62)	Grey/brown silt, clayey, sandy	9	18/8 (115/50)	50 (1040)	30	5 (100)
19 (62)	26 (85)	Grey sand, silty	12	19/9 (120/55)	-	32	0 (0)

Table 6. Representative Soil Profile for 35th and 39th Street Piers with Characteristic Soil Parameters
Based on soil profile B-4

Depth below ground, top of layer	Depth below ground, bottom of layer	Layer description	SPT-N, representative value	Bulk/ effective unit weight, γ/γ'	Undrained shear strength, s_u	Peak internal angle of friction, φ'	Effective cohesion, c'
m (ft)	m (ft)		-	kN/m³ (pcf)	kPa (psf)	°	kPa (psf)
0 (0)	15 (49)	Brown sand, gravelly, silty	15	19/9 (120/55)	-	35	0 (0)
15 (49)	18 (59)	Black organic clay, sandy, silty	3	15/5 (95/30)	20 (420)	28	0 (0)
18 (59)	19.5 (64)	Grey sand, clayey, silty	12	19/9 (120/55)	-	32	0 (0)
19.5 (64)	22.5 (74)	Grey/black organic clay, silty	5	18/8 (115/50)	30 (630)	28	0 (0)
22.5 (74)	25.5 (84)	Grey/brown sand, clayey, silty, gravelly	20	19/9 (120/55)	-	34	0 (0)
25.5 (84)	30 (98)	Brown clay, silty, sandy	15	18/8 (115/50)	50 (1040)	30	5 (100)
30 (98)	31 (102)	Sand, clayey, silty	20	19/9 (120/55)	-	34	0 (0)

Table 7. Representative Soil Profile for Upland Area with Characteristic Soil Parameters

Based on soil profile HB-9.

Depth below ground, top of layer	**Depth below ground, bottom of layer**	**Layer description**	**SPT-N, representative value**	**Bulk/ effective unit weight, γ/γ'**	**Undrained shear strength, s_u**	**Peak internal angle of friction, φ'**	**Effective cohesion, c'**
m (ft)	m (ft)		[-]	kN/m³ (pcf)	kPa (psf)	[°]	kPa (psf)
0 (0)	4 (13)	Fill, brown sand	8	18/8 (115/50)	-	30	0 (0)
4 (13)	5 (16)	Fill, grey silt	2	15/5 (95/30)	15 (310)	28	0 (0)
5 (16)	11.5 (38)	Fill, brown sand	15	19/9 (120/55)	-	32	0 (0)
11.5 (38)	12 (39)	Red/brown sand	50	20/10 (125/65)	-	40	0 (0)

4 Loads

Based on solicited participation from industry and other stakeholders, including manufacturers, developers, government agencies, etc., the design loads were determined to be 30 MT/m² (6,000 PSF) for onloading and offloading areas, and 15 MT/m² (3,000 PSF) for storage and handling areas.

The higher live load areas at the dock are intended to handle the loads associated with crawler cranes. Whereas the lesser live loads are intended to handle the loads associated with Self Propelled Modular Transporters (SPMTs) and other equipment.

5 Materials

5.1 Concrete

All new structural concrete will conform to the following:

- Concrete will be normal weight with a minimum compressive strength of 5,000 psi at 28 days.
- Concrete reinforcement will conform to ASTM A 615, Grade 60 and epoxy coated in accordance with ASTM A 775.
- Concrete cover will be a 3-inch minimum.
- Maximum water to cementitious materials (w/cm) ratio allowed is 0.4.

5.2 Steel

All new structural steel work will conform to the following:

- Steel pipe pile and steel sheet pile material will be fabricated in accordance with API 5L with material either API5LX52, ASTM A572 Grade 50 or approved alternative with a minimum yield strength of 50 ksi or greater.
- Structural pipe will conform to ASTM A500 Grade B.
- All welding will conform to the Structural Welding Code for Steel as adopted by the American Welding Society (AWS).

5.3 Stone

Acceptable rock material will be any of the following: granite, quartzile, basalt, diabase, gabbro, dolomite, or rhyolite. Stone will weigh more than 165 pounds per cubic foot, have a specific gravity, saturated surface dry (SSD), greater than 2.60.

5.4 Fill

Where possible, fill material will be re-used cut material on site, and/or dredge material.

5.5 Corrosion Protection

Corrosion protection will be considered in the design of waterfront facilities. Corrosion protection will involve a combination of protective coating and sacrificial steel.

6 Exclusions

The following items are not included in the Pre-FEED:

- Design of mooring/berthing structures (e.g., fender system, bollards, etc.). Representative cost of these items will be included in the Opinion of Probable Cost (OPC).
- Utilities
- Ancillary structures (e.g., office buildings, etc.)
- Operational Infrastructure and Equipment
- Intermodal Connections
- Property Ownership
- Professional services
- Permitting

7 References

[1] COWI, "Assessment of Ports and Infrastructure," NYSERDA, New York, 2017.

[2] USGS, "Topobathymetric Elevation Model of New England," 22 November 2017. [Online]. Available: https://topotools.cr.usgs.gov/coned/new_england.php.

[3] NOAA, "Datums for 8518750, The Battery NY," 15 10 2013. [Online]. Available: https://tidesandcurrents.noaa.gov/datums.html?id=8518750.

[4] NYSERDA, "Climate Change in New York State (ClimAID)," NYSERDA, New York, 2014.

[5] FEMA, "FLOOD INSURANCE STUDY, CITY OF NEW YORK," FEMA, New York, 2013.

[6] A. T. C. (ATC), "ATC Hazards by Location," 2018. [Online]. Available: https://hazards.atcouncil.org/. [Accessed October 2018].

[7] N. O. a. A. A. (NOAA), "Air Freezing Index-USA Method (Base 32 deg Fahrenheit)," 2018. [Online]. Available: https://www.ncdc.noaa.gov/climate-information/statistical-weather-and-climate-information/frost-protected-shallow-foundations. [Accessed October 2018].

[8] FEMA, "Region II Coastal Analysis and Mapping," FEMA, 2018. [Online]. Available: http://www.region2coastal.com/view-flood-maps-data/what-is-my-bfe-address-lookup-tool/. [Accessed October 2018].

[9] U. D. o. Defense, "United Facilities Criteria, Design: Piers and Wharves (UFC 4-152-01)," US Department of Defense, 2017.

[10] AECOM, "Subsurface Exploration Report-South Brooklyn Marine Terminal269 37th Street, Brooklyn New York"," NYC EDC, NYC, 2018.

[11] K. a. Mayne, "Manual on Estimating Soil Properties for Foundation Design," Cornell University, 1990.

[12] COWI, "SITE SELECTION REPORT - SOUTH BROOKLYN MARINE TERMINAL," COWI, New York, 2018.

Appendix B. Pre-FEED Drawings

NYSERDA 2018 PORTS ASSESSMENT

SBMT PRE-FRONT END ENGINEERING DESIGN

LOCATION PLAN SCALE: N.T.S.

