

7. SITE CHARACTERISTICS FOR REMAINING TWO SITES

With certain modifications, both the Mack Point and Sears Island sites can meet the floating OSW Port Criteria discussed in Section 4 of this report. However, existing site characteristics differ at each site and, therefore, the required actions and associated costs to meet these criteria varies between the sites. This section discusses the existing site conditions and required modifications to meet the proposed criteria.

7.1 Bathymetric and Geophysical

Bathymetric and geophysical data used for the evaluation of the proposed Sears Island and Mack Point sites were sourced from the report titled “High Resolution Geophysical Surveys Assembly Site and Turbine Area (WP8-1 and WP8-2) Site Report” written by the Alpine Ocean Seismic Survey, Inc. for the University of Maine Advanced Structures and Composites Center, dated November 2017. The study included both proposed areas, one that partially overlaps with the proposed Mack Point site footprint and the other that fully overlaps with the proposed Sears Island site footprint. Due to the partial coverage at the Mack Point site, significant extrapolation of this data was required.

The bathymetric survey produced contours of the existing mudline at the time of the survey. A shallow penetration sub-bottom profile was also performed. These results produced a basement isopach figure that shows the limit of sub-surface penetration to a mappable reflector. In this study, the mappable reflector was interpreted as the upper surface of bedrock or glacial till overlying bedrock.

In order to reach the required design depth of -35 ft (MLLW), the outshore berthing face of the quayside must be located at or beyond the same elevation of the top of glacial till/bedrock. The depth of existing soil overburden on top of this till/bedrock level will then dictate the required dredge quantities for each site.

7.1.1 Mack Point Site

Results from the bathymetric survey show the seafloor at Mack Point gently dipping to the south from the shoreline at an approximate 3.6-degree slope. The mudline depth remains at or below -17 ft (LAT) for a distance of over 800 ft from the existing shoreline.

Results from the sub-bottom profile data show the thickness of soil overlying the bedrock varying from 3 to 10 ft within this same area. The till/bedrock elevation reaches the required design draft of -35 ft at Mack Point approximately 795 ft from the existing shoreline. This is shown in Figure 7-1 through Figure 7-3 below. The black area above the blue line in cross sections X1 and 114 represents the bottom material that will require dredging.

