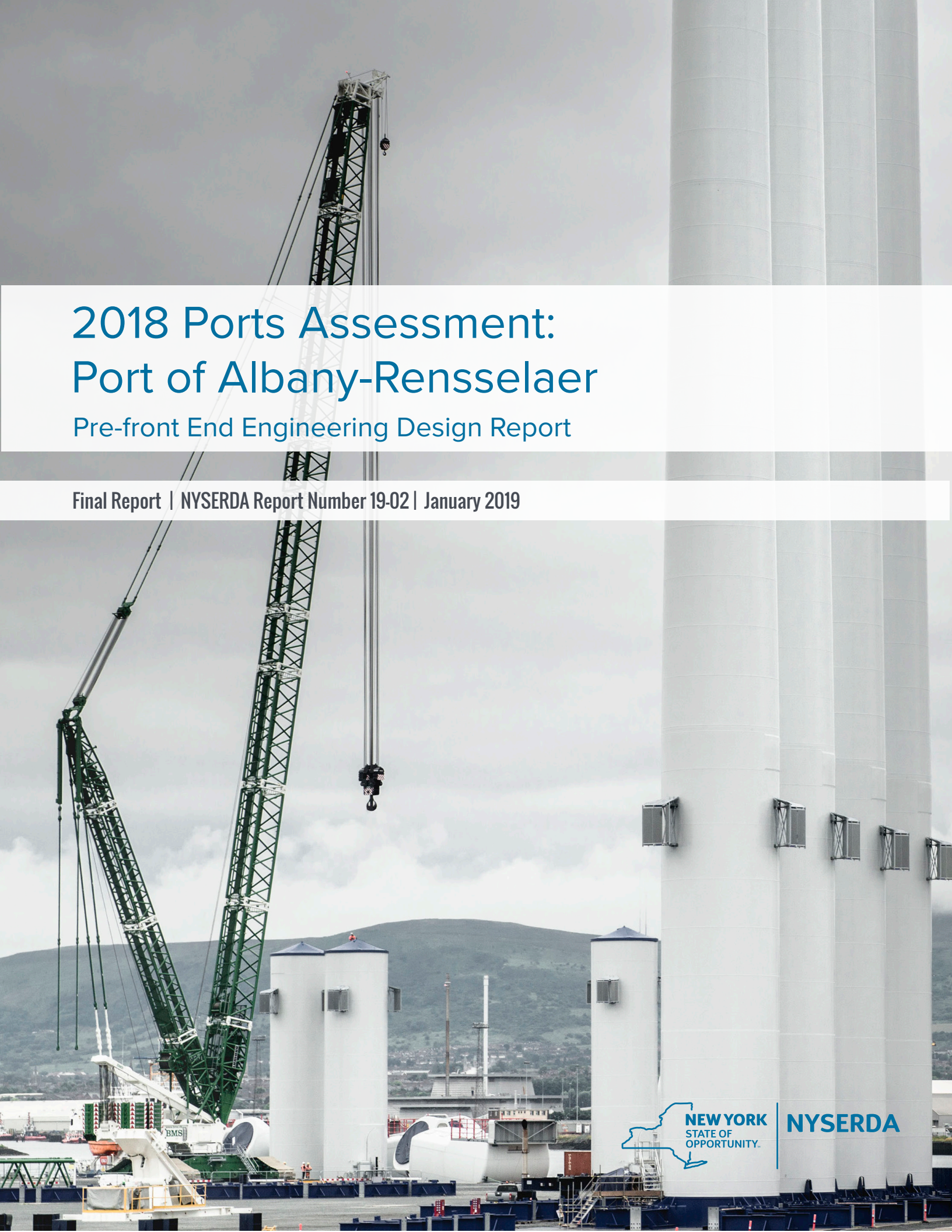

2018 Ports Assessment: Port of Albany-Rensselaer

Pre-front End Engineering Design Report

Final Report | NYSERDA Report Number 19-02 | January 2019

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Serve as a catalyst – advancing energy innovation, technology, and investment; transforming New York's economy; and empowering people to choose clean and efficient energy as part of their everyday lives.

Cover Image: MHI Vestas Offshore Wind

2018 Ports Assessment:
Port of Albany-Rensselaer
Pre-front End Engineering Design Report

Final Report

Prepared for:

New York State Energy Research and Development Authority

Albany, NY

Prepared by:

COWI North America, Inc.

New York, NY

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Acronyms and Abbreviations

BFE	Base Flood Elevation
CM	Cubic meter
CY	Cubic Yard
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
MSL	Mean Sea Level
MT	Metric Ton
NOAA	National Oceanic and Atmospheric Administration
NYSERDA	New York State Energy Research and Development Authority
OPC	Opinion of Probable Cost
OSW	Offshore Wind
Pre-FEED	Pre-front End Engineering Design
PSF	Pounds per Square Foot
RSLR	Relative Sea-Level Rise
SY	Square Yard
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WEA	Wind Energy Area

Executive Summary

The Port of Albany-Rensselaer (referred to as the Port of Albany) 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 facilities with greatest feasibility for offshore wind use and to 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. The Port of Albany is one of the facilities selected by NYSERDA, inclusive of significant stakeholder input, for Pre-FEED.

The Port of Albany was selected for Pre-FEED by NYSERDA after obtaining significant stakeholder input. The Port of Albany Pre-FEED is based upon a combination of site characterization information provided by the terminal operator and publicly available information. It should be noted that there may be some scope of offshore wind operations that would require less infrastructure development than what is outlined in this Pre-FEED.

The Port of Albany consists of multiple facilities, both on the western bank of the Hudson River, in Albany, New York, and on the eastern bank of the Hudson River in Rensselaer, New York. These facilities are owned and operated by the Port of Albany. There are some available areas, typically two to four hectares (5 to 10 acres) in size, within the existing port properties. However, these areas are typically considered too small to function as a manufacturing or fabrication facility for offshore wind. The Port of Albany is currently finalizing an expansion to acquire an additional parcel of approximately 31 hectares (77 acres) on Beacon Island, immediately south of the existing Albany facility on the western bank of the Hudson River. The additional area is split between approximately 2.7 hectares (6.6 acres) north of Normans Kill and approximately 28.5 hectares (70.4 acres) south of Normans Kill. This area is a relatively planar, undeveloped plot of land and consists of several wetland areas.

This site may potentially support manufacturing and fabrication activities; for example, this may include manufacturing of nacelles, towers, or blades, foundation fabrication, or substation fabrication activities. The Port of Albany site is an undeveloped plot of land. Therefore, all new infrastructure will be necessary in order to support offshore wind operations. The Port of Albany 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 upon the ultimate use of the facility, as well as future stages of design. The Pre-FEEDs are intended to be conservative, yet realistic to address the long-term needs of the supply chain. 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):

- Clearing and grubbing the site (27.9 hectares or 69.1 acres).
- Constructing a heavy load wharf with 30 MT/m² (6,000 PSF) of live load capacity. The wharf is pile-supported and 1,310 feet length and 116 feet width.

- Grading the site to the design level surface elevation. This consists of a gross cut volume of approximately 126,060 CY and a gross fill volume of approximately 134,210 CY, as well as hauling, and placement.
- Performing a ground improvement campaign, consisting of rigid inclusions and dynamic compaction to achieve 15 MT/m² (3,000 PSF) live load capacity throughout the site.
- Three rows of steel pipe-piles will be installed along the eastern shoreline north and south of the proposed wharf to stabilize the shoreline and achieve 15 MT/m² (3,000 PSF) capacity at the site's waterfront extents.
- Procuring and installing 322,150 CY of crushed stone to cover 27.4 hectares (67.6 acres) of surface.
- Dredging 212,390 CY of sediment from the berth area.

The OPC to develop the Port of Albany site yields a total projected construction cost of approximately $315 million (2018-dollar value). The OPC includes both a $242 million estimate of primary activities and a 30% design and construction contingency of $73 million due to the Pre-FEED level of the design.

The Port of Albany is air draft restricted by the Mid-Hudson Bridge, having a clearance of 134 feet MHHW. Port of Albany is water depth restricted by the authorized depth of the Hudson River Federal Channel at -32 feet MLLW. 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 percent to 70 percent 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 Port of Albany site presents an opportunity to develop such an offshore wind port facility. Developing the Port of Albany would provide an enormous benefit to the offshore wind industry by delivering a dedicated port facility, which will be critical for the supply chain while creating new and local jobs in the greater New York area.

1 Introduction

The Port of Albany-Rensselaer (referred to as the Port of Albany) 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 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 the greatest feasibility for offshore wind use and develop Pre-FEED designs of those facilities to illustrate their potential, while also establishing a further understanding of the activities, schedules, and costs necessary to develop each facility. The Port of Albany 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 Port of Albany site presents an opportunity to develop such an offshore wind port facility. Developing the Port of Albany would provide an enormous benefit to the offshore wind industry by delivering a dedicated port facility, which will be critical for the supply chain while creating new and local jobs in the greater New York area.

1.1 Site Description

The Port of Albany consists of multiple facilities, both on the western bank of the Hudson River in Albany, New York and on the eastern bank of the Hudson River in Rensselaer, New York. A vicinity map and facility map is shown in Figures 1 and 2.

Figure 1. Port of Albany Vicinity Map

Source: Google, County Boundaries by New York State

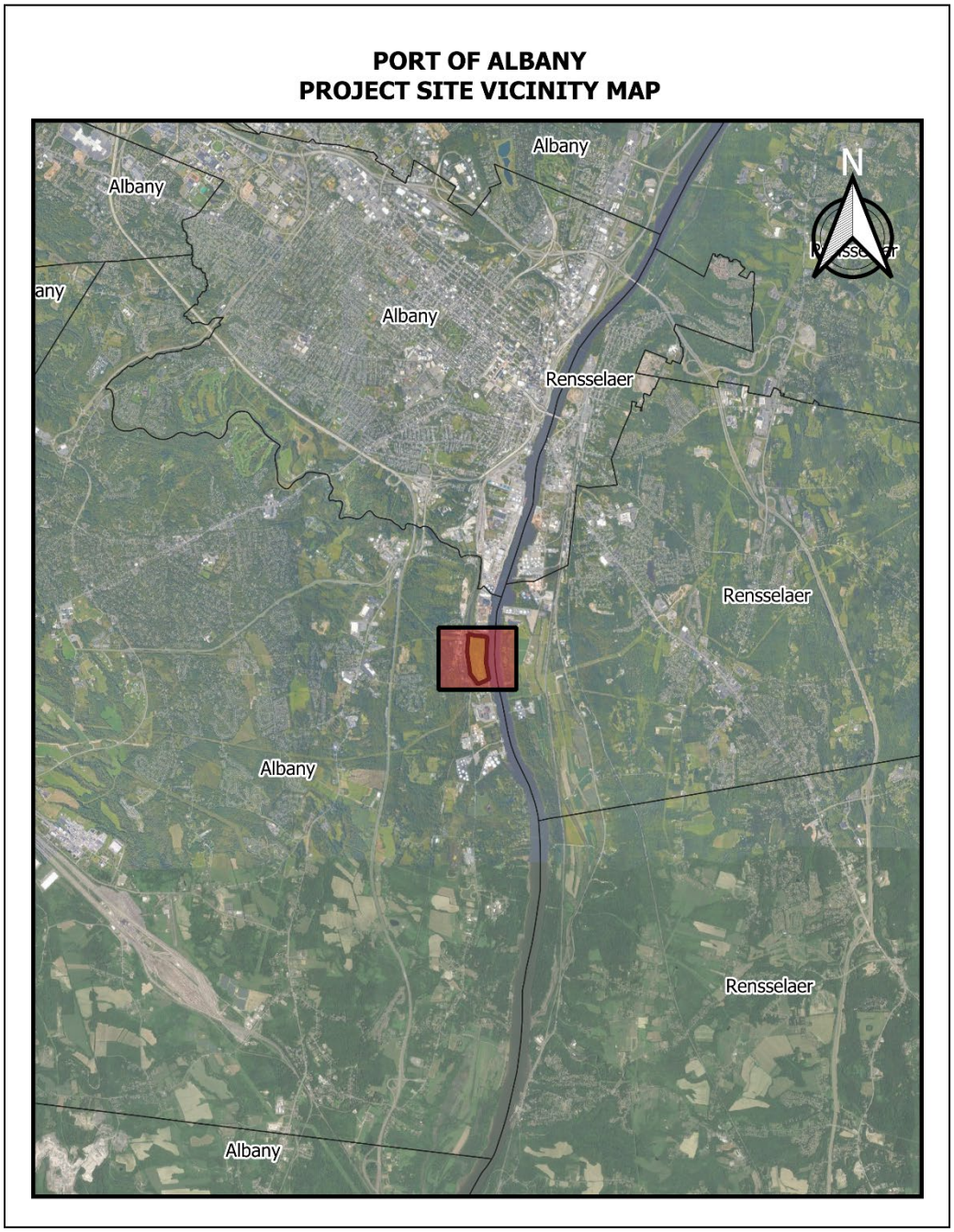
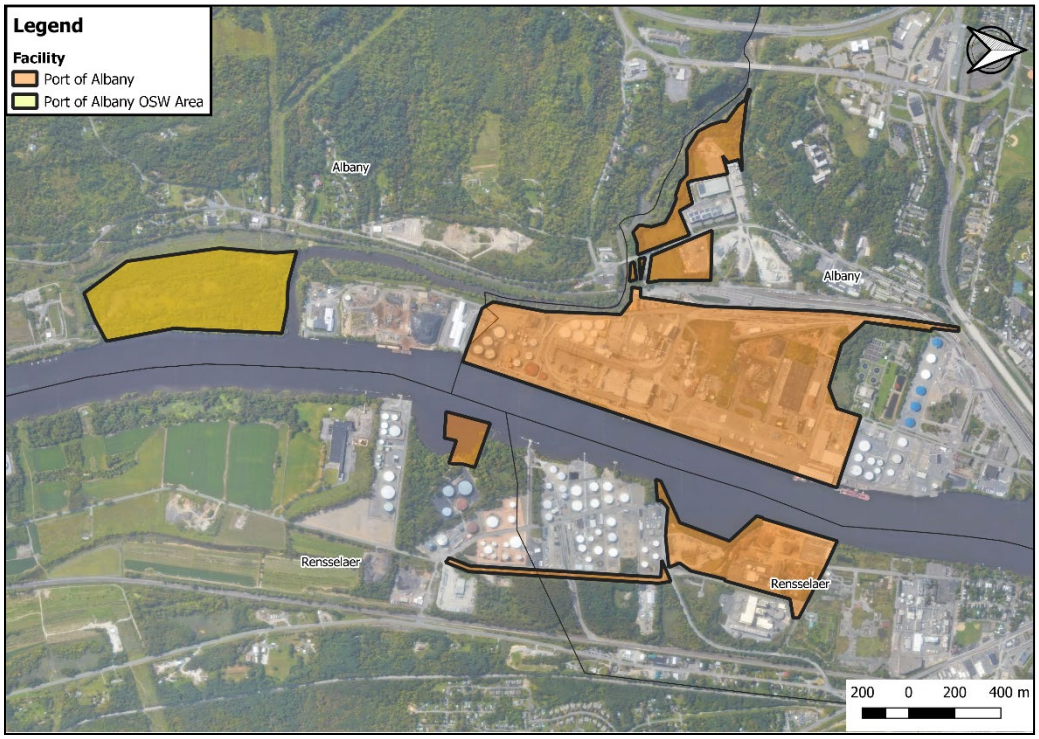


Figure 2. Port of Albany Facility Map

Source: Google, County Boundaries by New York State



Within the existing and operational port facility, there are some available areas ranging from two to four hectares (five to 10 acres) in area; however, these areas are considered too small to function as a manufacturing or fabrication facility for offshore wind. The Port of Albany is currently finalizing an expansion to acquire an additional approximately 31 hectares (77 acres) on Beacon Island, which is the property under investigation to be potentially developed into an offshore wind facility. Beacon Island is located immediately south of the existing facility on the western bank of the Hudson River within the Glenmont hamlet in the town of Bethlehem in Albany County.