DRAWING INDEX		
DWG NO.	DRAWING TITLE	REV.
A093893-G-01	COVER SHEET AND DRAWING INDEX	A
A093893-D-01	EXISTING SITE AND DEMOLITION PLAN	A
A093893-S-01	PROPOSED SITE PLAN	A
A093893-S-02	PIER 39, EXISTING AND PROPOSED BULKHEAD AND DREDGE SECTIONS (15 t/m²)	A
A093893-S-03	PIER 39, EXISTING AND PROPOSED BULKHEAD AND DREDGE SECTIONS (30 t/m²)	A
A093893-S-04	PIER 35, EXISTING AND PROPOSED REVETMENT SECTION	A

REV	DATE	DESCRIPTION	BY	CHK
A	11-19-2018	SBMT PRE-FEED DRAWING SET	PNCN	NLKP

OWNER

CLIENT

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

CONSULTANT

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PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

SBMT PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

COVER SHEET AND DRAWING INDEX

ENGINEER'S STAMP

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SCALE	DESIGNED	APPROVED
N/A	NLKP	BRCO
DRAWN	CHECKED	DATE
PNCN	NLKP	11-19-2018

JOB NO.	DRAWING NO.	REV.
A093893	G-01	A

PLOTTED BY: PENNY CONRAD PLOT DATE:11/9/2018 4:17:46 PM

FILE LOCATION: O:\A090000\A093893\CAD\SBMT\A093893-SBMT-G01.DWG

LEGEND:

- MHHW OR MLLW
- MAJOR CONTOUR LINES
- MINOR CONTOUR LINES
- SBMT FACILITY
- REVETMENT
- BUILDING DEMOLITION
- PAVEMENT DEMOLITION
- RAIL SPUR DEMOLITION
- HIDDEN BATHYMETRY (SEE NOTE 2)

GENERAL NOTES:

1. ELEVATION DATA IS BASED ON COASTAL NATIONAL ELEVATION DATABASE (CONED) PROJECT; HORIZONTAL DATUM IS UTM ZONE 18N COORDINATE SYSTEM NAD 83; THE VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. DATA IN THIS AREA KNOWN TO BE DIFFERENT THAN CONED PROJECT BASED UPON REPORTS BY FACILITY OWNER. SITE SURVEY RECOMMENDED.

EXISTING SITE AND DEMOLITION PLAN

1:2000

WATER LEVELS	EL. NAVD88, FT*
FEMA VE-ZONE	4.27 m (14.00 FT.)
MEAN HIGHER HIGH WATER (MHHW)	0.69 m (2.28 FT.)
MEAN HIGH WATER (MHW)	0.60 m (1.96 FT.)
MEAN SEA LEVEL (MSL)	-0.06 m (-0.20 FT.)
MEAN LOW WATER (MLW)	-0.78 m (-2.57 FT.)
MEAN LOWER LOW WATER (MLLW)	-0.84 m (-2.77 FT.)

ENGINEER'S STAMP

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GRAPHIC SCALES
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0 1:2000 100

REV	DATE	DESCRIPTION	BY	CHK
A	11-19-2018	SBMT PRE-FEED DRAWING SET	PNCN	NLKP

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NYSERDA 2018 PORTS ASSESSMENT

SBMT PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE
EXISTING SITE AND DEMOLITION PLAN

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PNCN	NLKP	11-19-2018
JOB NO.	DRAWING NO.	REV.
A093893	D-01	A

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LEGEND:

- MHHW OR MLLW
- SBMT FACILITY
- REVETMENT
- 15 T/m2 RELIEVING PLATFORM
- 30 T/m2 RELIEVING PLATFORM
- 15 T/m2 CAPACITY
- 30 T/m2 CAPACITY

GENERAL NOTES:

1. ELEVATION DATA IS BASED ON COASTAL NATIONAL ELEVATION DATABASE (CONED) PROJECT; HORIZONTAL DATUM IS UTM ZONE 18N COORDINATE SYSTEM NAD 83; THE VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. DATA IN THIS AREA KNOWN TO BE DIFFERENT THAN CONED PROJECT BASED UPON REPORTS BY FACILITY OWNER. SITE SURVEY RECOMMENDED.
3. PROPOSED SURFACE TREATMENT IS CRUSHED STONE; DEPTH OF STONE IS ~~DEPENDENT~~ UPON DESIGN LOAD CAPACITY. ~~SEE SECTION~~ DRAWINGS S-02 AND S-03 FOR DETAIL.
4. PROPOSED RELIEVING PLATFORM ALONG PIER 39 PERIMETER, BETWEEN PIER 39 AND PIER 35 AND ALONG THE NORTHWEST FACE OF PIER 35. SEE DRAWINGS S-02 AND S-03 FOR DETAIL.

GRAPHIC SCALES

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0 1:2000 100

REV	DATE	DESCRIPTION	BY	CHK
A	11-19-2018	SBMT PRE-FEED DRAWING SET	PNCN	NLKP

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PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

SBMT PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

PROPOSED SITE PLAN

SCALE	DESIGNED	APPROVED
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DRAWN	CHECKED	DATE
PNCN	NLKP	11-19-2018

JOB NO.	DRAWING NO.	REV.
A093893	S-01	A

ENGINEER'S STAMP

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PROPOSED SITE PLAN

1:2000

PLOTTED BY: PENNY CONRAD PLOT DATE:11/20/2018 11:35:39 AM

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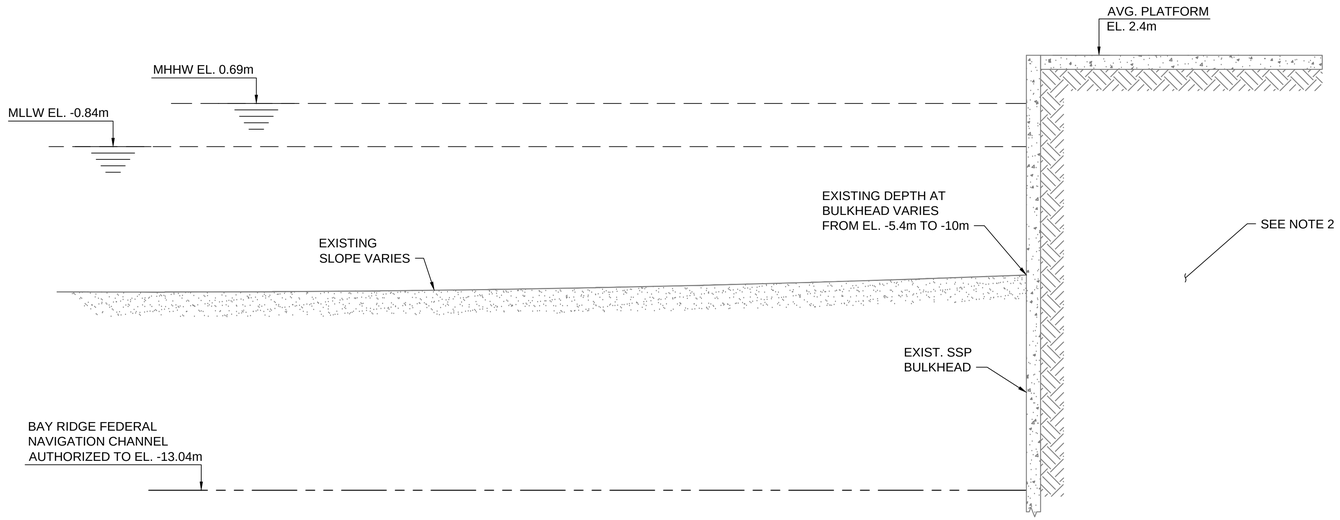
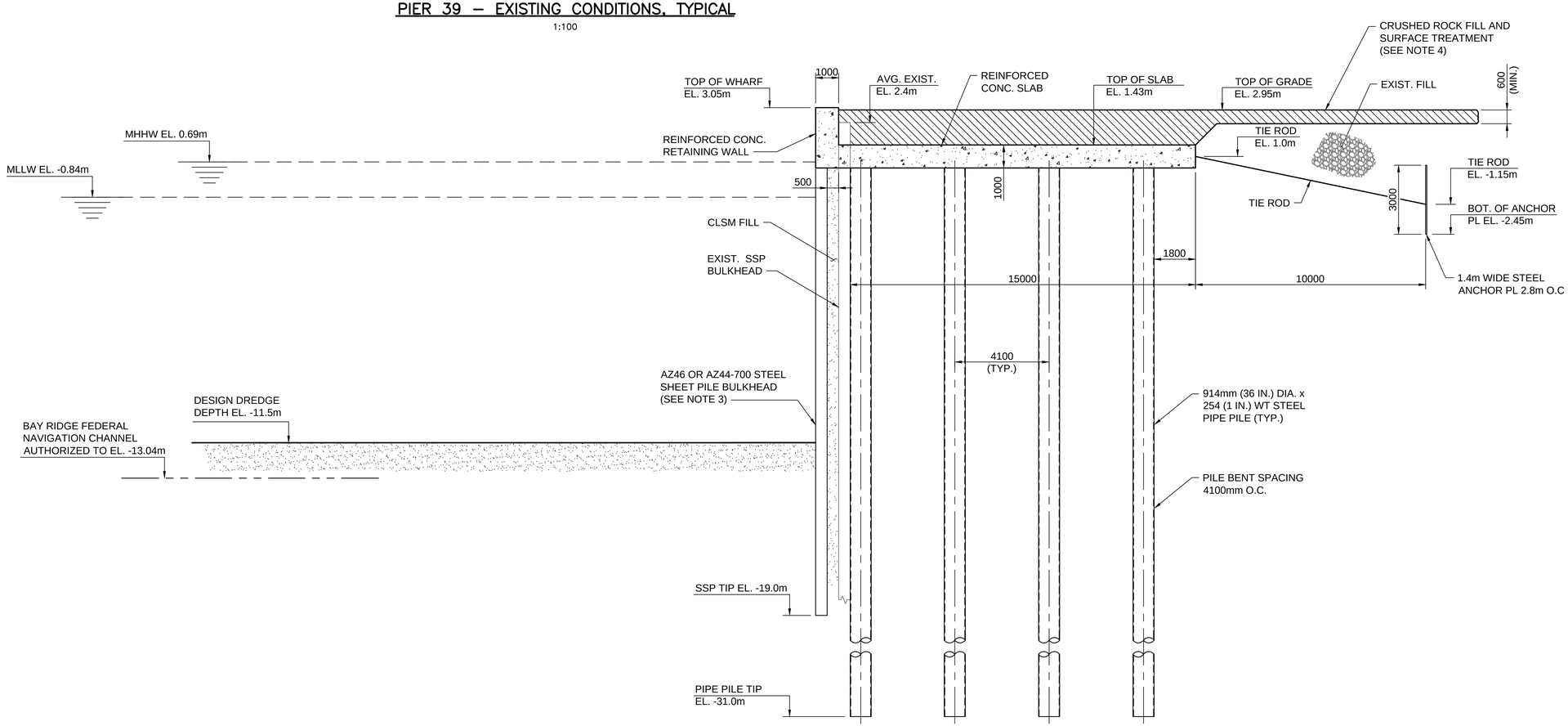