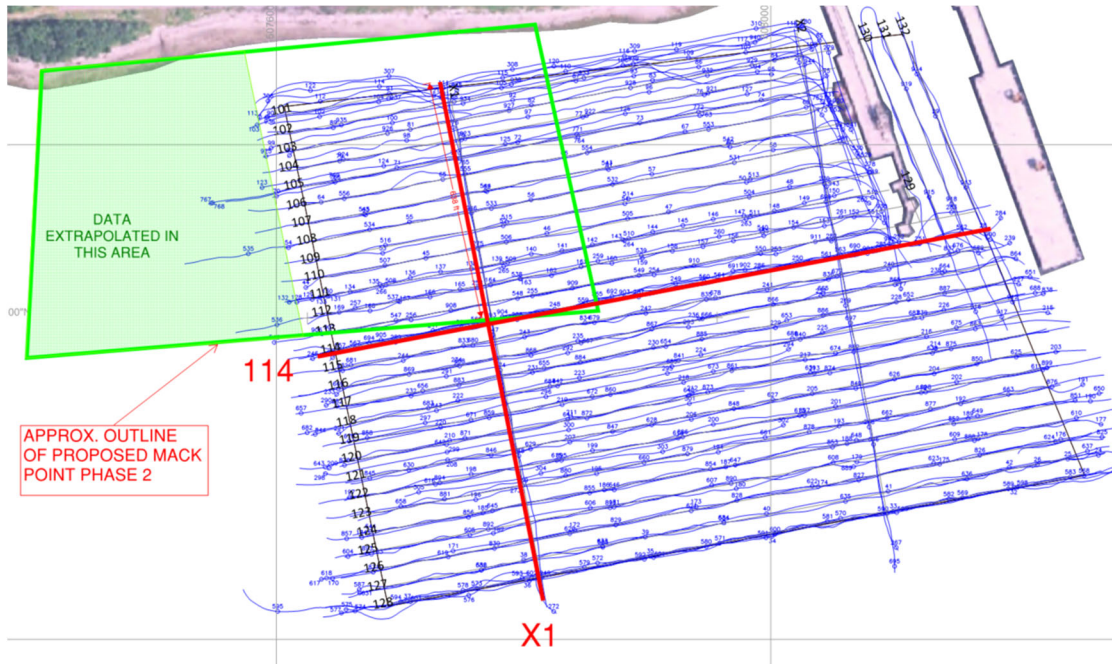


Figure 7-1: Mack Point Survey Data and Project Location

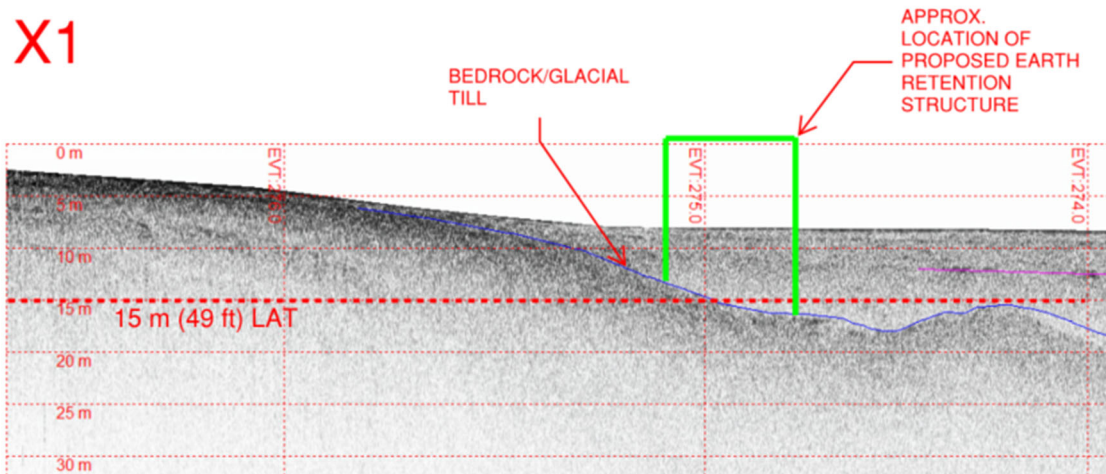


Figure 7-2: Survey Data Profile and Location of Proposed Earth Retention Structure