The project site is located in an undeveloped area within the 98.00-2-10.23 parcel owned by Port of Albany. The site can be described as relatively planar (uniform land elevations across the site) and undeveloped. The proposed platform is expected to occupy approximately 28 hectares (69.3 acres) of the undeveloped area on Beacon Island, as shown in Figure 3.

Figure 3. Platform Area

Source: USGS

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. The Port of Albany is potentially capable of serving multiple purposes over the lifetime of one or multiple offshore wind farms. The NYSERDA 2018 Pre-FEED concept for Port of Albany is based upon 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 under designed, depending on the ultimate functionality and use of the facility. In general, the Pre-FEED is intended to facilitate a broad range of component manufacturing, foundation fabrication and substation fabrication activities. Within these scenarios, activities at the terminal may include the following:

- Receive subcomponents (e.g., steel sections, electrical modules, fabricated subcomponents) and raw materials (aggregate, cement), etc.
- Manufacture WTG components (e.g., nacelle, towers, blades)
- Fabricate concrete and/or steel foundations
- Fabricate offshore electrical substations
- Provide laydown area and ancillary support to a manufacturing or fabrication contractor to handle subcomponents

- Apply protective coating and paints to fabricated components
- Prepare and load out components for transportation either to a secondary staging and installation site or directly to the offshore site

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

The Port of Albany is air draft restricted by the Mid-Hudson Bridge, having a clearance of 134 feet. This restriction can be addressed through the use of accommodating vessels and is not anticipated to significantly impact the use of the Port of Albany for its intended use.

1.3 Operational Characteristics

General facility characteristics were observed and published in the 2017 Ports Assessment. 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 the following:

- Two berth areas with a length of 660 feet 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 330 feet 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.
- A 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 requirements were less significant. The Pre-FEED design is, therefore, intended to cover conservative, yet realistic needs of the industry, through New York's 2035 offshore wind goals 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	Address: Beacon Island, Glenmont, Bethlehem, NY 12077 Latitude: 42°36'13.0" N Longitude: 73°45'56.0" W
Owner	Port of Albany: (518) 463-8763 http://www.portofalbany.us
Significant Tenants	Same as the Owner
Distance to Wind Energy Areas (WEAs), approximate water route lengths calculated using the GRS 1980 ellipsoid	Equinor Empire Wind Offshore Wind Farm: 311 km (194 mi) Hudson South Area: 358 km (222 mi) Hudson North Area: 362 km (225 mi) Fairway South Area: 375 km (233 mi) Fairway North Area: 419 km (260 mi) Deepwater South Fork Windfarm: 519 km (323 mi)
Area	Port of Albany-Rensselaer total: Beacon Island expansion total: 31.1 hectares (77 acres) Upland Area (above MHHW) included in Pre-FEED: 28 hectares (69.3 acres) Area below MHHW included in Pre-FEED: 3.1 hectares (7.6 acres)
Water Frontage	2,500 ft.
Primary Wharf Length(s)	1 x 400 m (1,310 ft.) @ 30 MT/m² (6,000 PSF), along north shoreline of site
Wharf & Storage Area Live Load Capacity	30 MT/m² (6,000 PSF) in staging/pre-assembly areas 15 MT/m² (3,000 PSF) in storage areas
Navigable Depth	32 ft. MLLW federally authorized for Hudson River Channel
Limiting Air Draft Restrictions (from facility to unrestricted offshore area)	Mid-Hudson Bridge: 134 ft.
Intermodal Connections	Adjacent to New York State Thruway Adjacent to the Port of Albany railway connection
Surrounding Land Use	Undeveloped, industrial (Port of Albany, north), residential (town of Bethlehem, west)

2 Design Basis

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

3 Proposed Site Design

The Port of Albany Pre-FEED is an indicative design, with facility characteristics compiled and consolidated from industry input and tailored to best suit the undeveloped site. 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 slope under the wharf will be supported and protected from wave action and scour by a bulkhead-revetment system.

Due to the site being undeveloped, all new infrastructure is necessary. Key site improvement and major infrastructure items investigated for the proposed site design include the following:

- Clear and grub existing site.
- Install one 30MT/m² heavy load quay 1,310 feet long and 65 feet in width along the northeastern shoreline.
- Grade existing site.
- Improve the ground bearing capacity across the site by placing crushed rock above existing grade with a thickness of 3 feet. The crushed rock also provides the working surface treatment, so no additional surface treatment is required.
- Improve the subsurface ground bearing capacity across the entire site through a combination of rigid inclusions and deep dynamic compaction.
- Improve the stability of the eastern shoreline and allowing live load right up to the shoreline through installation of three rows of steel.
- Dredged berth area to allow safe vessel access to the site.

These items are described in further detail and incorporated into the OPC in Section 5.

3.1 Clearing and Grubbing

Demolition is not anticipated at the site due to it being undeveloped. The project site currently consists of unmaintained vegetation, including trees and bushes ranging in size. Clearing and grubbing of the entire site (28 hectares or 69.1 acres) for the proposed design is anticipated.

3.2 Marine Structures

A heavy load wharf for loading and unloading OSW components from vessels is the key marine structure proposed within the Port of Albany Pre-FEED. Additional structures are necessary to support and protect the proposed wharf, as detailed in the following sections. A plan view identifying the location and extent of marine structures is seen in Pre-FEED Drawing S-01.

30 MT/m² Wharf

Based on industry input, one continuous heavy load wharf, with a 1,310 feet length to accommodate two design vessels, is included in the Port of Albany Pre-FEED. The wharf was designed to support 30 MT/m² ~6,000 PSF) live load. A steel sheet pile bulkhead, in conjunction with the wharf, is included in the design to function as a cut-off wall.

The wharf platform consists of a heavily reinforced concrete slab supported by steel pipe piles. Pile bents are spaced every 3.2 m (10.5 ft.) on center. A cutoff wall is provided approximately 20 m (65 ft.) landward from the offshore face of the wharf. The cutoff wall effectively decreases the necessary width of pile-supported wharf. A cross-section of the heavy load wharf that identifies its extents, as well as its components' (piles, concrete deck, etc.) sizing, elevations, and location is shown in Pre-FEED Drawing S-02.

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 face of the heavy load wharf. Both systems are assumed to be installed every 65 feet on center.

A stone revetment beneath the proposed wharf (1,310 LF in length) is included in the Pre-FEED. The revetment will stabilize the slope under the wharf and protect from scour. The revetment consists of two layers of primary stone on top of an underlayer; at the base of the revetment, an embedded toe design was incorporated to prevent scour. Revetment elevations, stone sizing, layer thickness, and toe design can be seen in Pre-FEED Drawing S-02.

3.3 Earthwork and Ground Improvement

Design Platform Elevation

As discussed in the Design Basis (Appendix A), the design platform elevation was investigated through a comparison of several guidance, but ultimately determined based on minimization of material (fill) cost. The existing average elevation of the site is +13.4 feet NAVD88. To minimize total earthwork quantities, with inclusion of the proposed surface treatment (see Section 3.4), the design platform elevation was determined to be +16.4 feet NAVD88.

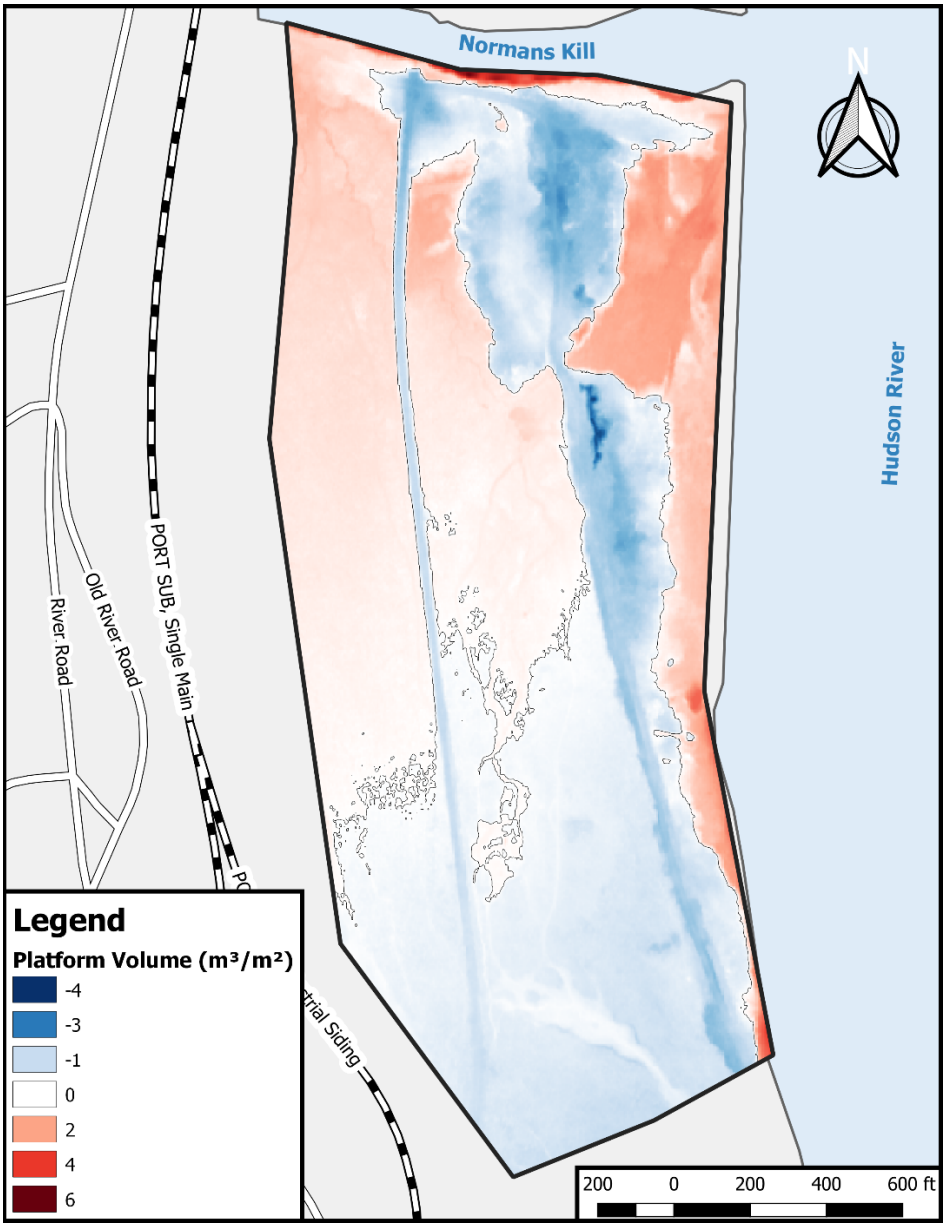
Grading

The existing elevation of Port of Albany is relatively flat. However, grading the site is proposed as part of the process to prepare for ground bearing capacity improvements and to meet the site's design elevation. As described in section 3.1.1., the design level surface at elevation of +13.5 feet NAVD88 was designed to minimize net cut/fill volumes, in order to reduce the need to dispose of, or purchase, fill material. 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 the Ground Improvement and Surface Treatment sections.

Grading the site to the design level surface elevation results in a net fill volume of approximately 8,150 CY. The net volume is derived from an anticipated gross cut volume of approximately 126,060 CY and a gross fill volume of approximately 134,210 CY; this design assumes that cut material is of sufficient quantity to be reused on site. The areas designated for cut and fill are shown in Figure 4.

Figure 4. Proposed Earthwork Volume

Source: New York State



Ground Improvement

Due to the subsurface conditions at the Beacon Island site, a ground improvement campaign is required for the upland portions of the site to support the vertical live loads from offshore wind components. Based on the site's geotechnical properties and design loads, a combination of ground improvement methods is included in the Pre-FEED, including rigid inclusions and dynamic compaction. Additionally, pipe piles at the site's offshore extents prevent shoreline slope failure and allow for placement of live load near the shoreline.

Rigid inclusions are modulus-controlled columns that function by transferring vertical applied loads through weaker soils to more competent soils below. The rigid inclusions proposed for the Port of Albany consist of controlled low-strength material (CLSM) concrete columns that are installed at regular intervals in two directions at the least competent areas of the site. Ground improvement by means of rigid inclusions are adopted for parts of the site where ash fill and/or river sediments are present at shallow depth.

Dynamic compaction is a ground improvement technique for the platform area that densifies soils by using a weight of known mass being dropped repeatedly by a crane from a prescribed height. The underlying sediments are compacted due to the impact of the weight. Ground improvement by means of dynamic compaction is well suited for granular materials. Hence, the method is adopted for parts of the site where miscellaneous fill consisting of sand, silt and gravel are present at shallow depth.

The ground improvement approach varies depending the soil conditions, while the quantities for the ground improvement varies depending on both the soil conditions and the load requirement per site area. For the 15 MT/m² (3,000 PSF) area of the site, a combination of rigid inclusions and dynamic compaction is required. Rigid inclusions are to be installed over two-thirds of the area, spaced at 2.5 m (8.2 ft.) on center in both directions, while one-third of the site will use dynamic compaction. For the 30 MT/m² (6,000 PSF) area of the site, rigid inclusions spaced at 1.7 m (5.6 ft.) on center in both directions is required. For details on ground improvement methods, see Pre-FEED Drawings S-01 and S-03.

To stabilize the existing shoreline from both local and global failures, steel pipe piles will be installed along 365 m (1,200 ft.) of the shoreline, in locations adjacent to storage areas, except in the length of shoreline which is stabilized by the installation of the wharf is located. Pipe piles will also be located along a portion of the site's north shoreline, extending 80 m (260 ft.) from the northeast corner of the site based on the westerly extent of the 30 MT/m² area. Three rows of pipe piles spaced at 3 m (10 ft.) in both directions are proposed. For more detail, see Pre-FEED Drawings S-01 and S-03.

3.4 Surface Treatment

Crushed stone is used for providing a surface treatment for operations in both the 15 MT/m² (3,000 PSF) and 30 MT/m² (6,000 PSF) areas of the site. Crushed stone is placed on top the site's design grade elevation (4.1 m or 13.5 ft. NAVD88) at a thickness of 0.9 m (3 ft.). This is sufficient to distribute loads to the soils and/or rigid inclusions below. Some settling of the stone is expected over the life of the facility,

especially early into the operational phase. The crushed stone surface is readily repairable by minor grading or fill with new stone.

The thickness of crushed stone was applied over the total platform area to determine the quantity of stone required. Compacted bank run gravel, 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.

3.5 Dredging

Berth Dredging

Vessels are anticipated to berth at the location of the heavy load wharf along the north shoreline of the site in parallel to the Hudson River Federal Navigation Channel. The berthing area, as well as the slope under the wharf to accommodate the revetment to be installed, will be dredged.