PIER 39 – EXISTING CONDITIONS, TYPICAL

1:100



PIER 39 AND PIER 35 – PROPOSED 15 T/m^2 WHARF AND DREDGE PROFILE, TYPICAL

1:100

NOTES:

1. ALL ELEVATIONS REFERENCE NAVD88 UNLESS STATED OTHERWISE.
2. EXTENT OF EXISTING STRUCTURES AND MATERIAL NOT DETERMINED DURING THIS PHASE OF DESIGN.
3. MATERIAL FOR STEEL SHEET PILE BULKHEAD SHALL BE ASTM A572 GR 50.
4. CRUSHED ROCK SHALL HAVE FRICTION ANGLE OF 40 DEGREES.

GRAPHIC SCALES

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0 1:100 5

REV	DATE	DESCRIPTION	BY	CHK
A	11-19-2018	SBMT PRE-FEED DRAWING SET	PNCN	KLKP

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SBMT PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

PIER 39 EXISTING AND PROPOSED BULKHEAD AND DREDGE SECTIONA (15 T/m^2)

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DRAWN	CHECKED	DATE
PNCN	NLKP	11-19-2018

JOB NO.	DRAWING NO.	REV.
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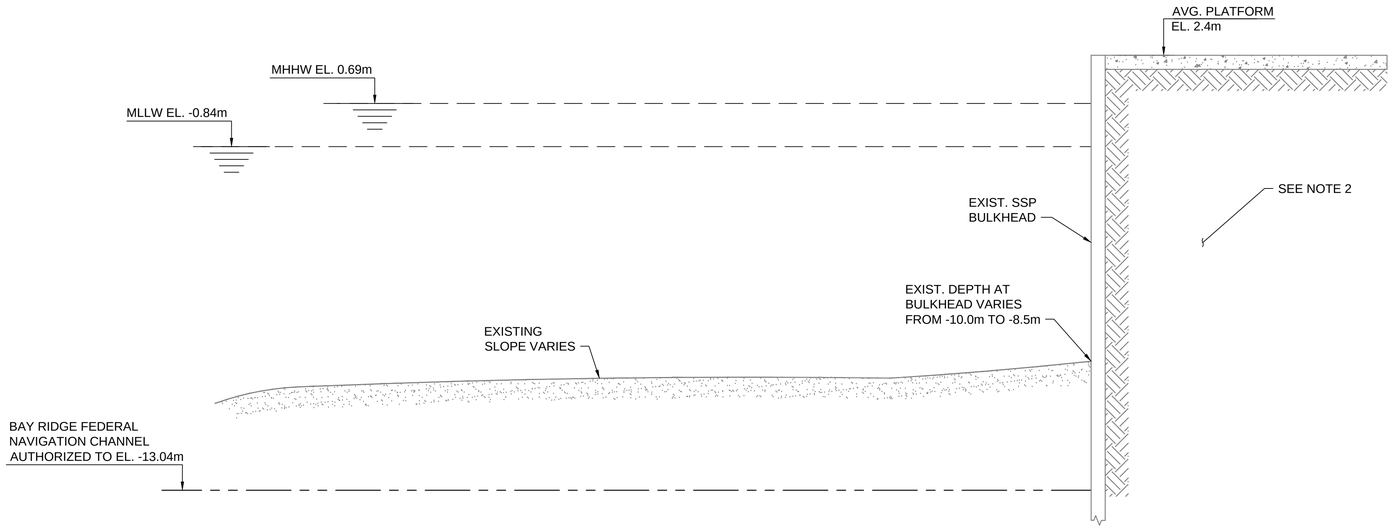
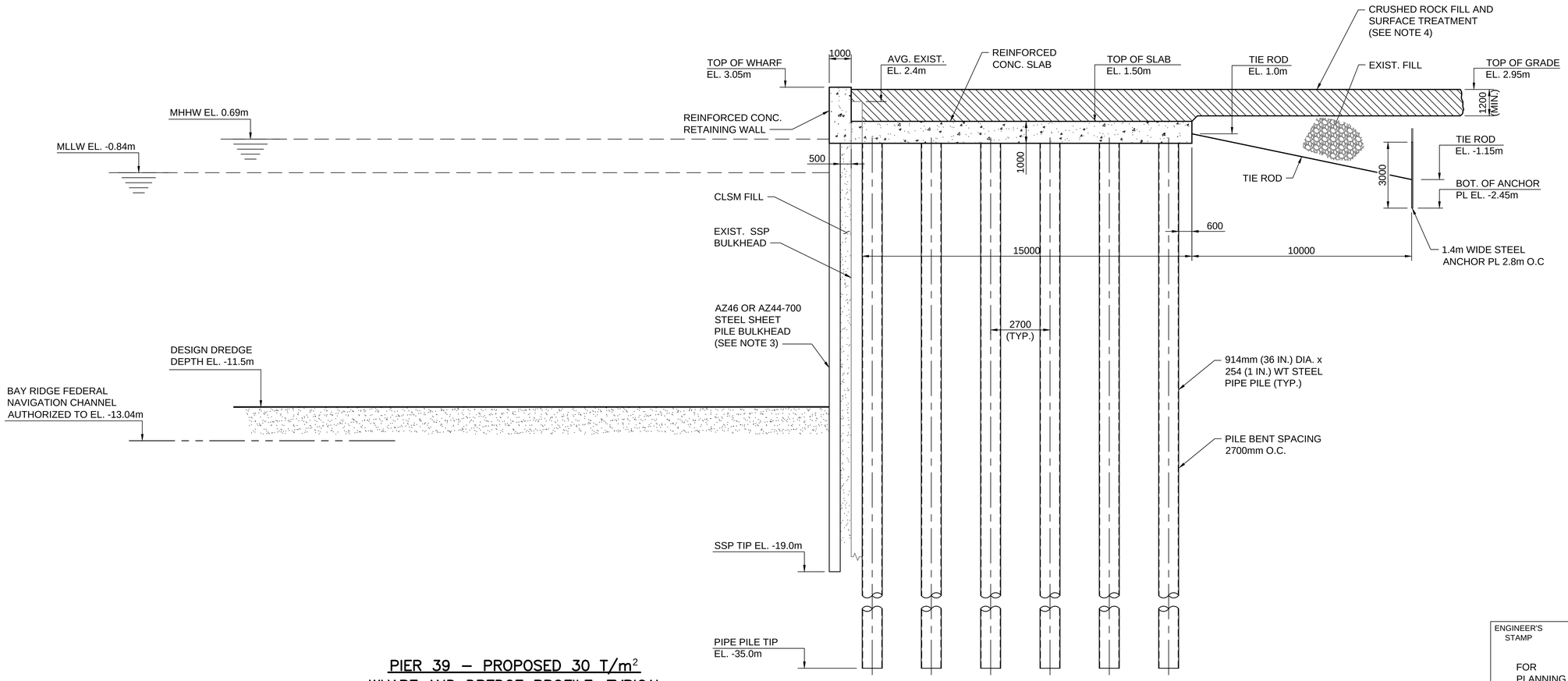