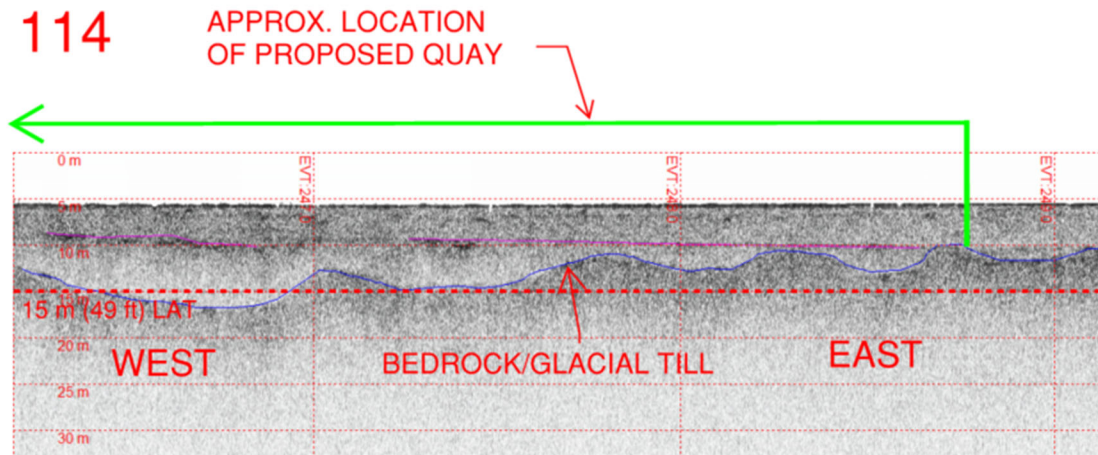


Figure 7-3: Approximate Location of Proposed Quay

7.1.2 Sears Island Site

Results from the bathymetric survey show the existing mudline at Sears Island gently dipping to the west from the shoreline at an approximate 3.0-degree slope for approximately 790 ft at the north, 200 ft at the center, and 970 ft from the southern extents of the site. The depth at the base of this slope is approximately -12 ft (LAT). Just to the west of the base of this slope is an abrupt, approximately 30-degree sloped, 30-ft drop in elevation. The slope runs parallel to the shoreline at Sears Island.

Results from the basement isopach data show the thickness of soil overlying the bedrock at the top of the slope, along the slope, and at the base of the slope to be between 1 and 3 ft. This is shown in Figure 7-4 through Figure 7-6 below. Both cross sections demonstrate that the required depth can be met (with significant buffer) without dredging at the site.