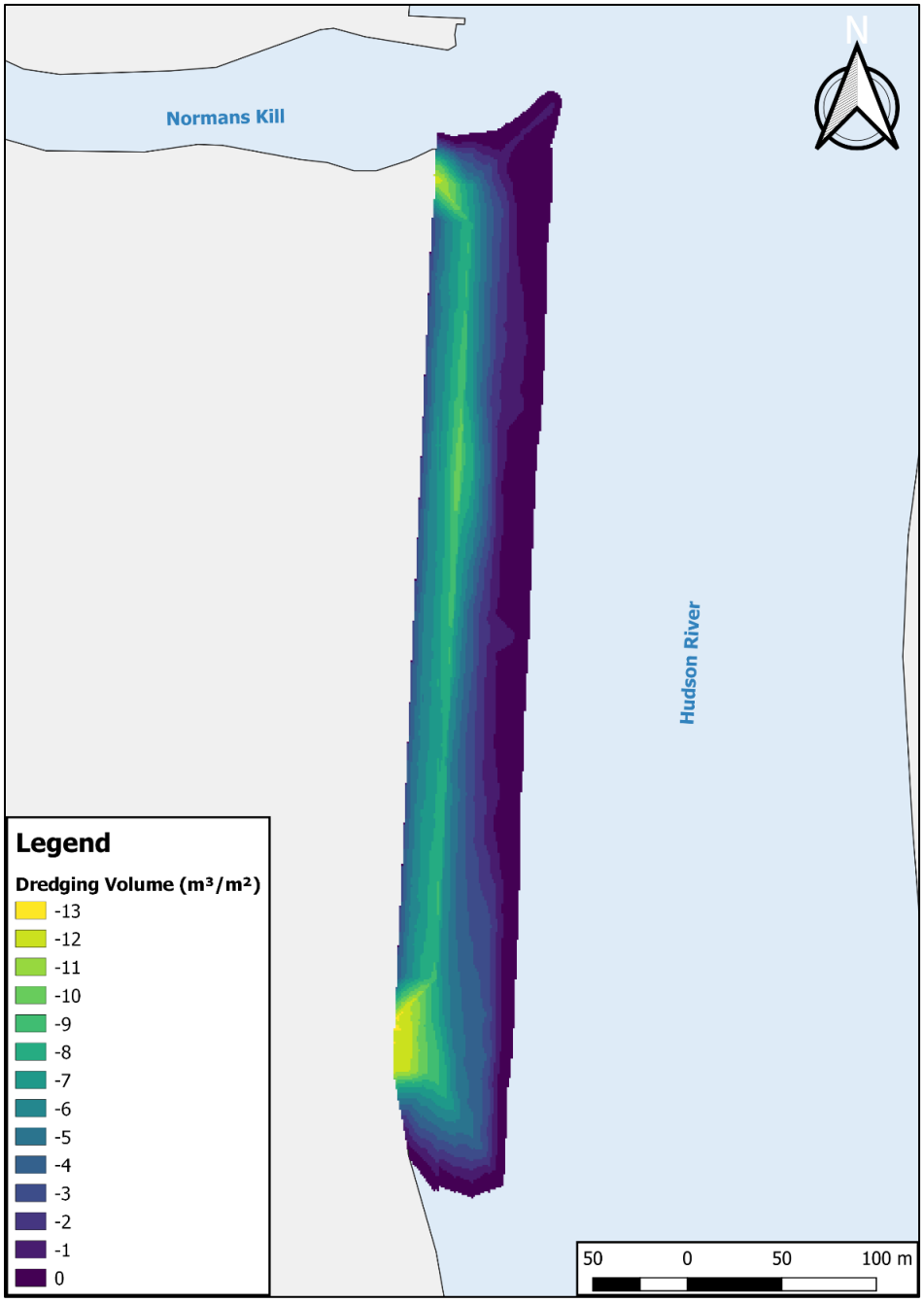
From west to east, the dredge footprint at the site extends from the face of the berth to the Hudson River channel. From north to south, the dredge footprint extends 470 m (1,550 ft.), spanning the length of the proposed wharf with the inclusion of buffers at the north and south wharf extents. The dredge footprint also includes 45-degree angle flares extending from its landward extent to the offshore extents of the footprint to accommodate approaching vessels. The design dredge elevation matches the authorized depth of the Hudson River at -10.3m (–33.8 ft.) NAVD88. See Pre-FEED Drawings S-01 and S-02 for information on proposed dredging conditions.

Dredge volumes were calculated using the design dredge extents and difference in elevation between the planned dredge elevation and the site's existing bathymetry. The resulting berth dredge volume was found to be 162,380 m^3 (212,390 CY). Dredging volume per area is shown in Figure 5.

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 5. Proposed Design Dredging Area

Source: New York State



Channel Dredging

The authorized depth of the Hudson River Federal Channel (-10.3m or –33.8 ft. NAVD88) is the responsibility of the U.S. Army Corps of Engineers (USACE). Therefore, existing depths in the project site vicinity were considered 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 and up the Hudson River. This navigation route includes travel beneath several bridges, including the Castleton, Alfred H. Smith Memorial, Rip Van Winkle, Kingston-Rhinecliff, Poughkeepsie, Mid-Hudson, Newburgh-Beacon, Bear Mountain, Tappan Zee, George Washington, and Verrazano-Narrows Bridges. The controlling air draft restriction posed on the Port of Albany site is due to the Mid-Hudson Bridge, having a clearance of 40.8 m (134 ft.). Water depths are limited by the Hudson River authorized dredging depth of -9.8 m (-32 ft.) MLLW.

4.2 Environmental Permitting

Port facilities will likely require either upland or shoreline improvements or both, in order to support offshore wind development. As such, the port developer or 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 with 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 are as follows (though some may be added or subtracted as plans develop):

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 provided the following information inform potential development at SBMT:

Permitting Considerations
Federally Regulated Wetlands and Other Waters of the U.S.
Submerged Aquatic Vegetation (SAVs)
Significant Coastal Fish and Wildlife Habitat (Normans Kill)
Threatened and Endangered Species (Shortnose Sturgeon, Bald Eagle)
Mitigation will be required to compensate for wetland and habitat loss

Other Considerations
The facility is located on Cabbage Island and nearly the entire island is mapped as federal wetlands
Potentially contaminated sediments in the Hudson River

Figure 6. NYS DEC Environmental and Permitting Considerations Map

4.3 Benefits

- Significant area available for OSW 28 hectares (69.3 acres).
- Adjacency to city of Albany and the Port of Albany infrastructure
- Good transportation (railroad, road, water) access
- Existing site elevations very close to proposed platform elevation, requiring relatively limited grading operation
- Owner is completing site investigations in preparation for redevelopment

4.4 Challenges

- The ground conditions at the site are soft, consisting of fill (ash and miscellaneous), river sediments, alluvial sands, and normally consolidated glacio-lacustrine (silt and clay) deposits to great depth (underlain by bedrock). Significant ground bearing capacity improvements are required to support large live loads.
- Potential regulatory challenges due to wetlands on site.
- Site is not developed and requires additional preparation (e.g., temporary roads) prior to development.
- Low limiting air draft of 40.8 m (134 ft.) of the Mid-Hudson Bridge may limit operations at the site by restricting maximum OSW component height or requiring vessels to transport the components horizontally.

4.5 Risks

- Depth to bedrock is very uncertain based on the currently available site investigation campaign. Further, no tests are available for characterization of the properties of bedrock. This provides an uncertainty for the required pile length for the piles below the wharf.
- No boreholes or cone penetration tests are available in the Hudson river. Hence, the variation in stratigraphy near the shore is unknown, resulting in a significant risk for the stability calculation.

These risks may also provide room for optimizations, should the ground conditions prove less onerous than anticipated for Pre-Feed.

4.6 Optimizations

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

- For the areas of the site where rigid inclusions are planned, alternative ground improvement methods, such as preloading in combination with vertical drains and possible (vacuum loading), could be adopted. For the detailed design, the preferred solution should be selected considering the restrictions of the project in terms of costs and time.
- There is a potential for reducing the costs of the geotechnical structures, and in particular, the costs for the rigid inclusions by performing further ground investigations providing a better characterization of the stratigraphy across the site.
- Currently, no advanced laboratory tests are available. Hence, soil properties have been determined conservatively based on standard SPT and CPT correlations. Advanced laboratory tests will likely provide room for optimization of the soil properties for design.

5 Opinion of Probable Cost

An 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 on the ultimate use of the facility and improvements needed to facilitate that use.

The OPC for the Port of Albany Pre-FEED was developed using similar methods as marine contractors. COWI develops OPCs 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 where unit pricing was used. Direct wage rates and fringe benefit rates for all labor are consistent with current Prevailing Wage rates for Albany County as published by the New York State Department of Labor. 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, including 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; therefore, 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 competitive bidding or market conditions. The OPC provided herein 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	QUANTITY	UNITS	UNIT PRICE	TOTAL
Mobilization and De-Mobilization				
Mobilization and Demobilization	1	Lump Sum	$1,444,000.00	$1,444,000.00
Demolition, Clearing, and Grubbing				
Clearing and Grubbing	279,710	Square Meter	$1.92	$536,000.00
Marine Structures				
30T/m² Pile Supported Wharf	13,920	Square Meter	$8,660.70	$120,557,000.00
Earthwork and Ground Improvement				
Upland Excavation above MHW	96,380	Cubic Meter	$16.55	$1,595,000.00
Upland Fill above MHW	102,610	Cubic Meter	$5.39	$553,000.00
Rigid Inclusions and Dynamic Compaction	279,710	Square Meter	$177.09	$49,533,000.00
Shoreline Slope Stabilization	450	Linear Meter	$37,866.67	$17,040,000.00
Surface Treatment				
Gravel 30T/m² Staging Area	273,670	Square Meter	$119.10	$32,593,000.00
Dredging				
Berth Dredging	162,380	Cubic Meter	$111.19	$18,055,000.00
Subtotal				**$241,906,000.00**
		Design and Construction Contingency	30%	$72,571,800.00
Total				**$314,478,000.00**

5.1 Exclusions

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

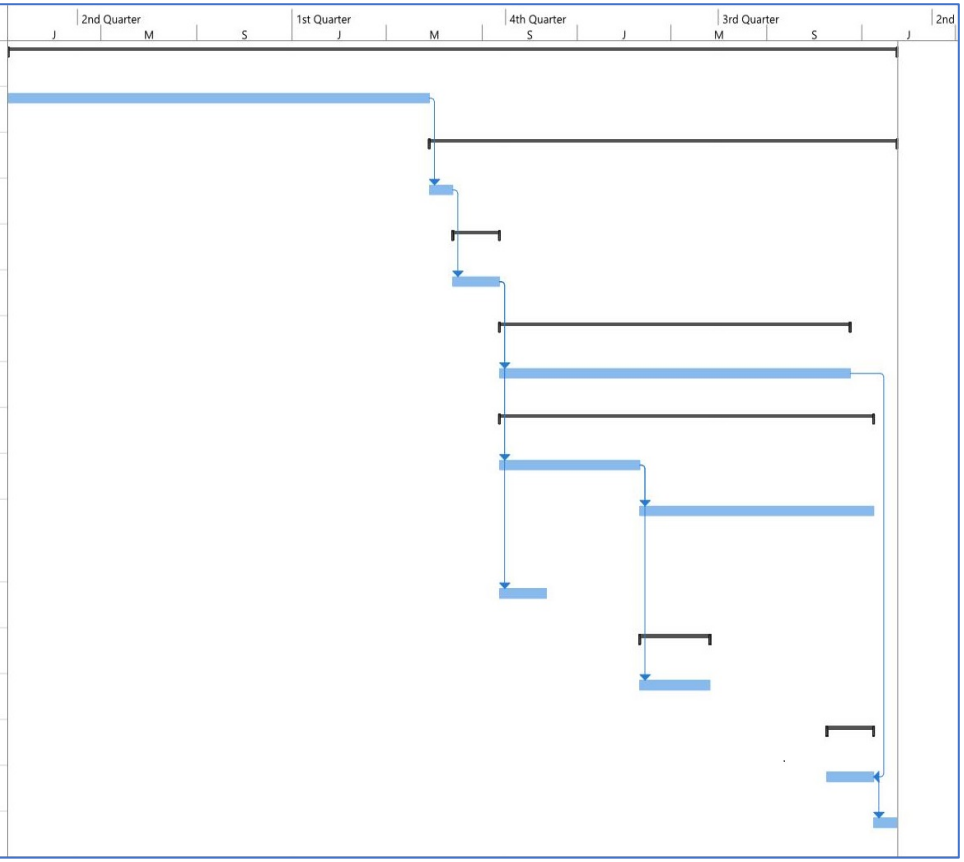
- Utilities
- Public access
- Operating infrastructure and equipment
- Site acquisition costs
- Permits and permit acquisition fees
- Professional services (design, regulatory, legal, etc.)
- Construction management fees
- Environmental mitigation/remediation
- Excavated soils are assumed to be clean—no disposal costs were accounted for

6 Schedule

An estimate schedule was prepared for the key improvements developed for the Pre-FEED. As noted in Sections 1.2, 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 7 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 7. Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	**PROJECT TOTAL**	**38 mons**	**Wed 1/2/19**	**Tue 2/15/22**	
2	**Planning, Engineering and Permittir**	18 mons	Wed 1/2/19	Thu 6/25/20	
3	**Construction Phase**	**20 mons**	**Thu 6/25/20**	**Tue 2/15/22**	
4	**Mobilization**	1 mon	Thu 6/25/20	Sat 7/25/20	2
5	**Demolition, Clearing**	**2 mons**	**Sat 7/25/20**	**Wed 9/23/20**	
6	Clearing and Grubbing	2 mons	Sat 7/25/20	Wed 9/23/20	4
7	**Marine Structures**	**15 mons**	**Wed 9/23/20**	**Fri 12/17/21**	
8	30 MT/SM Relieving Platform	15 mons	Wed 9/23/20	Fri 12/17/21	6
9	**Earthwork & Ground Improveme**	**16 mons**	**Wed 9/23/20**	**Sun 1/16/22**	
10	Grading	6 mons	Wed 9/23/20	Mon 3/22/21	6
11	Rigid Inclusions and Dynamic Compaction	10 mons	Mon 3/22/21	Sun 1/16/22	10
12	Shoreline Slope Stabilization	2 mons	Wed 9/23/20	Sun 11/22/20	6
13	**Surface Treatment**	**3 mons**	**Mon 3/22/21**	**Sun 6/20/21**	
14	Crushed Stone	3 mons	Mon 3/22/21	Sun 6/20/21	10
15	**Dredging**	**2 mons**	**Wed 11/17/2**	**Sun 1/16/22**	
16	Berth Dredging	2 mons	Wed 11/17/21	Sun 1/16/22	8FF+1 mon
17	Demobilization	1 mon	Sun 1/16/22	Tue 2/15/22	16



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

[4] Klokan Technologies GmbH, "EPSG:6347," 7 6 2013. [Online]. Available: https://epsg.io/6347.

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

[6] USACE, "FACT SHEET-Hudson River, NYC to Waterford, NY Maintenance Dredging," February 2018. [Online]. Available: http://www.nan.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/487349/fact-sheet-hudson-river-nyc-to-waterford-ny-maintenance-dredging/.

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

[8] NOAA, "Datums for 8518995, ALBANY, HUDSON RIVER NY," 15 10 2013. [Online]. Available: https://tidesandcurrents.noaa.gov/datums.html?id=8518995.

[9] NYS DEC, "Coastal New York LiDAR (Hydro Flattened Raster DEM)," 2012. [Online]. Available: http://gis.ny.gov/elevation/metadata/HydroFlattenedRasterDEM.xml.

[10] B. Associates, "Wetlands and Other Waters of the United States Delineation Report," Port of Albany, 2016.