PIER 39 – EXISTING CONDITIONS, TYPICAL

1:100



PIER 39 – PROPOSED 30 T/m^2 WHARF AND DREDGE PROFILE, TYPICAL

1:100

NOTES:

1. ALL ELEVATIONS REFERENCE NAVD88 UNLESS STATED OTHERWISE.
2. EXTENT OF EXISTING STRUCTURES AND MATERIAL NOT DETERMINED DURING THIS PHASE OF DESIGN.
3. MATERIAL FOR STEEL SHEET PILE BULKHEAD SHALL BE ASTM A572 GR 50.
4. CRUSHED ROCK SHALL HAVE FRICTION ANGLE OF 40 DEGREES.

GRAPHIC SCALES

CHECK GRAPHIC SCALES BEFORE USING

0 1:100 5

REV	DATE	DESCRIPTION	BY	CHK
A	11-19-2018	SBMT PRE-FEED DRAWING SET	PNCN	NLKP

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PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

SBMT PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

PIER 39 EXISTING AND PROPOSED BULKHEAD AND DREDGE SECTIONA (30 T/m^2)

SCALE	DESIGNED	APPROVED
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DRAWN	CHECKED	DATE
PNCN	NLKP	11-19-2018

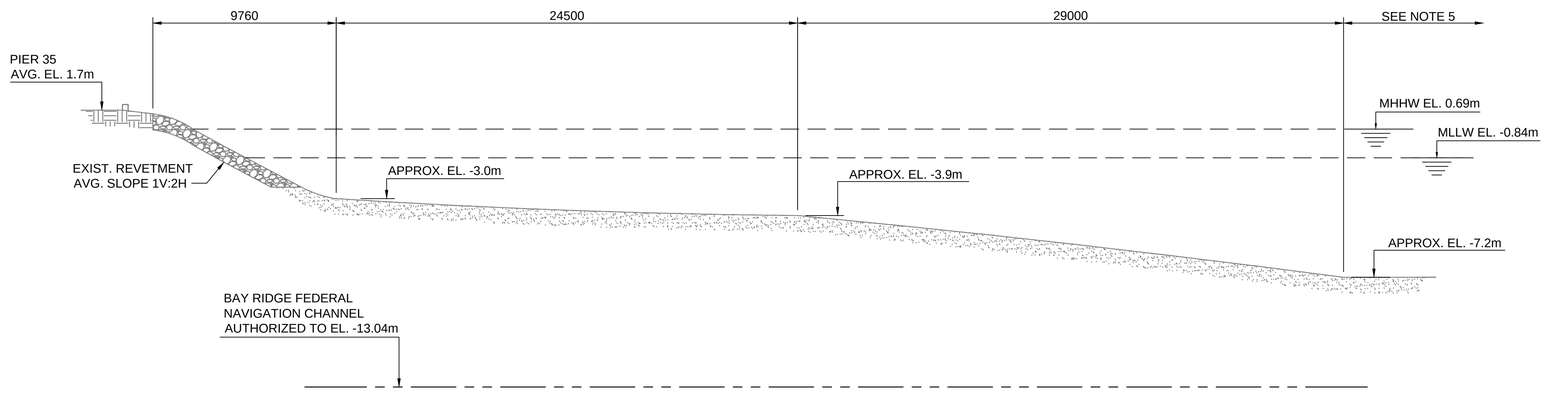
JOB NO.	DRAWING NO.	REV.
A093893	S-03	A

ENGINEER'S STAMP

FOR PLANNING PURPOSES ONLY

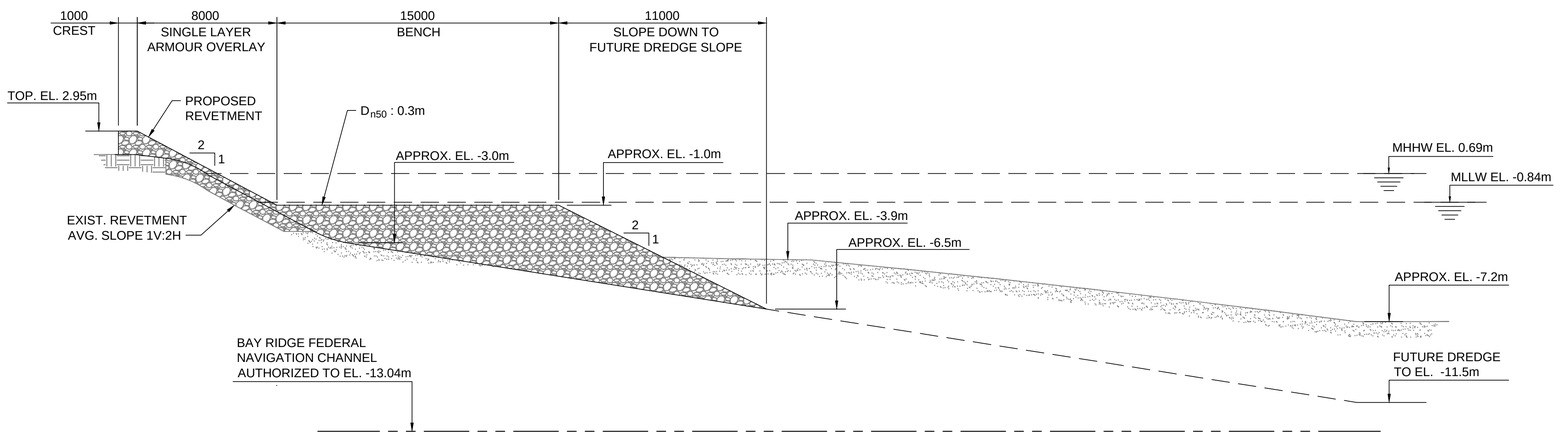
NOTES:

1. ALL ELEVATIONS REFERENCE NAVD88 UNLESS STATED OTHERWISE.
2. EXTENT OF EXISTING STRUCTURES AND MATERIAL NOT DETERMINED DURING THIS PHASE OF DESIGN.
3. MATERIAL FOR STEEL SHEET PILE BULKHEAD SHALL BE ASTM A572 GR 50.
4. CRUSHED ROCK SHALL HAVE FRICTION ANGLE OF 40 DEGREES.
5. APPROXIMATELY 82 METERS TO EAST FACE OF NORTH PORTION OF PIER 39; APPROXIMATELY 47 METERS TO EAST FACE OF SOUTH PORTION OF PIER 39; APPROXIMATELY 92 METERS TO WEST FACE OF PIER 29.