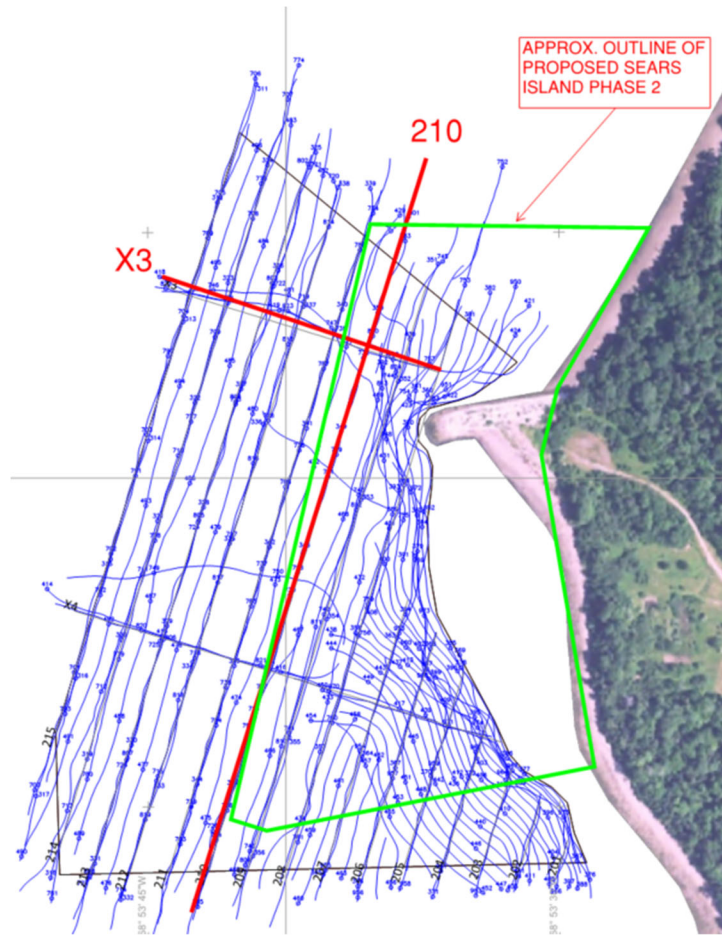


Figure 7-4: Sears Island Survey Data and Project Location

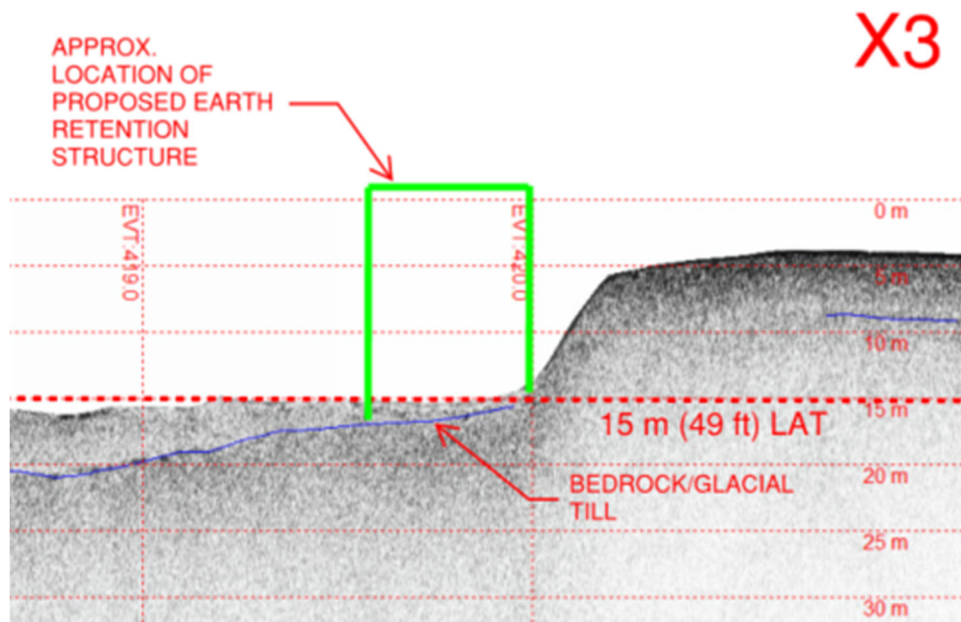


Figure 7-5: Survey Data Profile and Location of Proposed Earth Retention Structure

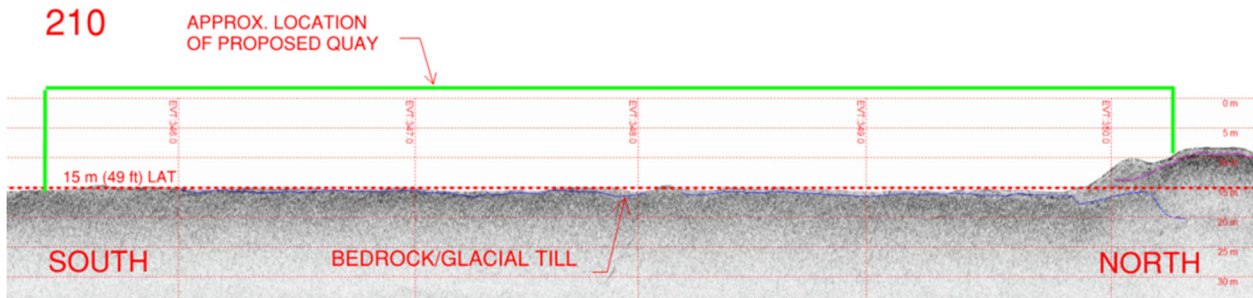


Figure 7-6: Approximate Location of Proposed Quay

7.1.3 Results of Bathymetric and Geophysical Analysis

The results of the bathymetric and geophysical study dictate the following:

- The berthing face of the proposed Mack Point site quay is required to be approximately 795 ft to the south of the existing shoreline in order to achieve the required water depth.
- At Mack Point there is up to a 10-ft depth of soil overburden above the indicated top of bedrock/glacial till elevation. This soil overburden will require dredging to achieve the required water depth at the berth.
- The berthing face of the proposed Sears Island site quay is required to be approximately 795 ft, 200 ft, and 970 ft from the shore at the northern, central, and southern extents of the site, respectively. At these locations, the elevation of the top of till/bedrock exceeds the required water depth. There is little to no soil overburden at any location at the Sears Island site and, therefore, no dredging will be required.

7.2 Geotechnical

Geotechnical data used for the feasibility study is based on a limited number of historical borings provided by Maine DOT. The information from these borings is summarized below.