Appendix A: Pre-FEED Design Basis

Table of Contents

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1 Project Description

1.1 Key Infrastructure Improvements

In order prepare the site for use as a manufacturing or fabrication facility, the following key infrastructure improvements are proposed within the Pre-FEED:

- Clear and Grub the site (28 hectares or 69.1 acres) of unmaintained vegetation (e.g., trees, bushes, etc.). Clearing and grubbing will provide access for site grading and ground improvement activities.
- Install marine structures along the waterfront edge 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 the Port of Albany, proposed marine structures include:
    - Construct pile-supported wharf along the shoreline of the site, as shown in Figure 1. The wharf will provide a heavy load capacity berthing area for vessels.
- Improve the ground bearing capacity and grade areas within the site (28 hectares or 69.1 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 2.2). 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.
- Stabilize the shoreline in order to allow live loads to be applied closer to the crest of the existing shoreline slopes.
- Install surface treatment within laydown areas of the site. Crushed stone will be used as surface treatment to accommodate the weight and durability of components and reduce maintenance costs. Surface treatment design may vary depending on the live load requirement.
- Dredge the berthing area to provide sufficient depth for design vessels to safely access the site. Under wharf slope will also be dredged to accommodate the revetment installation. Vessels are anticipated to berth at the location of the heavy load wharf along the north shoreline of the site. The design depth for dredging is discussed in Section 4.11. The limits of dredging extend from the face of the berth to the Hudson River Federal Navigation Channel. The location of the Hudson River extents is shown Figure 1.

The authorized depth of the Hudson River Federal Channel (-10.3 m or –33.8 ft. NAVD88) is the responsibility of the U.S. Army Corps of Engineers (USACE) and is not considered by this Pre-FEED. The minimum depth of the Hudson River channel near the proposed berthing area at the Port of Albany is approximately -9.4 m (-31 ft.) NAVD88 at the site in September 2017 as per the Controlling Depth Report published by USACE [1].

It should be noted that the Port of Albany has great potential to expand its berthing area in later phases due to its extensive waterfront if supporting numerous vessels simultaneously is desired.

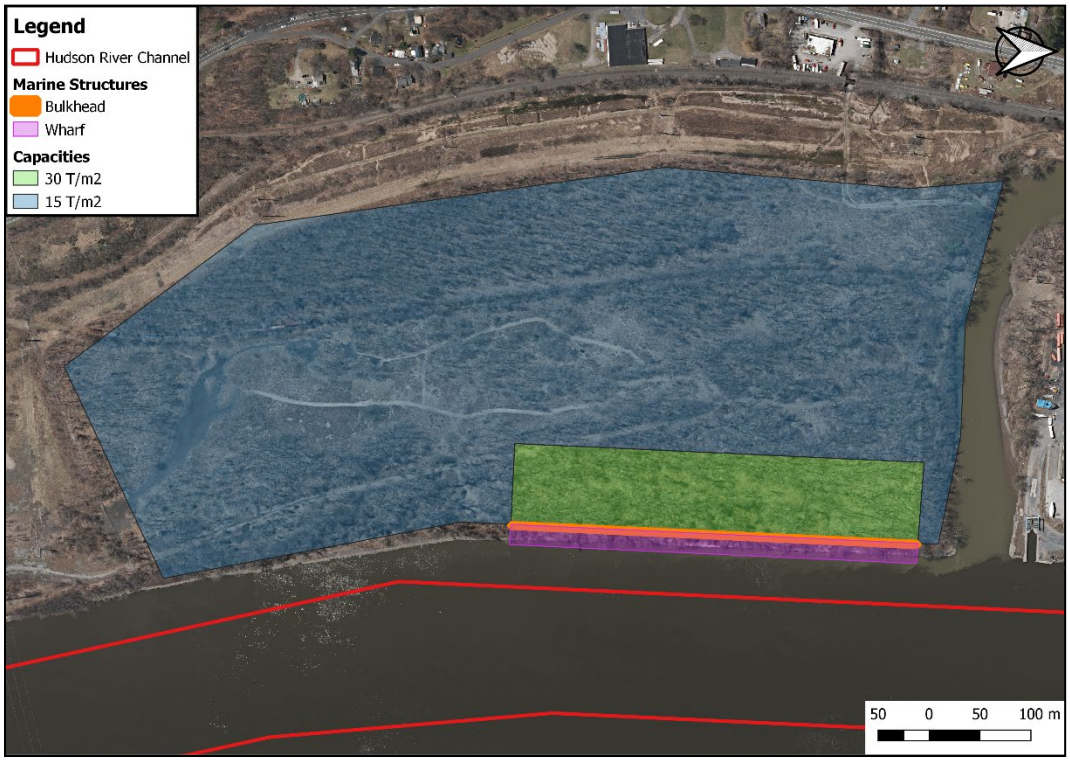
1.2 Definition of Load Areas

The heavy load wharf area will be along the northeastern corner of the site 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 manufacturing or fabrication activities and required equipment.

Figure 1. Proposed Structures and Load Areas

Source: USGS

The proposed revetment that will run beneath the proposed wharf is not included here for image clarity.



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
- 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 establish existing site elevations to prepare infrastructure design and estimate dredging and earthwork quantities for the purpose of material and cost estimation. The Coastal New York LiDAR Hydro Flattened Raster DEM dataset [2], a part of the Hudson River Estuary Program, will be used to develop the part topo-bathymetric model above Mean High Water. The Hudson River Condition Survey 4531, Survey dates February 3, 2017 to 22 February 2017 by the USACE [3] will be used to develop the bathymetry of the site topo-bathymetric model.

It should be noted that there is a coverage gap between the LiDAR and Condition Survey datasets; publicly available data that captured the gap between these datasets was not found. Therefore, the elevations of this area will be estimated through interpolation between the extents of the available datasets.

3.2 Tidal Datums

Tidal Datums for the Port of Albany are based upon USGS Station 01359139 Hudson River at Albany, NY [4], located approximately 5 km (3 mi) north of the project site. This gauge was chosen because it is the closest gauge in proximity to the site with published tidal data. These tidal datums will be used in defining the design platform elevation as well as the design dredge elevation.

Table 1. Tidal Datums

Tidal Datum	NAVD 88	MLLW
Mean Higher High Water (MHHW)	1.15m (3.78 ft.)	1.70m (5.58 ft.)
NAVD '88	0.00m (0.00 ft.)	0.55m (1.80 ft.)
Mean Lower Low Water (MLLW)	-0.55m (-1.80 ft.)	0.00m (0.00 ft.)

3.3 Relative Sea-Level Rise

Relative sea-level rise (RSLR) was calculated for each site, as part of the design berth elevation analysis. RSLR calculations used NOAA data to account for RSLR from 1992–2002 and Climate Change in New York State by NYSERDA (ClimAID) [5] data for Region 5 (Troy Dam) to account for RSLR from 2002–2070. Year 1992 is the baseline for the RSLR calculation because it is the middle of the current tidal epoch (1983–2001). The total design RSLR value was obtained as a sum of 1992–2002 SLR (NOAA) and 2002–2070 SLR (ClimAID). Low (10th percentile), middle (75th 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 ClaimAID high estimate.

Table 2. Relative Sea-Level Rise

RSLR	1992–2002[a]	2002–2070[b]	1992–2070
Low Estimate	0.03m (0.09 ft.)	0.22 m (0.72 ft.)	0.25 m (0.82 ft.)
Middle Estimate		0.77 m (2.52 ft.)	0.80 m (2.62 ft.)
High Estimate		1.14 m (3.73 ft.)	1.17 m (3.83 ft.)

Note(s):

a As per mean RSLR trend provided by NOAA for Station 8518750, The Battery, NY; 2.93 mm/yr. [6].

b As per ClimAID RSLR estimates for Region 5 (Troy Dam) [5].

3.4 Waves

Wave activity will inform the design platform elevation as well as the revetment design. Due to the site's location on the Hudson River, vessel generated wake waves will likely be controlling. Wake wave data, based on typical vessels, was obtained from the Engineering Manual 1110-2-1100 [7]. Using this guidance, the maximum vessel generated wave height at a distance of 30 m (98 ft.) is 0.9 m (3 ft.).

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 prediction station is the Port of Albany NOAA prediction station HUR0618 [8], which is located approximately 2.3 km (1.5 mi) north of the project site. Average currents at a depth of 9.1 m (30 ft.), based on one year of data (2018), can be used as a point of reference for typical conditions:

- ebb: -0.47 knots
- flood: 0.39 knots

3.6 Wind

The location and elevation of the Pre-FEED structures is 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 (ATC) [9] 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 10 m or 33 ft. above ground) at Port of Albany is 41.1 m/s (92 mph).

3.7 Snow and Ice

Vertical loads due to snow and ice loads are less than the design live loading and should not occur simultaneously. Therefore, snow and ice loads do not control the design of marine structures in this Pre-FEED.

The Applied Technology Council (ATC) [9] 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 Port of Albany is 0.2 MT/m² (40 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 (ATC) [9] 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. The National Oceanic and Atmospheric Administration (NOAA) provides air freezing index (AFI) values that can be used to predict ice loads. As a point of reference, the 100-year AFI for the Port of Albany is 1,350-degree F-Days [10].

3.10 Design Platform Elevation

Several alternative methods of determining the design platform elevation have been reviewed, including estimates of existing platform/terrain elevation [2], FEMA base flood elevation [11], and the United Facilities Criteria (UFC) formula [12]. 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	4.05 m (13.28 ft.)
UFC Guidance	3.54 m (11.61 ft.)
Base Flood Elevation	5.49 m (18.00 ft.)

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 upon its intended use, as well as under keel clearance (0.6 m or 2 ft.) and additional allowable overdepth for dredging (0.6 m or 2 ft.).

As a manufacturing or fabrication facility, the Port of Albany may have several types of vessels berthing at the site. Table 4 provides the list of potential vessels their associated characteristics.

Table 4. Design Vessel Characteristics

	Heavy Lift Cargo Vessel[a]	Transport Barge[b]	Inshore Feeder Barge[c]
LOA	152.6m (501 ft.)	91.4m (300 ft.)	122m (400 ft.)
Beam	27.4m (90 ft.)	17.1m (56 ft.)	36.6m (120 ft)
Operational Draft	8.1m (27 ft.)	3.7m (12 ft.)	8m (27 ft)

Note(s):

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

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

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

3.12 Design Depth

Based on the design vessel characteristics, the design depth, including under keel clearance and allowable over depth allowance for dredging, would be 9.4 m (31 ft.); however, due to the site's location, a design depth of 10.3 m (33.8 ft.) NAVD88 will be used to match the Hudson River.

3.13 Geotechnical Conditions

For the evaluation of the geotechnical conditions and characterization of the soil properties the supplemental geotechnical report of Dente Group [13] dated July 2017 has been assessed. The following geotechnical field and laboratory works have been performed and presented in Reference 13:

- Two test borings (SB-1 and SB-2) have been performed by ACME Boring. The borings are performed at the north and south ends of Beacon Island, respectively, and to depths of 18.9 m

(61.5 ft.) to 24.4 m (80.8 ft.) below ground surface, respectively. The borings were accompanied by a series of SPTs. Two odometer tests and two index properties tests of soil samples that have been obtained from SB-1 have also been performed.

- Five cone penetrometer tests (SCPT-01, SCPT-02, CPT-03, SCPT-05, SCPT-06) have been performed by ConeTec. Shear wave velocity testing at four of these locations have also been performed. The CPTs are located across the site of Beacon Island providing a good coverage of the variation in soil conditions. The CPTs are performed to varying depths of 18.9 m (61.8 ft.), 25.9 m (84.7 ft.), 44.2 m (144.4 ft.), 34.4 m (112.5 ft.) and 25.0 m (82.0 ft.) below ground level for SCPT1, SCPT2, CPT3, SCPT5 and SCPT6, respectively. Four of these cone penetrometer tests (SCPT-01, SCPT-02, SCPT-05 and SCPT-06) include measurement of the shear wave velocity (so-called seismic CPTs).

The locations of the mentioned CPTs and borehole logs are presented in Figure 2 also shows eight borehole locations (B-1 to B-8) and three well locations (MW-1 to MW-3) performed by CME Associates (February 2017) prior the above-mentioned Dente Group site investigation. It should be noted that the Dente Group report [13] does not include the borehole logs from the CME Associates site investigation. The Dente Group report [13] presents two generalized cross-sections (Figures 3 and 4) in north-south and west-east directions. For these cross-sections, the CME Associates boreholes have been taken into consideration. As such, the interpretation of the CME Associates boreholes is only based on what it is presented in the Dente Group report [13].

Figure 2. Overview of Borehole and CPT Locations

Source: The figure is extracted from Reference [13].

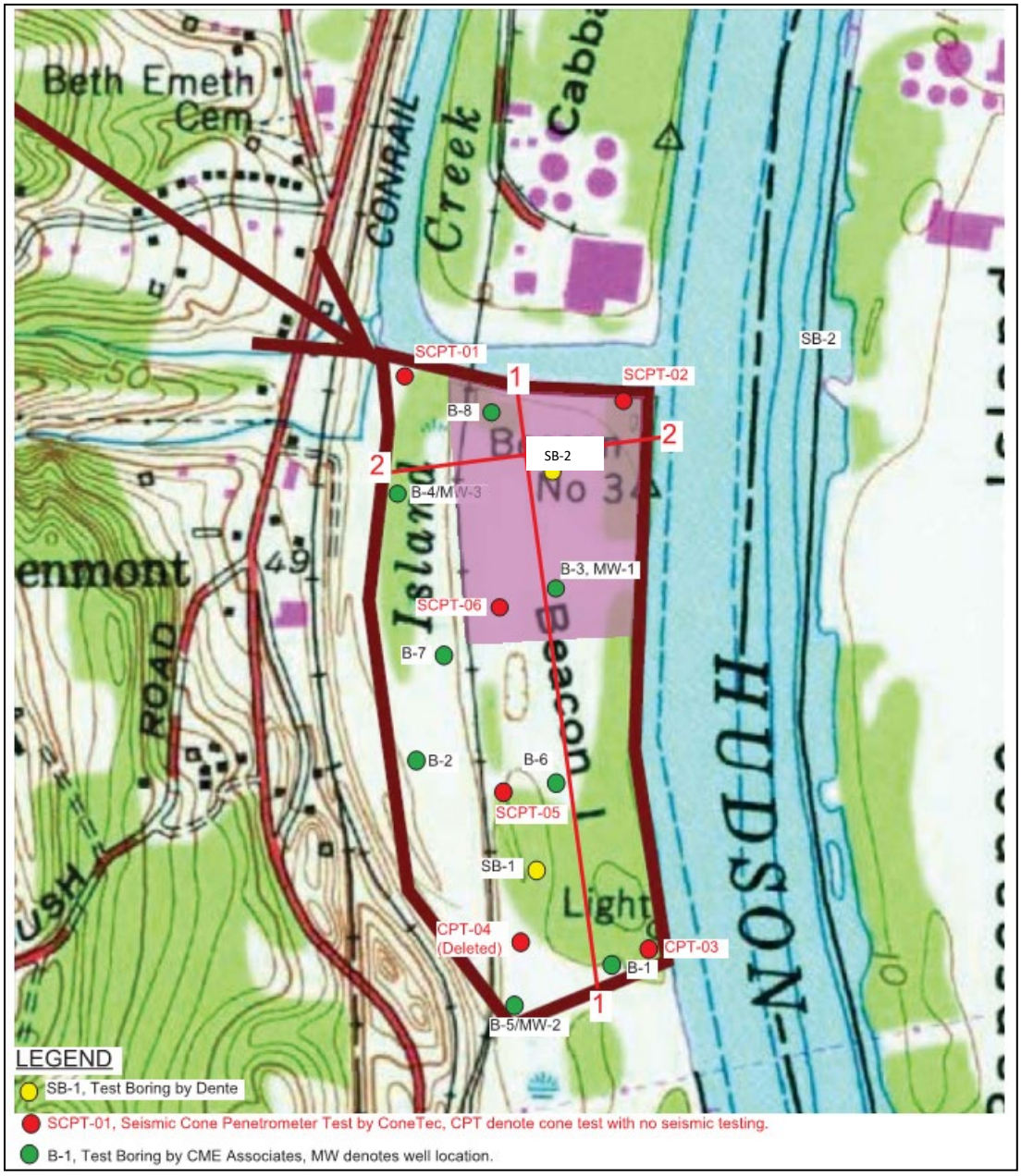


Figure 3. Generalized North-South Section Through the Site

Source: The figure is extracted from Reference [13].