PIER 35 – EXISTING CONDITIONS

1:150



PIER 35 – PROPOSED REVETMENT SECTION, TYPICAL

1:150

GRAPHIC SCALES

CHECK GRAPHIC SCALES BEFORE USING

0 1:150 7.5

REV	DATE	DESCRIPTION	BY	CHK
A	11-19-2018	SBMT PRE-FEED DRAWING SET	PNCN	NLKP

OWNER

CLIENT

NEW YORK STATE OF OPPORTUNITY. NYSERDA

CONSULTANT

BTMI | COWI
BRIDGE TUNNEL MARINE

276 5th Avenue, Suite 1006 New York, NY 10001
Tel.: 646.545.2125 Fax: 646.553.1620
Website: www.cowi-na.com

PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

SBMT PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

PIER 35 EXISTING AND PROPOSED REVETMENT SECTION

ENGINEER'S STAMP

FOR PLANNING PURPOSES ONLY

SCALE	DESIGNED	APPROVED
1:150	NLKP	BRCO
DRAWN	CHECKED	DATE
PNCN	NLKP	11-19-2018
JOB NO.	DRAWING NO.	REV.
A093893	S-04	A

PLOTTED BY: PENNY CONRAD PLOT DATE:11/20/2018 12:02:13 PM

FILE LOCATION: \\COWI.NET\PROJECTS\A090000\A093893\CAD\SBMT\A093893-SBMT-S04.DWG

Appendix C. Opinion of Probable Cost Backup

BTMI BRIDGE TUNNEL MARINE | COWI

*IN NEW YORK AND NORTH CAROLINA, SERVICES ARE PROVIDED BY BTMI ENGINEERING, PC

NYSERDA 2018 PORTS STUDY					
PRE-FRONT END ENGINEERING DESIGN REPORT					
SOUTH BROOKLYN MARINE TERMINAL (SBMT)					
OPINION OF PROBABLE COSTS					
PROJECT NO:	A093893.2				
PROJECT NAME:	NYSERDA 2018 PORTS STUDY				
CLIENT:	NYSERDA				
SITE LOCATION:	BROOKLYN, NY, UPPER NEW YORK BAY				
PREPARED BY:	MTBR				
DATE:	4-Jan-2019				
CHECKED BY:	JOBA				
WORK ITEM DESCRIPTION		**QUANTITY**	**UNITS**	**UNIT PRICE**	**TOTAL**
MOBILIZATION AND DE-MOBILIZATION					
-	Mobilization and Demobilization	1	Lump Sum	$1,686,000.00	$1,686,000.00
-					

DEMOLITION, CLEARING AND GRUBBING					
	Demolition - Warehouses	36860	Square Meter	$138.82	$5,117,000.00
	Demolition - Rail Spur	550	Linear Meter	$67.27	$37,000.00
	Demolition - Pavement	214560	Square Meter	$46.39	$9,953,000.00
MARINE STRUCTURES					
	30T/m² Relieving Platform	7990	Square Meter	$11,370.21	$90,848,000.00
	15T/m² Relieving Platform	11350	Square Meter	$5,973.66	$67,801,000.00
	Revetment Armor	800	Linear Meter	$20,943.75	$16,755,000.00
EARTHWORK & GROUND IMPROVEMENT					
	Upland Excavation above MHW	64310	Cubic Meter	$18.02	$1,159,000.00
	Upland Fill above MHW	61630	Cubic Meter	$5.86	$361,000.00
SURFACE TREATMENT					
	Gravel 30T/m² Staging Area	32140	Square Meter	$168.11	$5,403,000.00
	Gravel 15T/m² Storage Area	226260	Square Meter	$86.06	$19,471,000.00
DREDGING					
	Berth Dredging	91850	Cubic Meter	$111.19	$10,213,000.00
SUBTOTAL					$228,804,000.00
			CONTINGENC	30%	$68,641,200.0

			Y:		0
				TOTAL	$297,446,000.00

NOTE:
COWI HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, EQUIPMENT, OR SERVICES FURNISHED BY OTHERS, OR OVER THE CONTRACTOR'S METHODS OF DETERMINING PRICES, OR OVER COMPETITIVE BIDDING OR MARKET CONDITIONS. COWI'S OPINIONS OF PROBABLE PROJECT COST AND CONSTRUCTION COST PROVIDED FOR HEREIN, ARE MADE ON THE BASIS OF COWI'S BEST JUDGEMENT AS EXPERIENCED AND QUALIFIED PROFESSIONAL ENGINEERS, FAMILIAR WITH THE CONSTRUCTION INDUSTRY; BUT COWI CANNOT AND DOES NOT GUARANTEE THAT PROPOSALS, BIDS OR ACTUAL PROJECT OR CONSTRUCTION COSTS WILL NOT VARY FROM OPINIONS OF PROBABLE COST PREPARED BY COWI.

PROJECT NO.:		A093893.2				
DATE:		4-Jan-2019				
REFERENCES:						
THIS OPINION OF PROBABLE COST IS BASED UPON THE FOLLOWING DRAWINGS						
	PREPARED BY	DRAWING NAME	DRAWING NO.	REV.	DATE	COPY ATTACHED ?
	COWI	COVER SHEET & DRAWING INDEX	A093893-G-01	A	11/9/18	YES
	COWI	EXISTING SITE AND DEMOLITION PLAN	A093893-D-01	A	11/9/18	YES
	COWI	PROPOSED SITE PLAN	A093893-S-01	A	11/9/18	YES
	COWI	PIER 39 EXISTING AND PROPOSED BULKHEAD AND DREDGE SECTIONS (15 T/m^2)	A093893-S-02	A	11/9/18	YES
	COWI	PIER 39 EXISTING AND PROPOSED BULKHEAD AND DREDGE SECTIONS (30 T/m^2)	A093893-S-03	A	11/9/18	YES
	COWI	PIER 35 EXISTING AND PROPOSED REVETMENT SECTION	A093893-S-04	A	11/9/18	YES

PROJECT NO.:	A093893.2							
DATE:	4-Jan-2019							
ASSUMPTIONS:								

1	CURRENCY IN U.S. DOLLARS					
2	COSTS ARE BASED ON FY 2018$					
3	OPC IS BASED ON MATERIAL PRICING AND AVAILABILITY AS OF THE DATE OF THE OPC. MATERIAL PRICING AND AVAILABILITY AT TIME OF CONSTRUCTION MAY VARY.					
4	RESOURCES USED FOR PRICING:					
	a	PREVAILING WAGE RATES FOR NEW YORK CITY				
	b	R.S. MEANS HEAVY CONSTRUCTION COST DATA				
5	EXCLUDED ITEMS:					
	a	SALES AND USE TAXES				
	b	UTILITIES				
	c	CONTAMINATED MATERIALS HANDLING AND DISPOSAL				
	d	ELECTRICAL WORK				
	e	MECHANICAL WORK				
	f	ITEMS NOT SPECIFICALLY LISTED IN "REFERENCES" SECTION OF THIS OPC.				
	g	ENGINEERING AND CONSTRUCTION OVERSIGHT				
	h	CONSTRUCTION MANAGEMENT FEES				
	i	PERMIT ACQUISITION AND PERMIT FEES				
	j.	ARCHITECTURAL FINISHES				
	k	FENDERING AND MOORING APPURTENANCES				
6	ACCESS FOR WORK IS FROM WATERBORNE AND UPLAND-BASED EQUIPMENT WITH UPLAND STAGING ON SITE OR ADJACENT TO THE WORK AREA.					
7	IT IS ASSUMED THAT THERE WILL BE UNRESTRICTED ACCESS FOR THE WORK WITH NO DISRUPTIONS.					