7.2.1 Mack Point Soil Properties

Geotechnical data used for the Mack Point site analysis consists of information from the report “Explorations and Geotechnical Engineering Services” written by S.W. Cole Engineering Inc., dated April 22, 2013. This information is supplemented by information from the report “Sprague Energy Corporation Preliminary Hydrogeologic Study” written by Aries Engineering, Inc., dated August 1993.

S.W. Cole performed three borings to a depth of approximately 20 ft near the shoreline at the proposed Mack Point site. The soil profile in the location of the borings generally consists of a layer of fill overlying a layer of organic soils that overlie glacial till. The classification of the fill varied randomly throughout the borings. The organic layer was a 2-to 3-ft layer of loose sandy silt that contains organics and wood debris. The borings were terminated at the glacial till, which consisted of medium dense brown silt and sand with some gravel.

The nine borings summarized in the Aries Engineering, Inc. report were performed by Great Works Test Boring, Inc. in June 1992 and are located to the east of the proposed uplands area at Mack Point. The study was primarily focused on the hydrogeological properties at the Sprague Oil Terminal but included geotechnical data as well. The soil profile in the location of the borings generally consists of a layer of a 4-to 16-ft layer of gravelly sand and then an 11-to 22-ft layer of clay and silt. The report also indicates that the bedrock beneath the site is representative of the Penobscot Formation. The report goes on to state that “the Penobscot Formation generally consists of graphitic to sulfidic greenschist facies schist composed of siltstone and pelite” (page 11).

At this point, it is unknown what a majority of the geotechnical properties at the Mack Point site consist of due to limited historical borings. However, the site has been operating commercially for more than 40 years; therefore, it is assumed that the uplands soils have been consolidated to a certain extent and that the required compaction level can be achieved via vibro-compaction. There is no geotechnical data offshore at the proposed site.

7.2.2 Sears Island Soil Properties

Geotechnical data used for the Sears Island site consists of information from the report “Soils Report 83-103” written by the Maine Department of Transportation Materials and Research Division, dated April 1983.

A series of borings and test pits were performed within and nearby the footprint of the proposed uplands area. The soil profile within the studied area generally consisted of a 3-ft layer of topsoil over a 12-to 16-ft-thick layer of silty till. The borings reached a maximum depth of 21.5 ft and were generally classified as AASHTO A-4 soils, silty soils, shown in Table 7-1 below.

Table 7-1: AASHTO Soil Classification (AASHTO)

GENERAL CLASSIFICATION	GRANULAR MATERIALS (35 percent or less of total sample passing No. 200)							SILT-CLAY MATERIALS (More than 35 percent of total sample passing No. 200)			
	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6
Sieve analysis, percent passing: 2 mm (No. 10) 0.425 mm (No. 40) 0.075 mm (No. 200)	50 max. 30 max. 15 max.	50 max. 25 max.	51 min. 10 max.	35 max.	35 max.	35 max.	35 max.	36 min.	36 min.	36 min.	36 min.
Characteristics of fraction passing 0.425 mm (No. 40) Liquid limit Plasticity index	6 max.		NP	40 max. 10 max.	41 min. 10 max.	40 max. 11 min.	41 min. 11 min.	40 max. 10 max.	41 min. 10 max.	40 max. 11 min.	41 min. 11 min.*
Usual significant constituent materials	Stone fragments, gravel and sand		Fine sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
Group Index**	0		0	0	4 max.			8 max.	12 max.	16 max.	20 max.

Classification procedure: With required test data available, proceed from left to right on chart; correct group will be found by process of elimination. The first group from left into which the test data will fit is the correct classification.
 *Plasticity Index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity Index of A-7-6 subgroup is greater than LL minus 30 (see Fig 4-9).
 **See group index formula (Eq. 4-1) Group index should be shown in parentheses after group symbol as: A-2-6(3), A-4(5), A-6(12), A-7-5(17), etc.

Based on this classification, it was assumed that the soils can be reused for infill placement with an appropriate wick drain and soil surcharge program.

There is no geotechnical data offshore at the proposed site.