Line of cross-section is indicated on Figure 3.

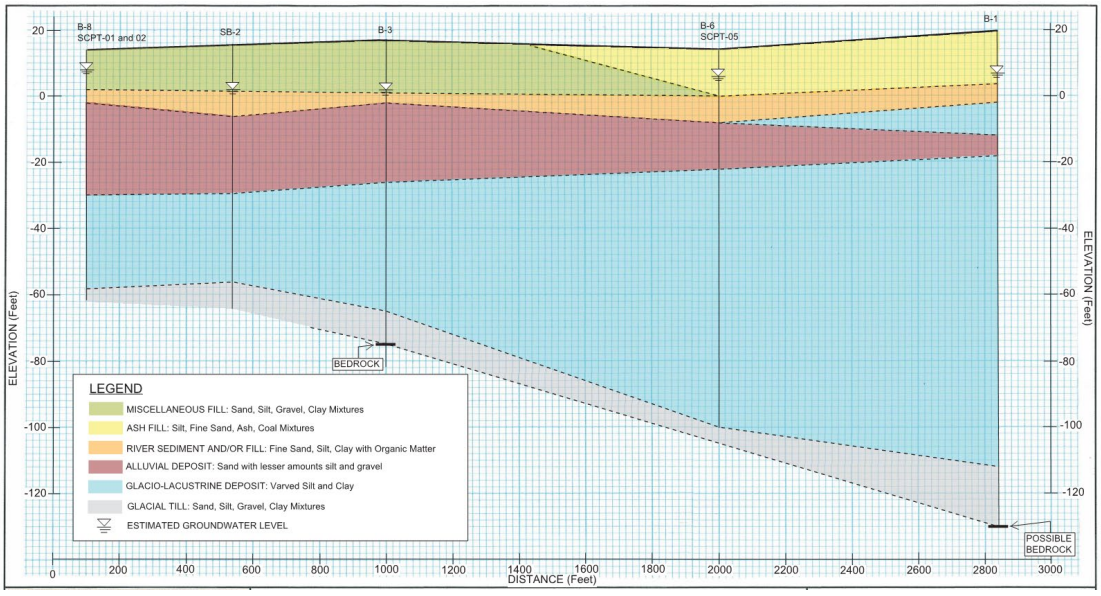
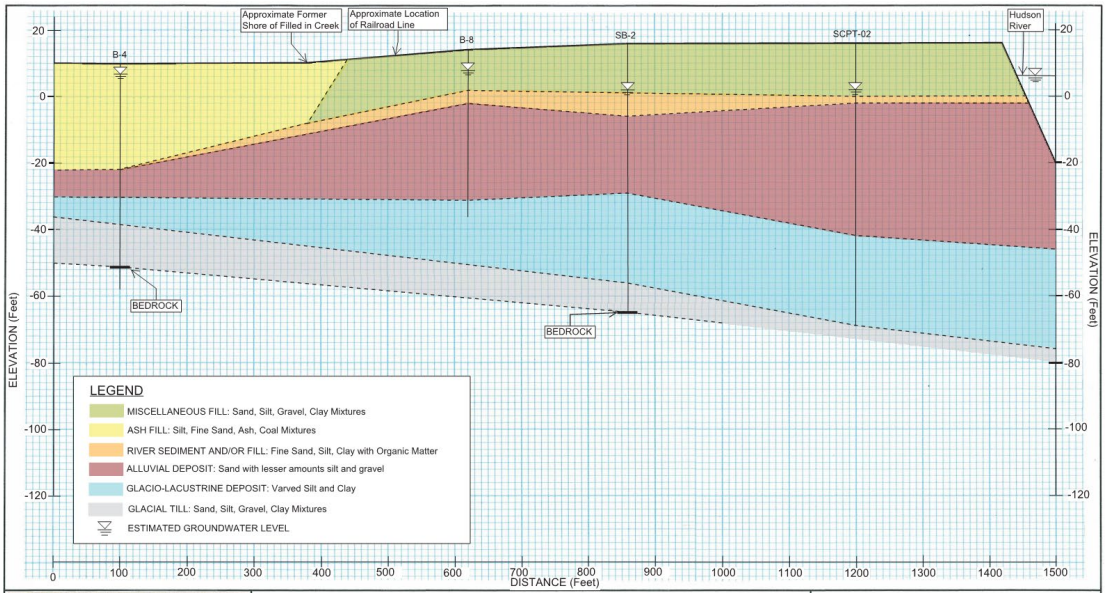


Figure 4. Generalized West-East Section Through the Site

Source: The figure is extracted from Reference [13].

Line of cross-section is indicated on Figure 3.



Digitized corrected cone tip resistance traces (data were only available in hardcopy) and simplified cone tip resistance traces are presented in Figure 5 while the stratigraphy and the SPT N-values from boreholes SB-1 and SB-2 are presented in Table 5. It is noted that repeated SPT-N values of zero are measured in the Glacio-lacustrine deposits. This indicates that the material is soft, which is also the conclusion from the CPT measurements. However, values of zero are not reasonable for the depths where material is present, and the zero values are considered to be affected by drilling disturbances

(which is likely due to the silt content in the material). The properties of the Glacio-lacustrine deposits are therefore mainly derived based on the CPT measurements.

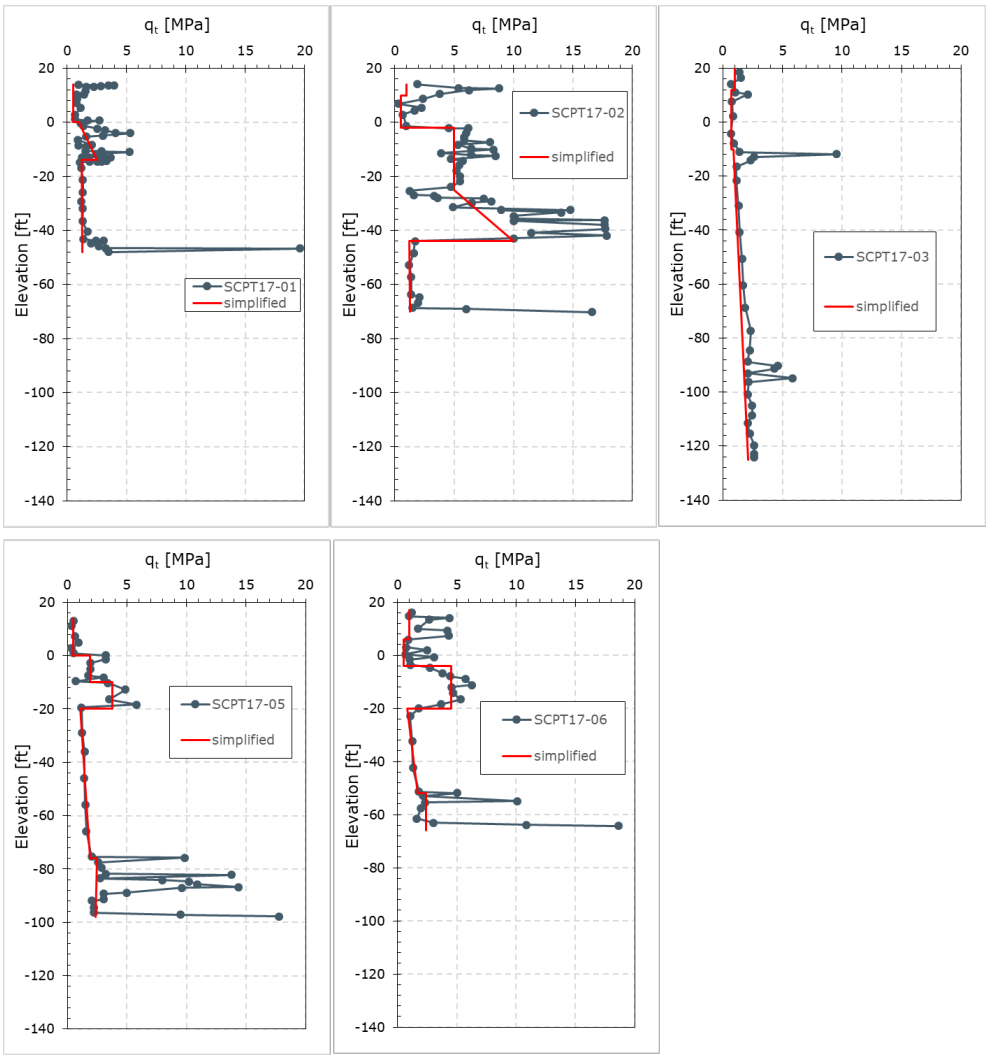
Table 5. SPT N-Values in Boreholes SB-1 and SB-2

SB-1			SB-2		
Layer	**Elevation centre**	**SPT - N**	**Layer**	**Elevation centre**	**SPT - N**
	[ft]			**[ft]**	
Ash fill	16	1	Miscellaneous fill	10	1
River sediment; Silt traces of sand and organic matter	14	0		13	10
	12	0		11	11
	10	0		9	24
	8	0		7	12
	6	0		5	12
	4	0		3	12
Alluvial; Sand	2	2	River sediment; Silt traces of clay and organic matter	1	7
	0	5		-1	5
	-2	1		-3	0
	-4	2	Alluvial; Sand	-5	1
	-9	7		-10	6
	-14	3		-15	7
Glacio-lacustrine deposit; Silt and Clay	-19	0		-20	10
	-24	0		-25	6
	-29	0	Glacio-lacustrine deposit; Silt and Clay	-30	3
	-34	0		-35	0
	-39	0		-40	0
	-44	0		-45	0
				-50	2
				-55	0
			Glacial till; Sand silt gravel	-60	70

The inspection of the CPT traces and the generalized cross sections, as presented in Figures 3 and 4, revealed a general soil stratigraphy within the boundaries of the site that comprises various fill materials overlying alluvial deposits (mainly sandy material). Below glacio-lacustrine silt and clay is present followed by glacial till and bedrock.

Figure 5. Corrected Cone Resistance (Qt) and Simplified Qt Profiles

Source: Digitized from Reference [13]



In general, the ground surface is higher toward the east side of the site (next to the River) and slopes down toward the west.

Different fill materials have been identified in Reference 13. With the information available for the preparation of this report, all superficial material is treated as fill. Any further diversification would impose unnecessary complications at this stage of the project. The fill materials vary in depth throughout the site, but they consistently appear to be very poor in strength properties as this is indicated by the very low SPT values and the CPT traces. Below the fill material, a layer of river sediments is found with a thickness of 0 to 10 feet. On the CPT traces, it has not been possible to differentiate between fill materials and the river sediments. It is noted that the river sediments contain organic material (three measurements are available showing organic content in the range of 5-19 %). Also, it is noted that the water content ranges between 40% and 100% in the river sediment.

The presence of the alluvial sand can be identified with increased cone tip resistance in the CPT traces (see Figure 5). The alluvial sand deposit has also a varied thickness. It seems that it is thicker in the

north-east corner of the site decreasing in thickness towards West and South. The alluvial sand seems to be only a couple of feet deep in CPT-03. In SCPT-02 the layer is almost 12 m (40 ft.) thick, while in the rest of the site the thickness varies from below 3 m (10 ft.) up to 8.5 m (28 ft.) according to Figures 3 and 4. In SCPT-02, where the alluvial sand is thickest, it appears to be in a denser state in the bottom part of the layer.

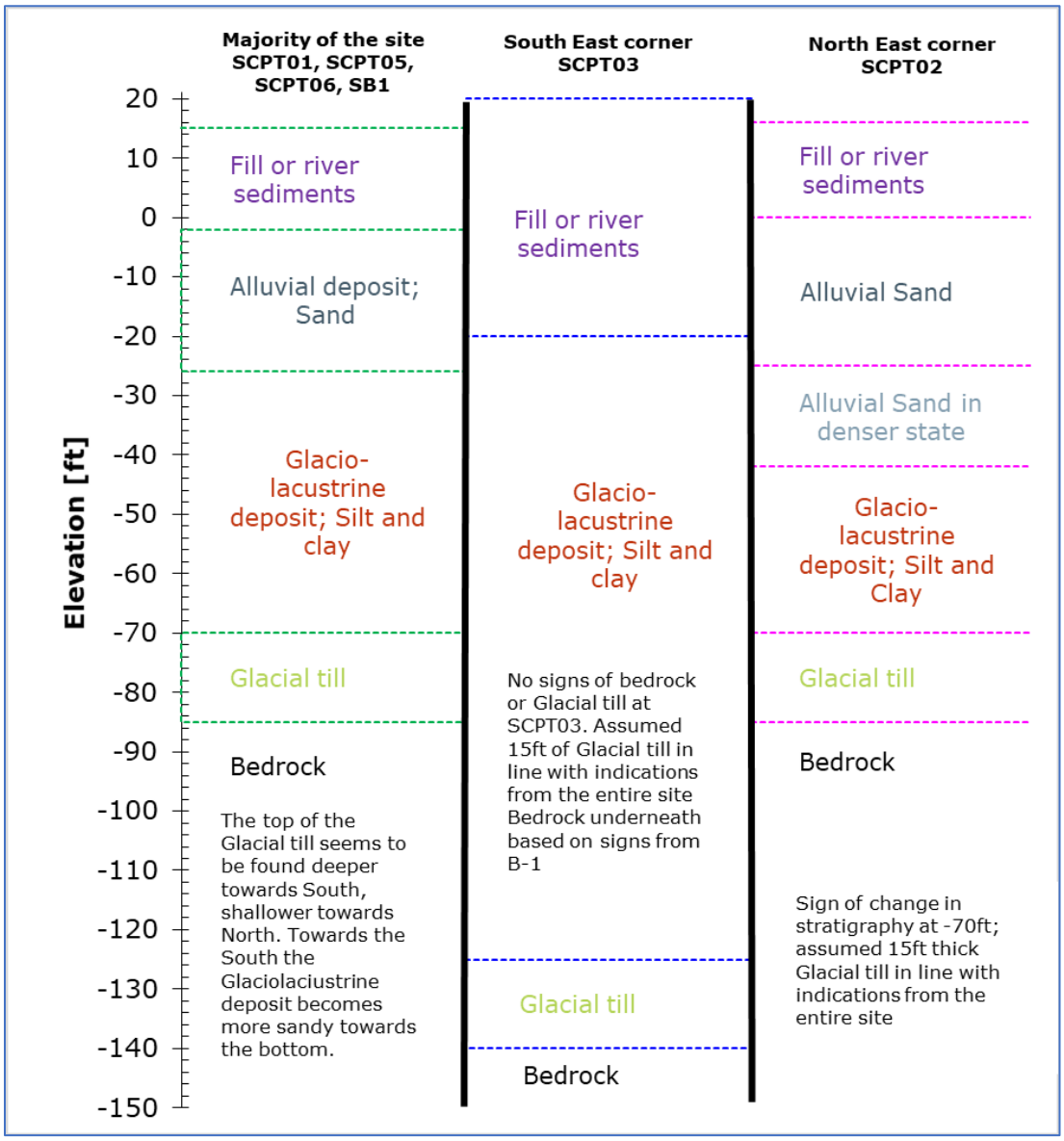
The glacio-lacustrine silt and clay is generally identified in the CPT traces by the very low cone resistance traces, which are also accompanied by substantial pore water pressure build-up. It seems this layer is also present in all the borehole logs as those were interpreted and presented in Reference 13 and repeated herein in Figures 3 and 4. In general, the top of layer varies in conjunction with the thickness of the overlying alluvial sands. The layer is found deeper in the north-east part of the site (around -12 m to -14 m or -40 ft. to -45 ft. elevation) and shallower at the south-east part of the site (around -6.1 m or -20 ft. elevation). In the rest of the site the top of this layer is located at an elevation of approximately -6.7 m to -9.0 m (-22 ft. to -30 ft.). The bottom of this layer is identified in the majority of the CPT traces (apart from SCPT-3) and it seems that it is also confirmed from the borehole logs (see Figures 3 and 4). In general, it appears the layers dip toward the south.