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
MOBILIZATION AND DE-MOBILIZATION						
Mobilization and Demobilization						
Quantity:	1	Lump Sum				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
COORDINATION	120.0	MH	100.00	12000.00		PROJECT MANAGER
PREP OFF SITE	10.0	SHIFT	17278.46	172784.61		
MOBILIZATION	10.0	SHIFT	17278.46	172784.61		
SET-UP ON SITE	5.0	SHIFT	17278.46	86392.31		
BREAK-DOWN ON SITE	10.00	SHIFT	17278.46	172784.61		

DEMOBILIZATION	10.00	SHIFT	17278.46	172784.61		
TOTAL LABOR & EQUIPMENT					789530.76	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
MARINE TOWING	1	LS	500000.00	500000.00		
				0.00		
				0.00		
				0.00		
TOTAL SUBCONTRACTORS & U/P					500000.00	
SUBTOTAL PROJECT					1289530.76	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		103162.46	
OVERHEAD		10%	PERCENT		139269.32	
PROFIT		10%	PERCENT		153196.25	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					$1,685,158.79	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
DEMOLITION, CLEARING AND GRUBBING						
Demolition - Warehouses						
Quantity:	36860	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
				0.00		
				0.00		
TOTAL LABOR & EQUIPMENT					0.00	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS

WAREHOUSE DEMOLITION & DEBRIS HAULING	28087 3.2	CM	12.33	346316 6.56		Building demolition, large urban projects, mixture of types, includes rubbish handling, includes 32 km haul, excludes foundation demolition, excludes dump fees. Rsmeans bare total, line no. 024116130080. Assumes buildings are 7.62 m tall.
DEBRIS DISPOSAL	5,579	MT	81.00	451895. 37		Selective demolition, dump charges, typical urban city, building construction materials, includes tipping fees only. Rsmeans bare total, line no. 024119200100. Assumes dead load of 151.4 kg/sm.
				0.00		
TOTAL SUBCONTRACTORS & U/P					391506 1.93	
SUBTOTAL PROJECT					391506 1.93	
ESCALATION		0%	PERC ENT		0.00	
GENERAL CONDITIONS		8%	PERC ENT		313204. 95	
OVERHEAD		10%	PERC ENT		422826. 69	
PROFIT		10%	PERC ENT		465109. 36	
SALES TAX		0%	PERC ENT		0.00	
TOTAL OPC					$5,116, 202.92	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
DEMOLITION, CLEARING AND GRUBBING						
Demolition - Rail Spur						
Quantity:	550	Linear Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
				0.00		
				0.00		
TOTAL LABOR & EQUIPMENT					0.00	
SUBCONTRACTORS &	QUANTITY	UNIT	UNIT $	EXTENDE		COMMENTS

UNIT PRICES		S		D $		
RAIL SPUR DEMOLITION	550.0	LM	37.04	20372.00		Rs means bare total, line no. 024113333500
DEBRIS HAULING	275	LCM	9.60	2640.00		Cycle hauling (wait, load, travel, unload or dump & return) time per cycle, excavated borrow, loose cubic meters, 30 min load/wait/unload, 15.28 m^3 truck, cycle 16.1 km, 32 kmh, excludes loading equipment. Rs means bare total, line no. 312323204638. Assume each linear meter of demolished track creates 0.5 cm of debris.
DEBRIS DISPOSAL	59.4	MT	81.00	4811.40		Selective demolition, dump charges, typical urban city, building construction materials, includes tipping fees only. Rsmeans bare total, line no. 024119200100. Assumes rails weigh 54 kg/m.
				0.00		
TOTAL SUBCONTRACTORS & U/P					27823.40	
SUBTOTAL PROJECT					27823.40	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		2225.87	
OVERHEAD		10%	PERCENT		3004.93	
PROFIT		10%	PERCENT		3305.42	

SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					$36,359.62	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
DEMOLITION, CLEARING AND GRUBBING						
Demolition - Pavement						
Quantity:	214560	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
				0.00		
				0.00		
TOTAL LABOR & EQUIPMENT					0.00	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS

PAVEMENT DEMOLITION	214560.0	SM	10.18	2184220.80		RS MEANS BARE TOTAL, LINE NO. 024113175050, 100-150 mm THICK
DEBRIS HAULING	40230.0	LCM	9.60	386208.00		CYCLE HAULING (WAIT, LOAD, TRAVEL, UNLOAD OR DUMP & RETURN) TIME PER CYCLE, EXCAVATED BORROW, LOOSE CUBIC METERS, 30 MIN LOAD/WAIT/UNLOAD, 15.28 m^3 TRUCK, CYCLE 16.1 km, 32 kmh, EXCLUDES LOADING EQUIPMENT. RS MEANS BARE TOTAL, LINE NO. 312323204638. ASSUMES 50% VOIDS.
DEBRIS DISPOSAL	62294.3447	MT	81.00	5045841.92		SELECTIVE DEMOLITION, DUMP CHARGES, TYPICAL URBAN CITY, BUILDING CONSTRUCTION MATERIALS, INCLUDES TIPPING FEES ONLY. RSMEANS BARE TOTAL, LINE NO. 024119200100.
				0.00		
				0.00		
TOTAL SUBCONTRACTORS & U/P					7616270.72	
SUBTOTAL PROJECT					7616270.72	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		609301.66	
OVERHEAD		10%	PERCENT		822557.24	

PROFIT		10%	PERCENT		904812.96	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					$9,952,942.57	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
MARINE STRUCTURES						
30T/m² Relieving Platform						
Quantity:	7990	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
STEEL PIPE PILES	22121718.3	KG	2.20	48769982.52		914 DIA. X 25 mm WT
CONCRETE SLAB	7986.0	CM	196.19	1566793.31		1.0 m THICK
CONCRETE SLAB REINFORCEMENT	947579.9	KG	2.20	2089053.55		118 KG/CM ASSUMED
CONCRETE RETAINING WALL	750.2	CM	196.19	147183.61		
CONCRETE RETAINING WALL REINFORCEMENT	89015.1	KG	2.20	196244.42		118 KG/CM ASSUMED
CONCRETE FORMWORK	10490.5	SMCA	53.82	564593.46		
STEEL TIE RODS	7078.4	KG	2.20	15605.20		25.4 mm DIAMETER
STEEL ANCHOR PLATES	145696.4	KG	2.20	321205.23		3m X 1.4m X 25.4mm ASSUMED
STEEL SHEET PILES (OVERSHEETING)	2442608.1	KG	2.20	5385022.69		AZ44-700N ASSUMED
BULKHEAD COATING	13337.8245	SM	43.06	574268.04		OUTER FACE, TOP TO 3 m BELOW ML