7.3 Dredge Sediment Characteristics

A study by Ramboll Environ titled “Proposed Strategy for Maintenance Dredging of the Federal Navigation Channel At Searsport Terminal, Maine,” dated April 2017, provides valuable information about the dredge material characteristics and appropriate disposal strategies of sediments adjacent to the proposed Mack Point site.

The Ramboll Environ study occurred due to shoaling in the federal navigation channel leading to the Mack Point Terminal. Three dredge material disposal options were evaluated: landfill disposal, ocean disposal, and beneficial reuse. The material in the dredge area was chemically analyzed and the results indicate that the chemical concentrations of the sediment are below required Maine Department of Environmental Protection (Maine DEP), Army Corp of Engineers (ACOE), and US Environmental Protection Agency (USEPA) screening levels for beneficial reuse and ocean disposal. Additional testing was recommended prior to landfill disposal.

In addition to the sediment characterization, the percent fines of the samples were also calculated. Although not specified in the report, this is typically the percentage of the soils passing the standard No. 200 sieve. These results indicated the average percent fines of the 20 samples was 85.5%, with 14 samples above the 90% fines level. Based on these results, the dredged sediment would not be suitable for structural fill without amendment with a binding agent, such as cement.

7.4 FEMA Flood Level Designation

According to the Flood Insurance Rate Map (FIRM) Number 23027C0459E, published by FEMA and made effective on July 5, 2015, both Mack Point and Sears Island fall within Zones VE, AE, and X. The delineation of these three zones generally follows the shoreline with the VE zone outshore of shoreline and the AE zone being inland of the shoreline. Further inland, most of the proposed uplands area is within the X zone. See Figure 7-7 and Figure 7-8 below for site FEMA flood maps.