The change from glacio-lacustrine deposit to glacial till is identified in the CPT traces with a pick-up in the cone tip resistance as already mentioned above. This seems to agree well with what is presented in Figures 3 and 4 from the borehole logs. There are only very few locations that the bottom of this layer has been identified (B-3, B-4, and SB-2), and from these, the layer appears to be around 4.5 m (15 ft.) deep. In the remaining CPT's and borings, the investigation point only extend a short distance into the layer of Glacial Till and these can therefore not provide information on the thickness of the layer.

With an inherent conservatism, it is proposed to adopt three representative soil profiles, one based on the north-east part of the site (focusing on the coastline), one based on the south-east part of the site (focusing on the coastline), and one considered representative for the western part of the site (upland part). The representative soil profiles are presented in Figure 6.

Figure 6. Representative Soil Profiles

For locations of geotechnical investigations, see Figure 3.



The Pre-FEED design will be performed using the representative soil profiles. The ground water level is believed to vary with seasonal fluctuations and the tidal variations in the Hudson river. The pore pressure dissipation tests in the CPTs and the wells show a general water level slightly above the mean water level in the Hudson River and a general elevation of around 10 ft. can be assumed for the purposes of the Pre-FEED design. References 14 and 15 were used (where possible) to correlate the SPT-N values measurements and CPT cone resistances to relevant characteristic soil parameters. A generally conservative approach was adopted due to the very limited laboratory data. It is highlighted that in some circumstances, a conservative value was simply assumed based on experience since no correlation was believed to be appropriate. The adopted characteristic soil properties are summarized in Table 6. It should be noted that for the bedrock that underlies the Glacial till, no information available

on the rock properties are available, and as such, similar soil parameters for the Glacial till are proposed to be used in the design calculations. For pile capacity calculations, a unit end bearing of 10 MPa (210,000 PSF) is adopted in bedrock. This value is deemed as a low estimate for a rock material and is considered appropriately conservative considering that no information on the rock properties are available.

Dente Group, cf. [13], have evaluated the risk of liquefaction based on the CPTU measurements. They conclude that liquefaction is not expected to occur, but that the soils may consolidate and experience settlements in the order of one to two inches in response to earthquake motions.

Table 6. Characteristic Soil Properties for Various Layers

Note that for bed rock, similar strength parameters as for Glacial Till are adopted, except for the pile unit end bearing for which a constant value of 10 MPa (20,000 PSF) are applied. The stratigraphy for the three representative profiles is presented in Figure 6.

Layer description	Bulk/ effective unit weight, γ/γ'	Undrained shear strength, s_u	Peak internal angle of friction, φ'	Effective cohesion, c'
	kN/m³ (PCF)	kPa (PSF)	°	kPa (PSF)
Fill material	15/5 (95/30)	-	26	
Alluvial deposit; sand	18/8 (115/50)	-	32	
Alluvial deposit; sand in denser state	19/9 (120/55)	-	35	
Glacio-lacustrine deposit	15/5 (95/30)	40 (840)	28	0 (0)
Glacial till	18/8 (115/50)	150 (3130)	30	15 (310)

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 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 three-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 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 can be any of the following: granite, quartzite, 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 reused 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 OPC.
- Utilities
- Ancillary structures (e.g., office buildings, etc.)
- Operational Infrastructure and Equipment
- Intermodal Connections
- Property Ownership
- Professional services
- Permitting

7 References

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

[2] NYS DEC, "Coastal New York LiDAR (Hydro Flattened Raster DEM)," 2012. [Online]. Available: http://gis.ny.gov/elevation/metadata/HydroFlattenedRasterDEM.xml.

[3] USACE, "Hudson RIver, NY FNP Condition Survey 4531," USACE, 2017.

[4] USGS, "USGS 01359139 Hudson River at Albany, NY," 2018. [Online]. Available: https://waterdata.usgs.gov/usa/nwis/uv?01359139.

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

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

[7] USACE, "Chapter 7: Harbor Hydrodynamics," in *EM 1110-2-1100 (Part II)*, USACE, 2008.

[8] NOAA, "Tides and Currents," NOAA, 2018. [Online]. Available: https://tidesandcurrents.noaa.gov/noaacurrents/Predictions?id=HUR0618_1. [Accessed October 2018].

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

[10] 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].

[11] 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].

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

[13] Dente Group, "Supplemental geotechnical report Beacon Island Parcel town of Bethlehem, New York," Port of Albany, 2017.

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

[15] R. P. P. J. Lunne T., "Cone Penetration Testing in Geotechnical Practice," Blackie Academic & Professional, 1997.

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

[17] NOAA, "Tides and Currents," NOAA, 2018. [Online]. Available: https://tidesandcurrents.noaa.gov/noaacurrents/Predictions?id=HUR0617_1. [Accessed December 2018].

[18] FEMA, "FIRM FIS. Albany County New York," FEMA, New York, 2015.

[19] U. N. District, "Controlling Depth Reports and Surveys," 28 February 2018. [Online]. Available: http://www.nan.usace.army.mil/Missions/Navigation/Controlling-Depth-Reports/.

Appendix B: Pre-FEED Drawings

NYSERDA 2018 PORTS ASSESSMENT

PORT OF ALBANY 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-G-02	EXISTING SITE PLAN	A
A093893-S-01	PROPOSED SITE PLAN	A
A093893-S-02	EXISTING SLOPE AND PROPOSED WHARF AND DREDGE SECTIONS	A
A093893-S-03	PROPOSED SLOPE STABILIZATION AND SOIL PROFILE SECTIONS	A

REV	DATE	DESCRIPTION	BY	CHK
A	12-06-2018	PORT OF ALBANY PRE-FEED DRAWING SET	PNCN	NLKP

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PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

POA PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

COVER SHEET AND DRAWING INDEX

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DRAWN	CHECKED	DATE
PNCN	NLKP	12-06-2018

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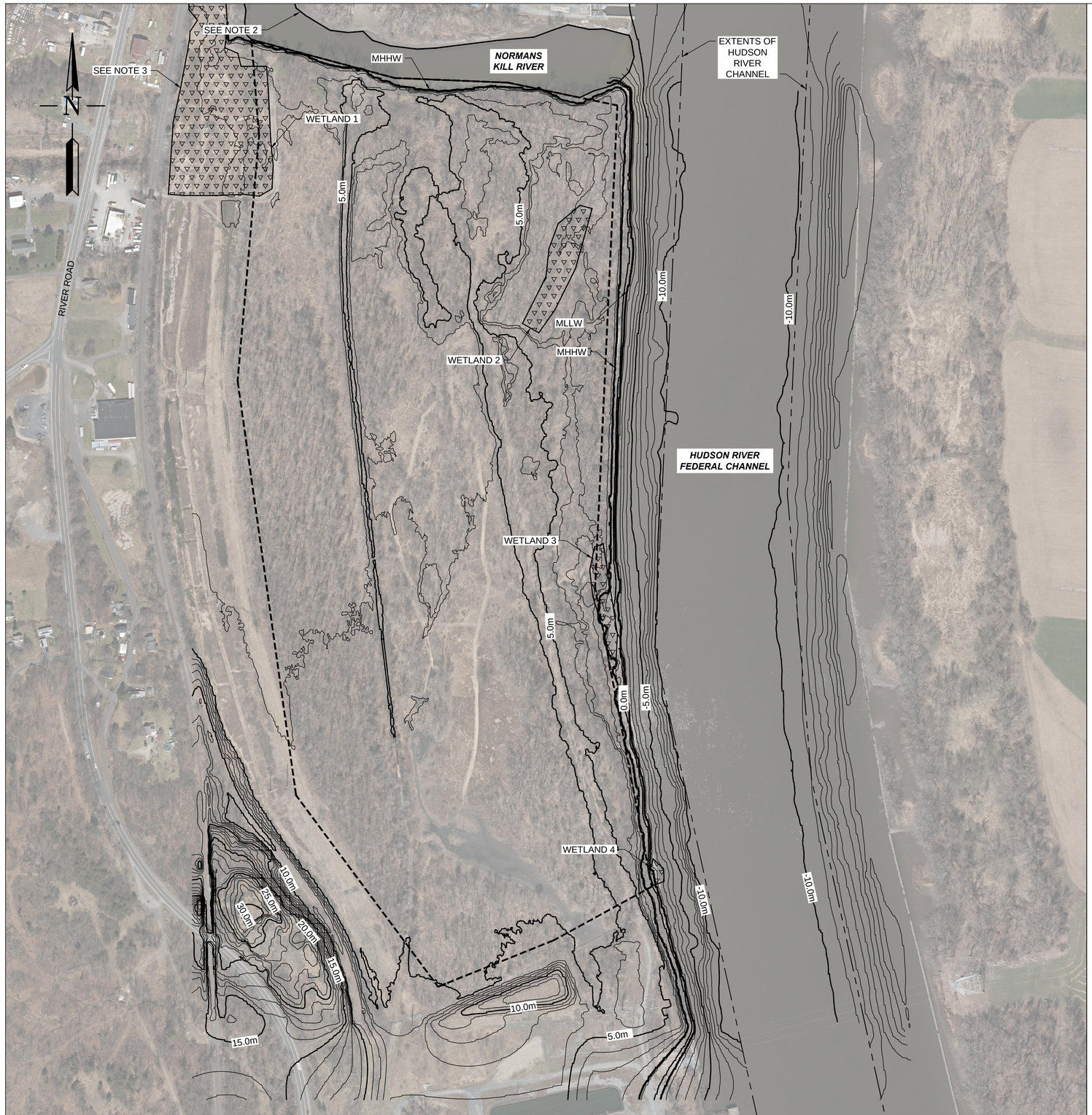

EXISTING SITE PLAN

1:2000

LEGEND:

- MHHW OR MLLW
- MAJOR CONTOUR LINES
- MINOR CONTOUR LINES
- PORT OF ALBANY FACILITY
- DELINEATED WETLAND AREAS
- HIDDEN BATHYMETRY (SEE NOTE 2)

GENERAL NOTES:

1. ELEVATION DATA IS BASED ON A COMBINATION OF THE FOLLOWING DATA SOURCES: COASTAL NEW YORK LIDAR HYDRO FLATTENED RASTER DEM DATASET, HUDSON ESTUARY PROGRAM AND HUDSON RIVER CONDITION SURVEY 4531. HORIZONTAL DATUM IS UTM 18N COORDINATE SYSTEM NAD 83; THE PROJECT VERTICAL DATUM IS THE NORTH AMERICAN DATUM 1988 (NAVD 88).
2. DATA IN THIS AREA UNKNOWN DUE TO LACK OF ACCURATE PUBLICLY AVAILABLE DATA. SITE SURVEY RECOMMENDED.
3. WETLAND AREAS AS PER SITE SPECIFIC WETLANDS DELINEATION INVESTIGATION. TO OBTAIN REPORT ON FINDINGS, IT IS RECOMMENDED TO REACH OUT TO THE PORT OF ALBANY.

TIDAL DATUM	EL. NAVD 88
FEMA AE-ZONE	4.88 m (16.00 FT.)
MEAN HIGHER HIGH WATER (MHHW)	1.15 m (3.78 FT.)
NAVD '88	0.00 m (0.55 FT.)
MEAN LOWER LOW WATER (MLLW)	-0.55 m (-1.80 FT.)

GRAPHIC SCALES

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REV	DATE	DESCRIPTION	BY	CHK
A	12-06-2018	PORT OF ALBANY PRE-FEED DRAWING SET	PNCN	NLKP

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PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

POA PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

EXISTING SITE PLAN

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A093893	G-02	A

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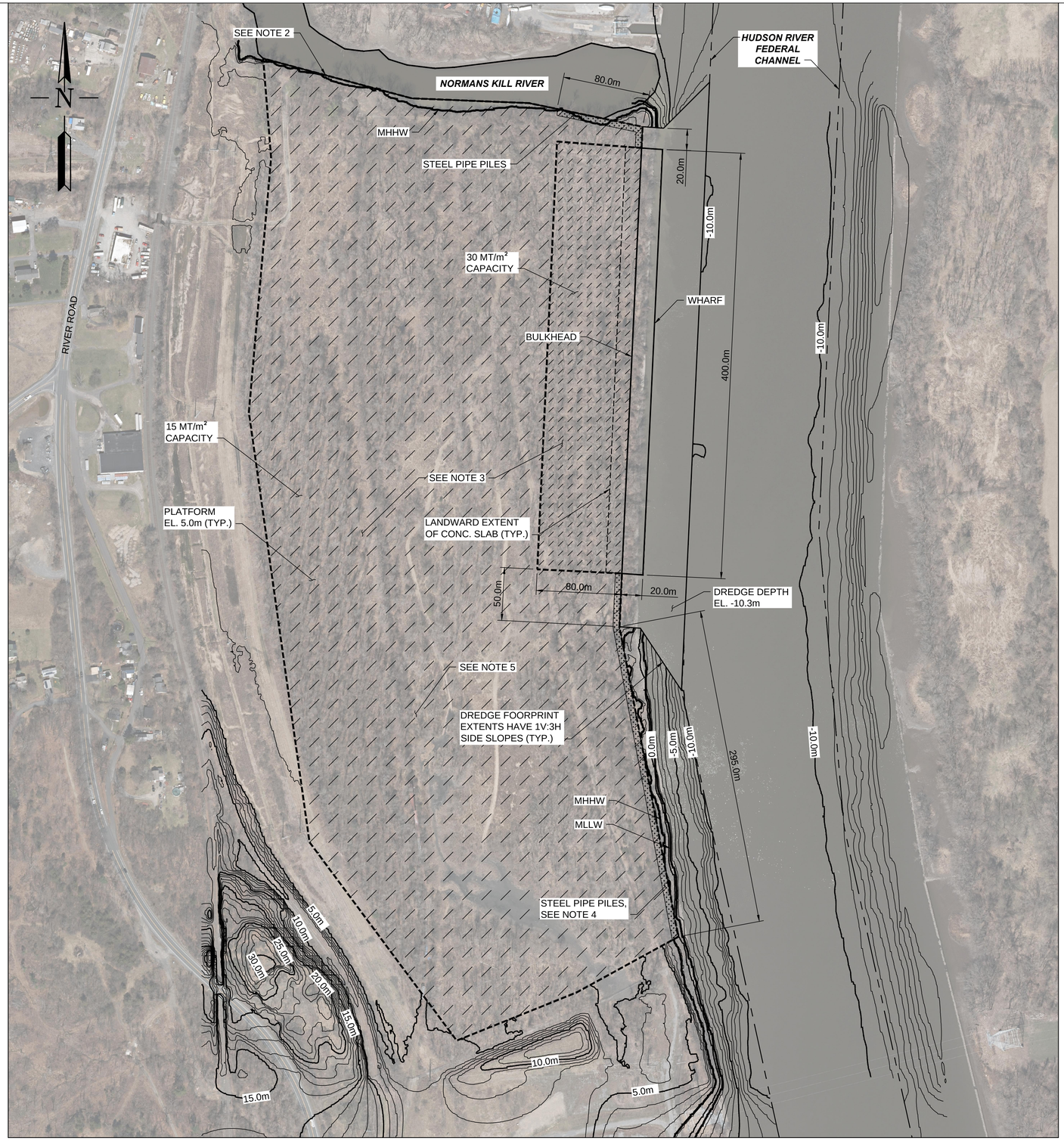