CLSM FILL	4559.9	CM	196.19	894626.03		0.5 m GAP BETWEEN NEW & OLD WALL
MARINE FENDER UNITS	8.0	EA	25000.00	200000.00		
MOORING BOLLARDS	8.0	EA	2500.00	20000.00		
TOTAL MATERIALS					60744578.06	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
SET AND DRIVE PIPE PILES	370.0	SHIFT	14558.46	5386630.66		ASSUME 3 PER SHIFT
PLACE REBAR	54.0	SHIFT	13358.46	721356.91		ASSUME 150 SM PER SHIFT
FORM AND POUR CONCRETE	59.0	SHIFT	13358.46	788149.21		ASSUME 150 SM PER SHIFT
INSTALL STEEL TIE RODS & ANCHOR PLATES	18.0	SHIFT	13358.46	240452.30		ASSUME 10 PER SHIFT
SET & DRIVE SSP BULKHEAD	87.0	SHIFT	14558.46	1266586.13		ASSUME 6 LM PER SHIFT
POUR CLSM FILL	23.0	SHIFT	13358.46	307244.61		ASSUME 200 CM PER SHIFT
ERECT FENDER UNITS	3.0	SHIFT	16078.46	48235.38		
ERECT BOLLARDS	1.0	SHIFT	16078.46	16078.46		
TOTAL LABOR & EQUIPMENT					8774733.671	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS

				0.00		
				0.00		
				0.00		
				0.00		
TOTAL SUBCONTRACTORS & U/P					0.00	
SUBTOTAL PROJECT					6951931 1.73	
ESCALATION		0%	PERC ENT		0.00	
GENERAL CONDITIONS		8%	PERC ENT		5561544. 94	
OVERHEAD		10%	PERC ENT		7508085. 67	
PROFIT		10%	PERC ENT		8258894. 23	
SALES TAX		0%	PERC ENT		0.00	
TOTAL OPC					$90,847, 836.57	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
MARINE STRUCTURES						
15T/m² Relieving Platform						
Quantity:	11350	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
STEEL PIPE PILES	12684004.2	KG	2.20	27963409.40		914 DIA. X 25.4 mm WT
CONCRETE SLAB	11343.8	CM	196.19	2225558.67		1.0 m THICK
CONCRETE SLAB REINFORCEMENT	1345994.1	KG	2.20	2967405.61		118 KG/CM ASSUMED
CONCRETE RETAINING WALL	1113.8	CM	196.19	218509.40		
CONCRETE RETAINING WALL REINFORCEMENT	132152.2	KG	2.20	291345.28		118 KG/CM ASSUMED
CONCRETE FORMWORK	14982.5	SMCA	53.82	806350.12		
STEEL TIE RODS	10048.1	KG	2.20	22152.21		25.4 mm DIAMETER
STEEL ANCHOR PLATES	206821.9	KG	2.20	455963.74		3m X 1.4m X 25.4mm ASSUMED
STEEL SHEET PILES (OVERSHEETING)	3325120.1	KG	2.20	7330626.28		AZ44-700N ASSUMED
BULKHEAD COATING	18162.144	SM	43.06	781982.01		OUTER FACE, TOP TO 3 m BELOW ML

CLSM FILL	6209.3	CM	196.19	1218214.17		0.5 m GAP BETWEEN NEW & OLD WALL
TOTAL MATERIALS					44281516.89	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
SET AND DRIVE PIPE PILES	205.0	SHIFT	14558.46	2984484.56		ASSUME 3.5 PER SHIFT
PLACE REBAR	76.0	SHIFT	13358.46	1015243.06		ASSUME 150 SM PER SHIFT
FORM AND POUR CONCRETE	84.0	SHIFT	13358.46	1122110.75		ASSUME 150 SM PER SHIFT
INSTALL STEEL TIE RODS & ANCHOR PLATES	25.0	SHIFT	13358.46	333961.53		ASSUME 10 PER SHIFT
SET & DRIVE SSP BULKHEAD	118.0	SHIFT	14558.46	1717898.43		ASSUME 6 LM PER SHIFT
POUR CLSM FILL	32.0	SHIFT	13358.46	427470.76		ASSUME 200 CM PER SHIFT
TOTAL LABOR & EQUIPMENT					7601169.08	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
				0.00		
				0.00		
				0.00		
TOTAL SUBCONTRACTORS					0.00	

& U/P						
SUBTOTAL PROJECT					51882685.97	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		4150614.88	
OVERHEAD		10%	PERCENT		5603330.08	
PROFIT		10%	PERCENT		6163663.09	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					##########	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
MARINE STRUCTURES						
Revetment Armor						
Quantity:	800	Linear Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
REVETMENT ARMOR STONE	100700.3	MT	110.23	11100294.80		DUMPED, 25% VOIDS ASSUMED, D50=305 mm
TOTAL MATERIALS					11100294.80	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
PLACE REVETMENT ARMOR STONE	107.0	SHIFT	16078.46	1720395.35		ASSUME 7.5 LM PER SHIFT
TOTAL LABOR & EQUIPMENT					1720395.35	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS

				0.00		
				0.00		
				0.00		
				0.00		
TOTAL SUBCONTRACTORS & U/P					0.00	
SUBTOTAL PROJECT					12820690.15	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		1025655.21	
OVERHEAD		10%	PERCENT		1384634.54	
PROFIT		10%	PERCENT		1523097.99	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					########## #	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
EARTHWORK & GROUND IMPROVEMENT						
Upland Excavation above MHW						
Quantity:	64310	Cubic Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
SOIL EXCAVATION	64310.0	BCM	13.78	886191.80		RS MEANS BARE TOTAL, LINE NO. 312316462400, DOZER, 90 m HAUL, ASSUME ALL CUT IS USED AS BACKFILL
TOTAL LABOR & EQUIPMENT					886191.80	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS

				0.00		
				0.00		
				0.00		
				0.00		
TOTAL SUBCONTRACTORS & U/P					0.00	
SUBTOTAL PROJECT					886191.80	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		70895.34	
OVERHEAD		10%	PERCENT		95708.71	
PROFIT		10%	PERCENT		105279.59	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					$1,158,075.44	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
EARTHWORK & GROUND IMPROVEMENT						
Upland Fill above MHW						
Quantity:	61630	Cubic Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
BACKFILL SOILS	61630.0	LCM	4.48	276102.40		RS MEANS BARE TOTAL, LINE NO. 312323142400, DOZER, 90 m HAUL, ASSUME ALL CUT IS USED AS BACKFILL
TOTAL LABOR & EQUIPMENT					276102.40	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS

				0.00		
				0.00		
				0.00		
				0.00		
TOTAL SUBCONTRACTORS & U/P					0.00	
SUBTOTAL PROJECT					276102.40	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		22088.19	
OVERHEAD		10%	PERCENT		29819.06	
PROFIT		10%	PERCENT		32800.97	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					$360,810.62	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
SURFACE TREATMENT						
Gravel 30T/m² Staging Area						
Quantity:	32140	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
GRAVEL FOR SURFACE TREATMENT	77975.6	MT	49.60	3867899.51		1922 KG/CM ASSUMED
TOTAL MATERIALS					3867899.51	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
PLACE GRAVEL FILL (LOOSE)	48678.6	LCM	3.01	146522.59		RS MEANS BARE TOTAL, LINE NO. 312323142200, ASSUME LOOSE VOLUME IS 20% GREATER THAN IN-PLACE VOLUME
COMPACT GRAVEL FILL	40565.5	ECM	2.95	119668.23		RS MEANS BARE TOTAL, LINE NO. 312323237640, 300 mm LIFTS, 4 PASSES, VIBRATING ROLLER
TOTAL LABOR &					266190.8	