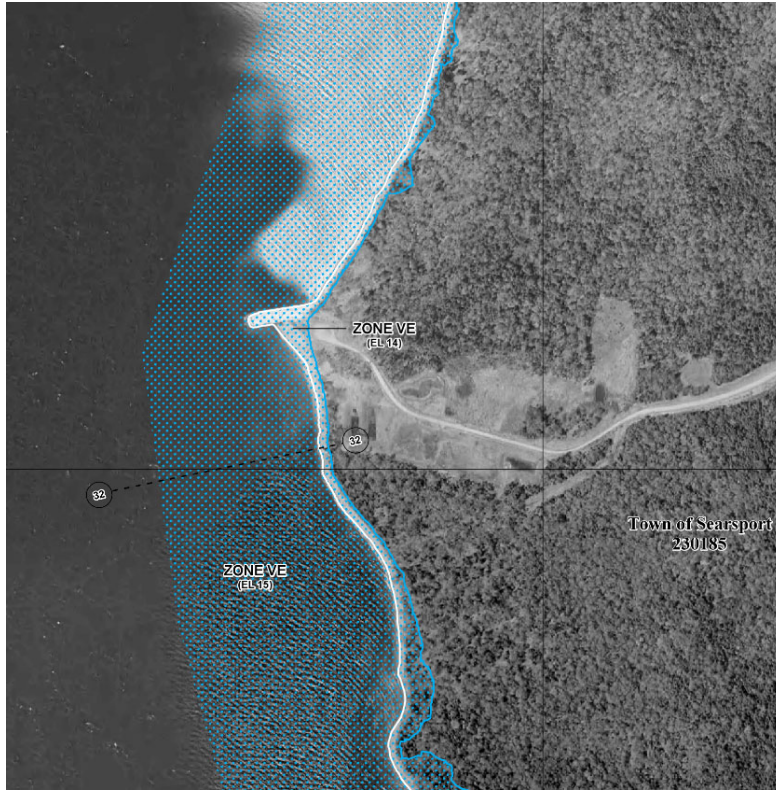


Figure 7-7: Sears Island Site FEMA Flood Map

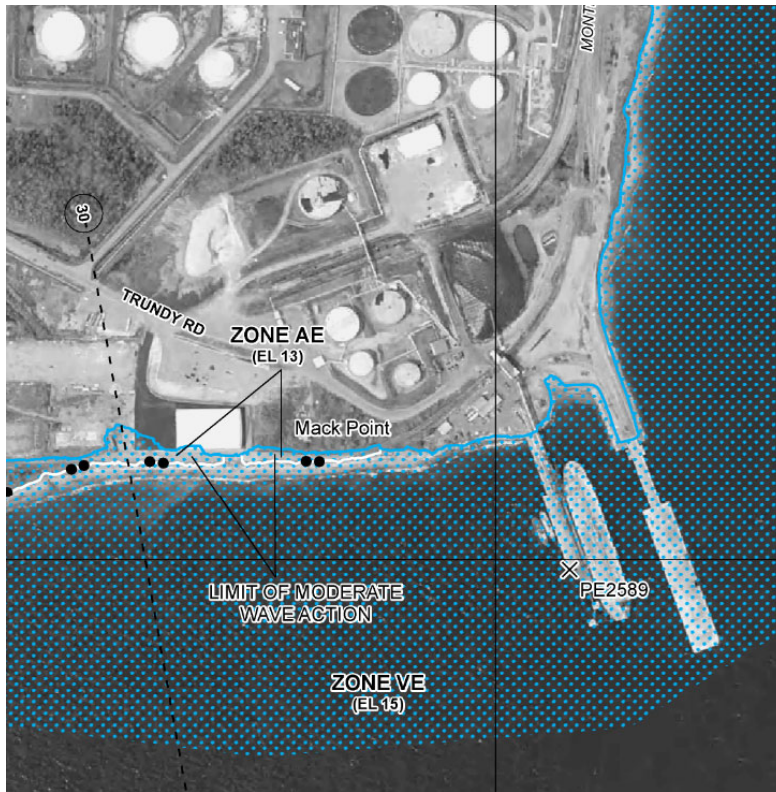


Figure 7-8: Mack Point Site FEMA Flood Map

These three zones are defined as follows:

VE Zone (Site Base Flood Elevation – EL +15 ft NAVD 88): A coastal high hazard area subject to high velocity water including waves; they are defined by the 1% annual chance (base) flood limits (also known as the 100-year flood) and wave effects 3 ft or greater. The hazard zone is mapped with base flood elevations (BFEs) that reflect the combined influence of still-water flood elevations, primary frontal dunes, and wave effects 3 ft or greater.

AE Zone (Site Base Flood Elevation – EL +13 ft NAVD 88): A hazard zone area within the 100-year flood limits defined with BFEs that reflect the combined influence of still-water flood elevations and wave effects less than 3 ft.

X Zone (Site Average Flood Elevation – n/a): An area determined to be outside the 0.2% annual chance floodplain.

The port facility will be designed to withstand the impact of a 100-year flood event as defined by FEMA. For the purposes of this study, both the Mack Point and Sears Island port facilities will be set to a minimum site grade of EL +15.0 ft NAVD88 (FEMA 100-year flood elevation).

7.5 Topographic Information

Topographic data was taken from the United States Geological Survey chart Searsport Quadrangle, Maine-Waldo County, 7.5-Minute Series, 2018.

7.6 Water Levels

Water levels are governed by the semi-diurnal tides described in Table 7-2. The Portland, Maine station (ID 8418150) is the tidal gage closest to the project sites.

Table 7-2: Tidal Parameters

Tidal Parameter	Elevation (ft MLLW)	Elevation (ft NAVD88)
Highest Astronomical Tide (HAT)	+11.95	+6.69
Mean Higher High Water (MHHW)	+9.91	+4.65
Mean High Water (MHW)	+9.47	+4.21
North American Vertical Datum of 1988 (NAVD88)	+5.26	0.00
Mean Low Water (MLW)	+0.35	-4.91
Mean Lower Low Water (MLLW)	0.00	-5.26
Lowest Astronomical Tide (LAT)	-2.12	-7.38

Note: All reported data taken from NOAA Station ID 8418150, Portland, ME.