PROPOSED SITE PLAN

1:2000

LEGEND:

- MHHW OR MLLW
- MAJOR CONTOUR LINES
- MINOR CONTOUR LINES
- PORT OF ALBANY FACILITY
- HIDDEN BATHYMETRY (SEE NOTE 2)
- 15 MT/m² CAPACITY
- 30 MT/m² CAPACITY
- STEEL PIPE PILES

GENERAL NOTES:

1. ELEVATION DATA IS BASED ON A COMBINATION OF THE FOLLOWING DATA SOURCES: COASTAL NEW YORK LIDAR HYDRO FLATTENED RASTER DEM DATASET, HUDSON ESTUARY PROGRAM, AND HUDSON RIVER CONDITION SURVEY 4531. HORIZONTAL DATUM IS UTM ZONE 18N COORDINATE SYSTEM NAD 83; THE PROJECT VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. DATA IN THIS AREA UNKNOWN DUE TO LACK OF ACCURATE PUBLICLY AVAILABLE DATA. SITE SURVEY RECOMMENDED.
3. BEARING CAPACITY IMPROVEMENTS FOR 15 MT/m² CAPACITY AREA TO INCLUDE APPROXIMATELY 16.5 HECTARES (41 ACRES) TREATED WITH RIGID INCLUSIONS AT 2.5 METER (8 FOOT) SPACING IN BOTH DIRECTIONS, AND APPROXIMATELY 8.3 HECTARES (20 ACRES) TREATED WITH DYNAMIC COMPACTION. BEARING CAPACITY IMPROVEMENTS FOR ENTIRE 30 MT/m² CAPACITY AREA TO INCLUDE RIGID INCLUSIONS AT 1.7 METER (6 FOOT) SPACING IN BOTH DIRECTIONS. SEE DRAWING S-03 FOR DETAILS.
4. SHORELINE SLOPE BEARING CAPACITY IMPROVEMENT AREAS TO INCLUDE 3 ROWS PIPE PILES WITH 3 METER (10 FOOT) SPACING IN BOTH DIRECTIONS. SEE DRAWING S-03 FOR DETAILS.
5. PROPOSED SURFACE TREATMENT IN ALL AREAS OUTSIDE OF CONCRETE SLAB IS CRUSHED STONE. SEE DRAWINGS S-02 AND S-03 FOR DETAILS.

GRAPHIC SCALES

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PROJECT TITLE

NYSERDA 2018 PORTS ASSESSMENT

POA PRE-FRONT END ENGINEERING DESIGN

DRAWING TITLE

PROPOSED SITE PLAN

ENGINEER'S STAMP

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PNCN	NLKP	12-06-2018
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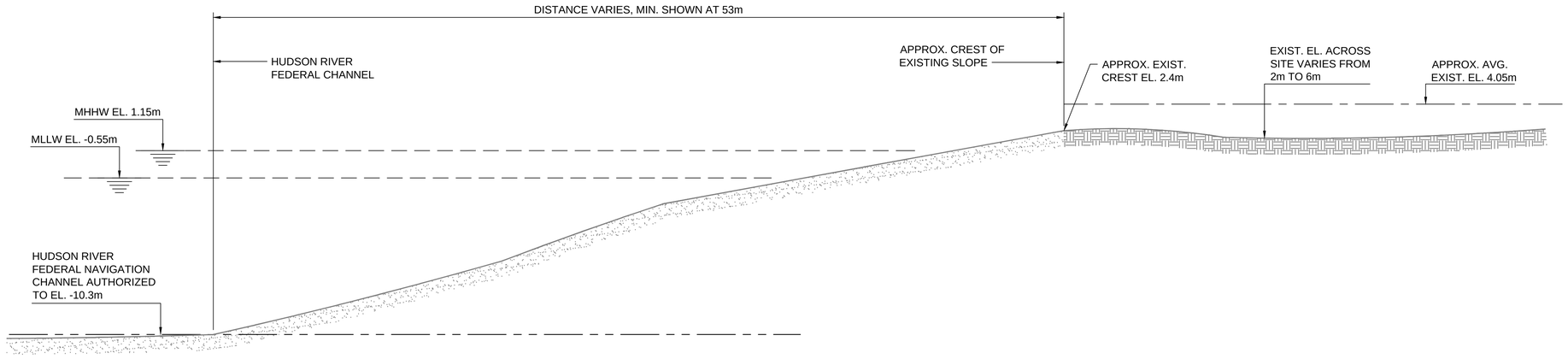
A093893	S-01	A

NOTES:

1. ELEVATION DATA IS BASED ON A COMBINATION OF THE FOLLOWING DATA SOURCES: COASTAL NEW YORK LIDAR HYDRO FLATTENED RASTER DEM DATASET, HUDSON ESTUARY PROGRAM AND HUDSON RIVER CONDITION SURVEY 4531. ALL ELEVATIONS REFERENCE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. MATERIAL FOR STEEL PIPE PILES AND CUT OFF WALL SHALL BE ASTM A572 GR 50; STEEL SHEET PILES OR COMBINED WALLS WITH LARGER MOMENT OF INERTIA THAN THE SPECIFIED PROFILE MAY BE ADOPTED.



TYPICAL EXISTING CONDITIONS

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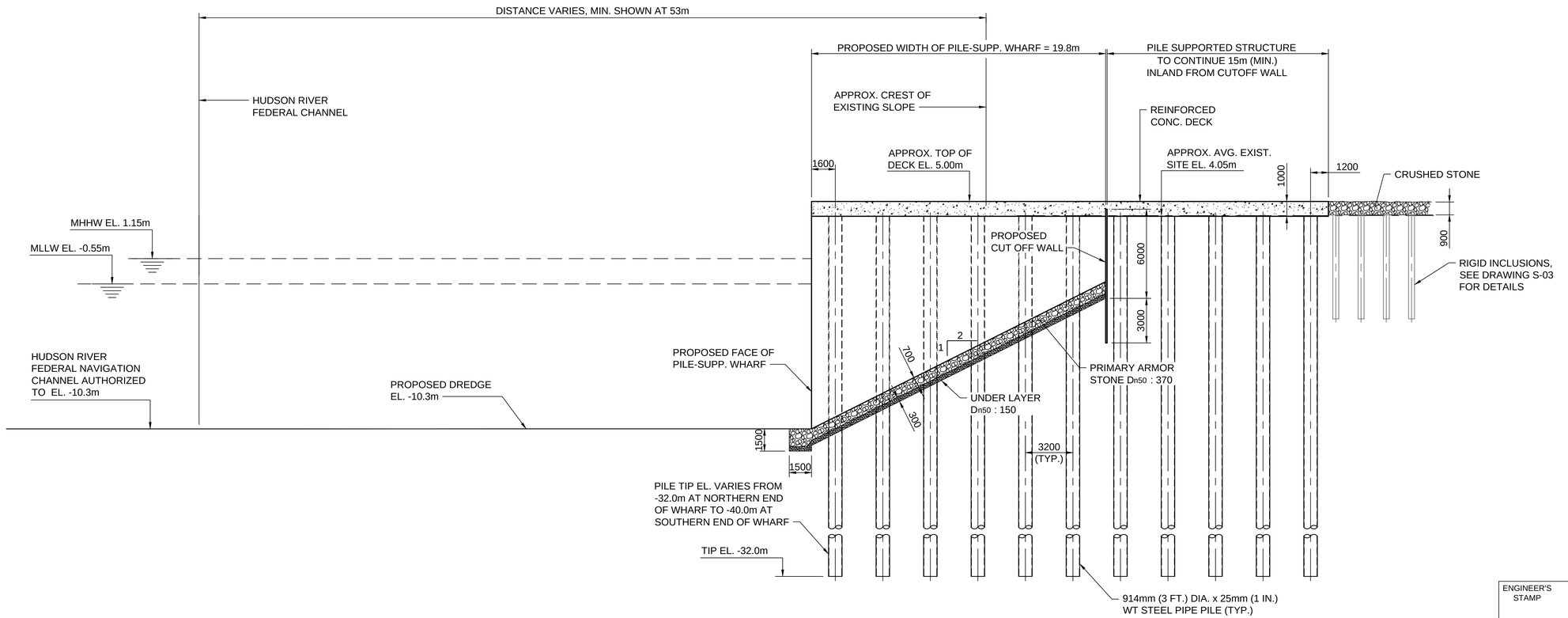

TYPICAL PROPOSED WHARF SECTION

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NYSERDA 2018 PORTS ASSESSMENT

POA PRE-FRONT END ENGINEERING DESIGN

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EXISTING SLOPE AND PROPOSED WHARF AND DREDGE SECTIONS

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A093893	S-02	A

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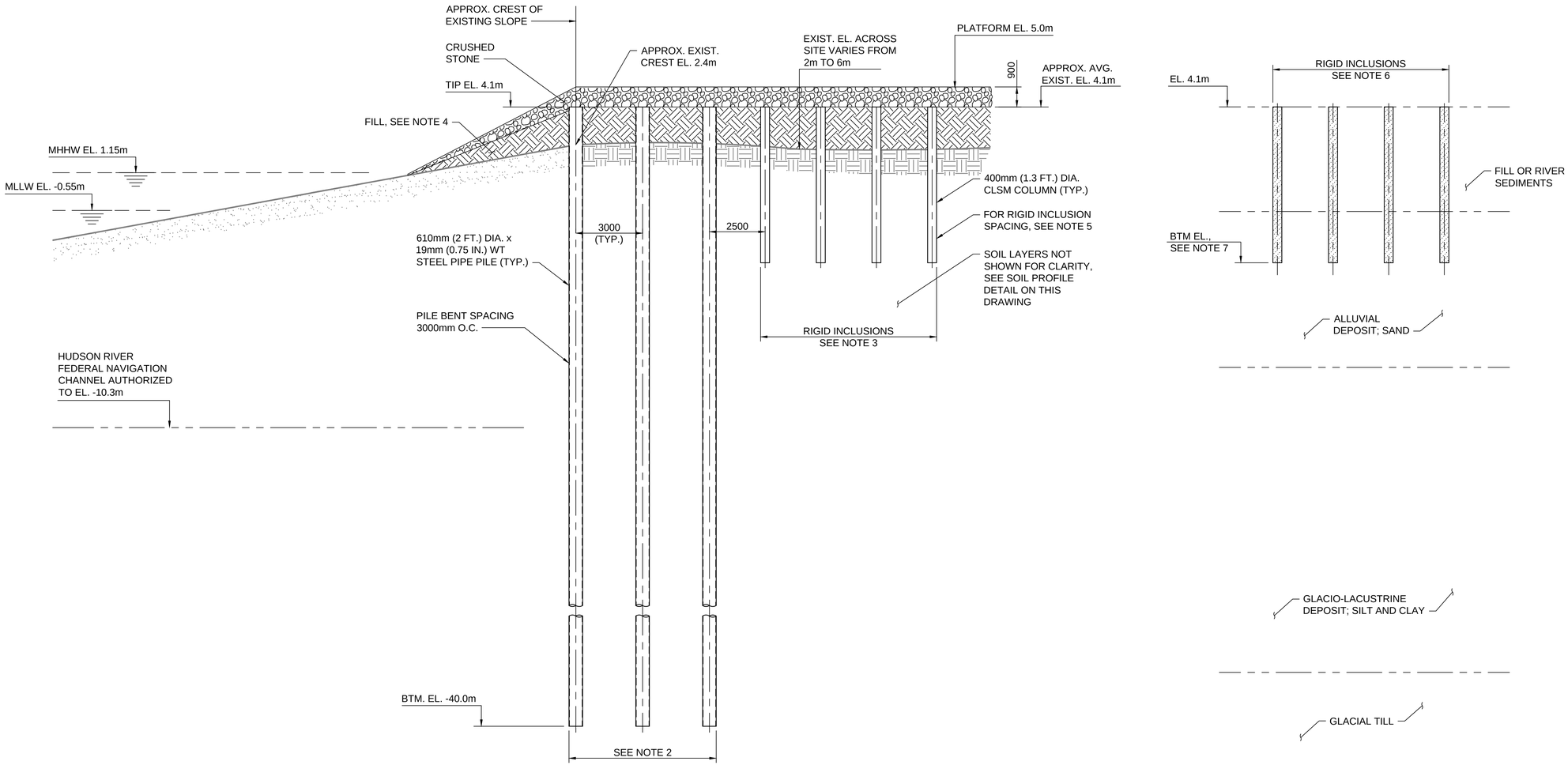

TYPICAL SLOPE STABILIZATION SECTION, 15 MT/m^2 AREAS

1:100

TYPICAL SOIL PROFILE SECTION

1:100

NOTES:

1. ELEVATION DATA IS BASED ON A COMBINATION OF THE FOLLOWING DATA SOURCES; COASTAL NEW YORK LIDAR HYDRO FLATTENED RASTER DEM DATASET, HUDSON ESTUARY PROGRAM AND HUDSON RIVER CONDITION SURVEY 4531. ALL ELEVATIONS REFERENCE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).
2. STEEL PIPE PILES ARE TO BE DRIVEN ALONG SHORELINE NORTH AND SOUTH OF PROPOSED WHARF. MATERIAL FOR STEEL PIPE PILES SHALL BE A572 GR 50.
3. RIGID INCLUSIONS OR DYNAMIC COMPACTION ARE TO BE INSTALLED/COMPLETED THROUGHOUT ENTIRE SITE IN AREAS OUTSIDE OF WHARF AND PILES ALONG SHORELINE.
4. FILL IS OBTAINED FROM CUT MATERIAL PRODUCED DURING GRADING PROCESS.
5. 15 MT/m^2 CAPACITY AREA TO INCLUDE RIGID INCLUSIONS AT 2.5 METER (8 FOOT) SPACING IN BOTH DIRECTIONS. 30 MT/m^2 CAPACITY AREA TO INCLUDE RIGID INCLUSIONS AT 1.7 METER (6 FOOT) SPACING IN BOTH DIRECTIONS.
6. DEPTH OF RIGID INCLUSIONS VARIES DEPENDING ON DEPTH OF ALLUVIAL DEPOSIT LAYER.