EQUIPMENT					1	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
				0.00		
				0.00		
				0.00		
TOTAL SUBCONTRACTORS & U/P					0.00	
SUBTOTAL PROJECT					4134090.33	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		330727.23	
OVERHEAD		10%	PERCENT		446481.76	
PROFIT		10%	PERCENT		491129.93	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					$5,402,429.24	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
SURFACE TREATMENT						
Gravel 15T/m² Storage Area						
Quantity:	226260	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
GRAVEL FOR SURFACE TREATMENT	281024.1	MT	49.60	13939903.94		1922 KG/CM ASSUMED
TOTAL MATERIALS					13939903.94	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
PLACE GRAVEL FILL (LOOSE)	175437.6	LCM	3.01	528067.18		RS MEANS BARE TOTAL, LINE NO. 312323142200, ASSUME LOOSE VOLUME IS 20% GREATER THAN IN-PLACE VOLUME
COMPACT GRAVEL FILL	146198.0	ECM	2.95	431284.10		RS MEANS BARE TOTAL, LINE NO. 312323237640, 300 mm LIFTS, 4 PASSES, VIBRATING ROLLER
TOTAL LABOR &					959351.2	

EQUIPMENT					8	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
				0.00		
				0.00		
				0.00		
TOTAL SUBCONTRACTORS & U/P					0.00	
SUBTOTAL PROJECT					14899255.21	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		1191940.42	
OVERHEAD		10%	PERCENT		1609119.56	
PROFIT		10%	PERCENT		1770031.52	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					##########	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
DREDGING						
Berth Dredging						
Quantity:	91850	Cubic Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
TOTAL MATERIALS					0.00	
LABOR & EQUIPMENT	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
TOTAL LABOR & EQUIPMENT					0.00	
SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS

BERTH DREDGING	91850.0	BCM	85.08	7814795.25		INCLUDES UPLAND DISPOSAL. BASED ON $111.18/CM ESTIMATE. THIS UNIT COST HAS BEEN REDUCED TO $85.08/CM IN ORDER TO REMOVE GENERAL CONDITIONS, OVERHEAD, AND PROFIT THAT WAS INCLUDED IN ESTIMATE. THIS WAS ORIGINALLY ESTIMATED TO BE $65-$162 / CM IN PHASE 1.
				0.00		
				0.00		
				0.00		
TOTAL SUBCONTRACTORS & U/P					7814795.25	
SUBTOTAL PROJECT					7814795.25	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		625183.62	
OVERHEAD		10%	PERCENT		843997.89	
PROFIT		10%	PERCENT		928397.68	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					##########	

PROJECT NO.:	A093893.2							
DATE:	4-Jan-2019							
LABOR AND EQUIPMENT RATE BREAKDOWN								
<u>CREW 1 - MARINE CONSTRUCTION WITH PILE DRIVING - UPLAND ACCESS</u>								
				FULL COST	A	B	A+B	
				W / BURDEN	DIRECT WAGES*	FRINGES		
	LABOR							
		DOCKBUILDER FOREMAN		170.87	64.36	50.67	115.03	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		OILER		115.27	41.22	38.28	79.50	
		OPERATOR - CRANE		179.46	79.03	31.85	110.88	
	EQUIPMENT							
		COMPRESSOR		50.00				

		CRANE		300.00				
		UTILITY TRUCK		50.00				
		PILE DRIVING HAMMER		150.00				
		MISC		50.00				
	TOTAL HOURLY RATE			1819.81				
	TOTAL SHIFT RATE			14558.46	BASED ON EIGHT (8) HOUR SHIFT			

PROJECT NO.:	A093893.2							
DATE:	4-Jan-2019							
LABOR AND EQUIPMENT RATE BREAKDOWN								
<u>CREW 2 - MARINE CONSTRUCTION - UPLAND ACCESS</u>								
				FULL COST	A	B	A+B	
				W / BURDEN	DIRECT WAGES*	FRINGES		
	LABOR							
		DOCKBUILDER FOREMAN		170.87	64.36	50.67	115.03	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		DOCKBUILDER		150.84	53.63	50.67	104.30	
		OILER		115.27	41.22	38.28	79.50	
		OPERATOR - CRANE		179.46	79.03	31.85	110.88	
	EQUIPMENT							
		COMPRESSOR		50.00				

		CRANE		300.00				
		UTILITY TRUCK		50.00				
		MISC		50.00				
	TOTAL HOURLY RATE			1669.81				
	TOTAL SHIFT RATE			13358.46	BASED ON EIGHT (8) HOUR SHIFT			

PROJECT NO.:	A093893.2						
DATE:	4-Jan-2019						
LABOR AND EQUIPMENT RATE BREAKDOWN							
CREW 3 - SITE WORK - UPLAND							
				FULL COST	A	B	A+B
				W / BURDEN	DIRECT WAGES*	FRINGES	
	LABOR						
		LABORER FOREMAN		136.77	50.40	42.63	93.03
		LABORER		121.08	42.00	42.63	84.63
		LABORER		121.08	42.00	42.63	84.63
		LABORER		121.08	42.00	42.63	84.63
		OPERATOR - EXCAVATOR		163.27	66.92	38.28	105.20
	EQUIPMENT						
		EXCAVATOR		120.00			
		COMPACTOR		20.00			
		UTILITY TRUCK		25.00			
		MISC		50.00			
	TOTAL HOURLY RATE			878.27			
	TOTAL SHIFT RATE			7026.18	BASED ON EIGHT (8) HOUR SHIFT		

PROJECT NO.:	A093893.2						
DATE:	4-Jan-2019						
LABOR AND EQUIPMENT RATE BREAKDOWN							
CREW 4 - MARINE CONSTRUCTION - WATERBORNE PILE DRIVING							
				FULL COST	A	B	A+B
				W / BURDEN	DIRECT WAGES*	FRINGES	
	LABOR						
		DOCKBUILDER FOREMAN		170.87	64.36	50.67	115.03
		DOCKBUILDER		150.84	53.63	50.67	104.30
		DOCKBUILDER		150.84	53.63	50.67	104.30
		DOCKBUILDER		150.84	53.63	50.67	104.30
		DOCKBUILDER		150.84	53.63	50.67	104.30
		DOCKBUILDER		150.84	53.63	50.67	104.30
		OILER		115.27	41.22	38.28	79.50
		OPERATOR - CRANE		179.46	79.03	31.85	110.88
	EQUIPMENT						
		BARGE - MATERIAL		75.00			
		COMPRESSOR		50.00			
		CRANE - BARGE MOUNTED		300.00			
		FLOAT STAGE (4)		40.00			

		TUG BOAT		200.00			
		PILE DRIVING HAMMER		150.00			
		UTILITY TRUCK		75.00			
		MISC		50.00			
	TOTAL HOURLY RATE			2159.81			
	TOTAL SHIFT RATE			17278.46	BASED ON EIGHT (8) HOUR SHIFT		

PROJECT NO.:	A093893.2						
DATE:	4-Jan-2019						
LABOR AND EQUIPMENT RATE BREAKDOWN							
CREW 5 - MARINE CONSTRUCTION - WATERBORNE							
				FULL COST	A	B	A+B
				W / BURDEN	DIRECT WAGES*	FRINGES	
	LABOR						
		DOCKBUILDER FOREMAN		170.87	64.36	50.67	115.03
		DOCKBUILDER		150.84	53.63	50.67	104.30
		DOCKBUILDER		150.84	53.63	50.67	104.30
		DOCKBUILDER		150.84	53.63	50.67	104.30
		DOCKBUILDER		150.84	53.63	50.67	104.30
		DOCKBUILDER		150.84	53.63	50.67	104.30
		OILER		115.27	41.22	38.28	79.50
		OPERATOR - CRANE		179.46	79.03	31.85	110.88
	EQUIPMENT						
		BARGE - MATERIAL		75.00			
		COMPRESSOR		50.00			
		CRANE - BARGE MOUNTED		300.00			

		FLOAT STAGE (4)		40.00			
		TUG BOAT		200.00			
		UTILITY TRUCK		75.00			
		MISC		50.00			
	TOTAL HOURLY RATE			2009.81			
	TOTAL SHIFT RATE			16078.46	BASED ON EIGHT (8) HOUR SHIFT		

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