GRAPHIC SCALES

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0 1:100 5

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PROPOSED SLOPE STABILIZATION AND SOIL PROFILE SECTIONS

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A093893	S-03	A

Appendix C: Opinion of Probable Cost Backup

NYSERDA 2018 PORTS STUDY					
PRE-FRONT END ENGINEERING DESIGN REPORT					
PORT OF ALBANY (POA)					
OPINION OF PROBABLE COSTS					
PROJECT NO:	A093893.2				
PROJECT NAME:	NYSERDA 2018 PORTS STUDY				
CLIENT:	NYSERDA				
SITE LOCATION:	ALBANY, NY, HUDSON RIVER				
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	$1,444,000.00	$1,444,000.00

DEMOLITION, CLEARING AND GRUBBING					
_	Clearing and Grubbing	279710	Square Meter	$1.92	$536,000.00
_					
MARINE STRUCTURES					
_	30T/m² Pile Supported Wharf	13920	Square Meter	$8,660.70	$120,557,000.00
_					
EARTHWORK & GROUND IMPROVEMENT					
_	Upland Excavation above MHW	96380	Cubic Meter	$16.55	$1,595,000.00
_	Upland Fill above MHW	102610	Cubic Meter	$5.39	$553,000.00
_	Rigid Inclusions and Dynamic Compaction	279710	Square Meter	$177.09	$49,533,000.00
_	Shoreline Slope Stabilization	450	Linear Meter	$ 37,866.67	$17,040,000.00
_					
SURFACE TREATMENT					
_	Gravel 30T/m² Staging Area	273670	Square Meter	$119.10	$32,593,000.00
_					
DREDGING					
_	Berth Dredging	162380	Cubic Meter	$111.19	$18,055,000.00
SUBTOTAL					**$241,906,000.00**
			CONTINGENCY:	30%	$72,571,800.00
				TOTAL	**$314,478,000.00**

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 AND DRAWING INDEX	G-01	A	11/19/18	YES
	COWI	EXISTING SITE PLAN	G-02	A	11/19/18	YES
	COWI	PROPOSED SITE PLAN	S-01	A	11/19/18	YES
	COWI	EXISTING SLOPE AND PROPOSED WHARF AND DREDGE SECTIONS	S-02	A	11/19/18	YES
	COWI	PROPOSED SLOPE STABILIZATION AND SOIL PROFILE SECTIONS	S-03	A	11/19/18	YES
	COWI	POA_PROPOSED STRUCTURES_CAPACITIES	-	A	11/14/18	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 ALBANY COUNTY, NY						
	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	13170.72	131707.18		
MOBILIZATION	10.0	SHIFT	13170.72	131707.18		
SET-UP ON SITE	5.0	SHIFT	13170.72	65853.59		
BREAK-DOWN ON SITE	10.00	SHIFT	13170.72	131707.18		

DEMOBILIZATION	10.00	SHIFT	13170.72	131707.18		
TOTAL LABOR & EQUIPMENT					604682.30	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
MARINE TOWING	1	LS	500000.00	500000.00		
TOTAL SUBCONTRACTORS					500000.00	
SUBTOTAL PROJECT					1104682.30	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		88374.58	
OVERHEAD		10%	PERCENT		119305.69	
PROFIT		10%	PERCENT		131236.26	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$1,443,598.83**	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
DEMOLITION, CLEARING AND GRUBBING						
Clearing and Grubbing						
Quantity:	279710	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		
TOTAL LABOR & EQUIPMENT					0.00	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**

CLEARING AND GRUBBING	28.0	HECTARE	14639.45	409480.06		RS MEANS BARE TOTAL, LINE NO. 311110100200, MEDIUM TREES TO 300 mm, CUT AND CHIP.
TOTAL SUBCONTRACTORS					409480.06	
SUBTOTAL PROJECT					409480.06	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		32758.40	
OVERHEAD		10%	PERCENT		44223.85	
PROFIT		10%	PERCENT		48646.23	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$535,108.54**	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
MARINE STRUCTURES						
30T/m² Pile Supported Wharf						
Quantity:	13920	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
STEEL PIPE PILES	30814158.5	KG	2.20	67933510.06		914 DIA. X 25 mm WT
PIPE PILE COATING	27298.7	SM	43.06	1175361.02		EXPOSED PILE LENGTH + 3.05m
CONCRETE SLAB	13920.0	CM	196.19	2730999.60		1.0 m THICK
CONCRETE SLAB REINFORCEMENT	1651679.4	KG	2.20	3641325.50		118 KG/CM ASSUMED
CONCRETE FORMWORK	14789.6	SMCA	53.82	795968.88		
STEEL SHEET PILES	788832.2	KG	2.20	1739075.20		AZ44-700N ASSUMED
BULKHEAD COATING	5409.6	SM	43.06	232913.57		OUTER FACE, COMPLETE HEIGHT
REVETMENT ARMOR STONE	19483.5	MT	110.23	2147688.53		DUMPED, 25% VOIDS ASSUMED, D50=370 mm TOP LAYER, D50=150 mm UNDERLAYER

MARINE FENDER UNITS	8.0	EA	25000.00	200000.00		
MOORING BOLLARDS	8.0	EA	2500.00	20000.00		
TOTAL MATERIALS					80616842.36	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
SET AND DRIVE PIPE PILES	252.0	SHIFT	10450.72	2633580.88		ASSUME 2.75 PER SHIFT
SET AND DRIVE PIPE PILES	277.5	SHIFT	13170.72	3654874.18		ASSUME 2.5 PER SHIFT
PLACE REBAR	140.0	SHIFT	10109.06	1415268.95		ASSUME 100 SM PER SHIFT
FORM AND POUR CONCRETE	279.0	SHIFT	10109.06	2820428.83		ASSUME 50 CM PER SHIFT
SET & DRIVE SSP BULKHEAD	40.0	SHIFT	10450.72	418028.71		ASSUME 10 LM PER SHIFT
PLACE REVETMENT ARMOR STONE	54.0	SHIFT	11970.72	646418.76		ASSUME 7.5 LM PER SHIFT
ERECT FENDER UNITS	3.0	SHIFT	11970.72	35912.15		
ERECT BOLLARDS	1.0	SHIFT	11970.72	11970.72		
TOTAL LABOR & EQUIPMENT					11636483.17	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL SUBCONTRACTORS					0.00	

SUBTOTAL PROJECT					92253325.53	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		7380266.04	
OVERHEAD		10%	PERCENT		9963359.16	
PROFIT		10%	PERCENT		10959695.07	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$120,556,645.81**	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
EARTHWORK & GROUND IMPROVEMENT						
Upland Excavation above MHW						
Quantity:	96380	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	96380.0	BCM	12.66	1220170.80		RS MEANS BARE TOTAL, LINE NO. 312316462400, DOZER, 90 m HAUL, ASSUME ALL CUT IS USED AS BACKFILL
TOTAL LABOR & EQUIPMENT					1220170.80	
SUBCONTRACTORS &	**QUANTIT**	**UNIT**	**UNIT $**	**EXTENDE**		**COMMENTS**

UNIT PRICES	**Y**	**S**		**D $**		
				0.00		
TOTAL SUBCONTRACTORS					0.00	
SUBTOTAL PROJECT					1220170.80	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		97613.66	
OVERHEAD		10%	PERCENT		131778.45	
PROFIT		10%	PERCENT		144956.29	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$1,594,519.20**	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
EARTHWORK & GROUND IMPROVEMENT						
Upland Fill above MHW						
Quantity:	102610	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	102610.0	LCM	4.12	422753.20		RS MEANS BARE TOTAL, LINE NO. 312323142400, DOZER, 90 m HAUL, ASSUME ALL CUT IS USED AS BACKFILL
TOTAL LABOR & EQUIPMENT					422753.20	

SUBCONTRACTORS & UNIT PRICES	QUANTITY	UNITS	UNIT $	EXTENDED $		COMMENTS
				0.00		
TOTAL SUBCONTRACTORS					0.00	
SUBTOTAL PROJECT					422753.20	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		33820.26	
OVERHEAD		10%	PERCENT		45657.35	
PROFIT		10%	PERCENT		50223.08	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$552,453.88**	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
EARTHWORK & GROUND IMPROVEMENT						
Rigid Inclusions and Dynamic Compaction						
Quantity:	279710	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**
DYNAMIC COMPACTION	60.0	SHIFT	5748.29	344897.47		BASED ON PRODUCTION RATE OF 30000 SM PER MONTH (PER DENSIT), 1/3 OF 15 T/SM AREA TO HAVE DYNAMIC COMPACTION
TOTAL LABOR & EQUIPMENT					344897.47	

SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
RIGID INCLUSIONS	1	LS	37558989.43	37558989.43		BASED ON BUDGETARY ESTIMATES FROM HAYWARD BAKER
TOTAL SUBCONTRACTORS					37558989.43	
SUBTOTAL PROJECT					37903886.90	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		3032310.95	
OVERHEAD		10%	PERCENT		4093619.79	
PROFIT		10%	PERCENT		4502981.76	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$49,532799.40**	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
MARINE STRUCTURES						
Shoreline Slope Stabilization						
Quantity:	450	Linear Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
STEEL PIPE PILES	5208065.7	KG	2.20	11481805.89		610 DIA. X 19 mm WT
TOTAL MATERIALS					11481805.89	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
SET AND DRIVE PIPE PILES	149.0	SHIFT	10450.72	1557156.95		ASSUME 3 PER SHIFT
TOTAL LABOR & EQUIPMENT					1557156.95	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL					0.00	

SUBCONTRACTORS						
SUBTOTAL PROJECT					13038962.84	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		1043117.03	
OVERHEAD		10%	PERCENT		1408207.99	
PROFIT		10%	PERCENT		1549028.79	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$17,039,316.64**	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
SURFACE TREATMENT						
Gravel 30T/m² Staging Area						
Quantity:	273670	Square Meter				
OPINION OF PROBABLE COSTS						
MATERIALS	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
GRAVEL FOR SURFACE TREATMENT	473447.5	MT	49.60	23484864.09		1922 KG/CM ASSUMED
TOTAL MATERIALS					23484864.09	
LABOR & EQUIPMENT	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
PLACE GRAVEL FILL (LOOSE)	295563.6	LCM	2.76	815755.54		RS MEANS BARE TOTAL, LINE NO. 312323142200. ASSUME LOOSE VOLUME IS 20% GREATER THAN IN-PLACE VOLUME.
COMPACT GRAVEL FILL	246303.0	ECM	2.60	640387.80		RS MEANS BARE TOTAL, LINE NO. 312323237640,

						300 mm LIFTS, 4 PASSES, VIBRATING ROLLER
TOTAL LABOR & EQUIPMENT					1456143.34	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**
				0.00		
TOTAL SUBCONTRACTORS					0.00	
SUBTOTAL PROJECT					24941007.42	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		1995280.59	
OVERHEAD		10%	PERCENT		2693628.80	
PROFIT		10%	PERCENT		2962991.68	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$32,592,908.50**	

PROJECT NO.:	A093893.2					
DATE:	4-Jan-2019					
DREDGING						
Berth Dredging						
Quantity:	162380	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		
				0.00		
				0.00		
TOTAL LABOR & EQUIPMENT					0.00	
SUBCONTRACTORS & UNIT PRICES	**QUANTITY**	**UNITS**	**UNIT $**	**EXTENDED $**		**COMMENTS**

BERTH DREDGING	162380.0	BCM	85.08	13815639.11		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.
TOTAL SUBCONTRACTORS					13815639.11	
SUBTOTAL PROJECT					13815639.11	
ESCALATION		0%	PERCENT		0.00	
GENERAL CONDITIONS		8%	PERCENT		1105251.13	
OVERHEAD		10%	PERCENT		1492089.02	
PROFIT		10%	PERCENT		1641297.93	
SALES TAX		0%	PERCENT		0.00	
TOTAL OPC					**$18,054,277.19**	

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		91.91	37.78	21.35	59.13	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		DOCKBUILDER		80.15	31.48	21.35	52.83	
		OILER		100.79	39.99	26.10	66.09	
		OPERATOR - CRANE		112.90	46.47	26.10	72.57	
	EQUIPMENT							
		COMPRESSOR		50.00				
		CRANE		300.00				
		UTILITY TRUCK		50.00				
		PILE DRIVING		150.00				

		HAMMER						
		MISC		50.00				
	TOTAL HOURLY RATE			1306.34				
	TOTAL SHIFT RATE			10450.72	BASED ON EIGHT (8) HOUR SHIFT			

PROJECT NO.:	A093893.2						
DATE:	4-Jan-2019						
LABOR AND EQUIPMENT RATE BREAKDOWN							
CREW 2 - MARINE CONSTRUCTION - UPLAND ACCESS							
				FULL COST	A	B	A+B
				W / BURDEN	DIRECT WAGES*	FRINGES	
	LABOR						
		DOCKBUILDER FOREMAN		91.91	37.78	21.35	59.13
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		OPERATOR - EXCAVATOR		107.29	43.47	26.10	69.57
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		OILER		100.79	39.99	26.10	66.09
		OPERATOR - CRANE		112.90	46.47	26.10	72.57
	EQUIPMENT						
		COMPRESSOR		50.00			
		CRANE		300.00			
		UTILITY TRUCK		50.00			
		MISC		50.00			

	TOTAL HOURLY RATE			1263.63			
	TOTAL SHIFT RATE			10109.06	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		92.20	37.13	22.85	59.98
		LABORER		80.64	30.94	22.85	53.79
		LABORER		80.64	30.94	22.85	53.79
		LABORER		80.64	30.94	22.85	53.79
		OPERATOR - EXCAVATOR		107.29	43.47	26.10	69.57
	EQUIPMENT						
		EXCAVATOR		120.00			
		COMPACTOR		20.00			
		UTILITY TRUCK		25.00			
		MISC		50.00			
	TOTAL HOURLY RATE			656.41			
	TOTAL SHIFT RATE			5251.28	BASED ON EIGHT (8) HOUR SHIFT		

PROJECT NO.:	A093893.2						
DATE:	4-Jan-2019						
LABOR AND EQUIPMENT RATE BREAKDOWN							
<u>CREW 4 - MARINE CONSTRUCTION - WATERBORNE PILE DRIVING</u>							
				FULL COST	A	B	A+B
				W / BURDEN	DIRECT WAGES*	FRINGES	
	LABOR						
		DOCKBUILDER FOREMAN		91.91	37.78	21.35	59.13
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		OILER		100.79	39.99	26.10	66.09
		OPERATOR - CRANE		112.90	46.47	26.10	72.57
	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			1646.34			
	TOTAL SHIFT RATE			13170.72	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		91.91	37.78	21.35	59.13
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		DOCKBUILDER		80.15	31.48	21.35	52.83
		OILER		100.79	39.99	26.10	66.09
		OPERATOR - CRANE		112.90	46.47	26.10	72.57
	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			1496.34			
	TOTAL SHIFT RATE			11970.72	BASED ON EIGHT (8) HOUR SHIFT		

PROJECT NO.:	A093893.2							
DATE:	4-Jan-2019							
LABOR AND EQUIPMENT RATE BREAKDOWN								
<u>CREW 6 - DYNAMIC COMPACTION</u>								
				FULL COST	A	B	A+B	
				W / BURDEN	DIRECT WAGES*	FRINGES		
	LABOR							
		LABORER		80.64	30.94	22.85	53.79	
		OPERATOR - CRANE		112.90	46.47	26.10	72.57	
	EQUIPMENT							
		CRANE		300.00				
		UTILITY TRUCK		25.00				
		DYNAMIC COMPACTION WEIGHT		150.00				
		MISC		50.00				
	TOTAL HOURLY RATE			718.54				
	TOTAL SHIFT RATE			5748.29	BASED ON EIGHT (8) HOUR SHIFT			

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York State since 1975.

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