

PND CASCADE POINT FERRY TERMINAL Metocean Review

PREPARED FOR: PND Engineers Inc. Juneau, Alaska		BY: Mark Kim, PE OCEAN ENGINEER	
 1201 WESTERN AVENUE, SUITE 200 SEATTLE, WASHINGTON 98101-2953 T 206.624.7850 GLOSTEN.COM		CHECKED: Kyle C. Beattie, PE PRINCIPAL	
		APPROVED: Justin M. Morgan, PE PRINCIPAL-IN-CHARGE	
DOC. #: Doc. 23056.01-001	REV: B	FILE: 23056.01	

Revisions

Section	Rev	Description	Date	Approved
All	-	Initial Release	8/17/2023	JMM
All	A	Incorporated comments from client	8/28/2023	JMM
All	B	Included reference to new wind data and corrected wind data range on Table 1	9/6/2023	JMM

References

1. PND Engineers, Inc., *Cascade Point – Coastal Assessment and Design Study*, August 2006.
2. PND Engineers, Inc., *Cascade Point Marine Facility Vertical Wave Barrier Concept Design*, 23 January 2010.
3. Pacific International Engineering, *Design Wave Determination at Cascade Point, Berners Bay, Alaska*, 15 October 1997
4. Alaska ASOS Network, [PAJN] JUNEAU INTL AIRPORT (ASOS) (1948-Now), https://mesonet.agron.iastate.edu/request/download.phtml?network=AK_ASOS, 24 July 2023.
5. NDBC, *Station EROA2 Recent Data*, Station EROA2 – Eldred Rock, AK, https://www.ndbc.noaa.gov/station_page.php?station=eroa2, 24 July 2023.
6. Veri-Tech, CEDAS - ACES [software], v4.03, 2022.
7. PND Engineers, Inc, *JNU Cascade Point Ferry Terminal Existing Metocean & Geotechnical Information*, HSSWY00015, July 2023.
8. NOAA, *Datums for 9452210, Juneau AK*, Datums - NOAA Tides & Currents, <https://tidesandcurrents.noaa.gov/datums.html?id=9452210>, 24 July 2023.

Introduction

Glostén was tasked with reviewing the metocean reports for Cascade Point, Alaska provided by PND Engineers, Inc (PND). This task was to support the design of the proposed Alaska Department of Transportation and Public Facilities (AKDOT&PF) ferry terminal site.

The project site is located at Cascade Point, about 30 miles north of Juneau, Alaska. The purpose of the marine facilities is to provide a protected berth for an Alaska Class Ferry while incorporating small vessel and barge moorage infrastructure. (Reference 1)

The two referenced PND reports, *Coastal Assessment and Design Study* (Reference 1) and *Vertical Wave Barrier Concept Design* (Reference 2), referred to the Pacific International Engineering study (Reference 3) for the metocean data. The environmental criterion from the study is summarized in this document.

The review had shown that the study only captured a short period of wind data about 25 years ago. The climatology study with current data was performed for comparison.

Wind

The design wind speeds shown in (Reference 3) were generated from available historical wind data from Juneau Airport and Eldred Rock, located about 20 miles northwest of Cascade Point. While Eldred Rock is closer to Cascade Point, the records were only available for a 5-year period as opposed to the 44-year record from Juneau Airport. The short-term wind data from Eldred Rock was affirmed using statistical comparisons with the data from Juneau Airport.

Table 1 shows the comparison of the design wind speeds from (Reference 3) and the recent data set (Reference 4 and 5) for 25-year return period.

Table 1 Design wind speed comparison for 25-year return period

Direction (from)	PIE¹ 1985-1989	Juneau Airport² 1948-2022	Eldred Rock³ 2006-2022
N	62.0 kt	27.1 kt	68.4 kt
NE	-	25.4 kt	82.6 kt
E	-	47.8 kt	54.4 kt
SE	-	50.0 kt	65.1 kt
S	45.0 kt	28.8 kt	54.6 kt
SW	-	27.0 kt	61.6 kt
W	-	27.5 kt	49.2 kt
NW	-	18.1 kt	69.0 kt

¹ Reference 3

² Reference 4

³ Reference 5

There is a lack of correlation between the wind data from Juneau Airport and Eldred Rock, as mentioned in (Reference 3). The data from Eldred Rock appears to be a better source due to the site's proximity to Cascade Point.

The recommended design wind speeds with the recent wind data from Eldred Rock are listed in Table 2.

Table 2 Recommended design wind speeds

Direction (from)	Return Period		
	25-years	50-years	100-years
S	54.6 kt	57.9 kt	61.2 kt
SW	61.6 kt	69.2 kt	77.0 kt
W	49.2 kt	56.8 kt	64.3 kt
NW	69.0 kt	76.4 kt	83.6 kt

Wave

The design wave heights were derived from the wind data by applying the design wind speeds to measured fetch lengths, shown in Figure 1, using the Automated Coastal Engineering System (ACES) (Reference 6).

Reference 3 defined the significant wave height to be 9 feet when used with the highest wind speed during the 50-year period. The wave period of 7 seconds correlated to the wave height on the storm waves curve from Figure 9 Roberts Bank Wave Buoy Data in Reference 1.

Instead of using the highest wind speed from the 5-year data, the design wind speeds from Table 2 were used to generate the wave conditions. The fetch lengths in Figure 1 were also used in the calculation.

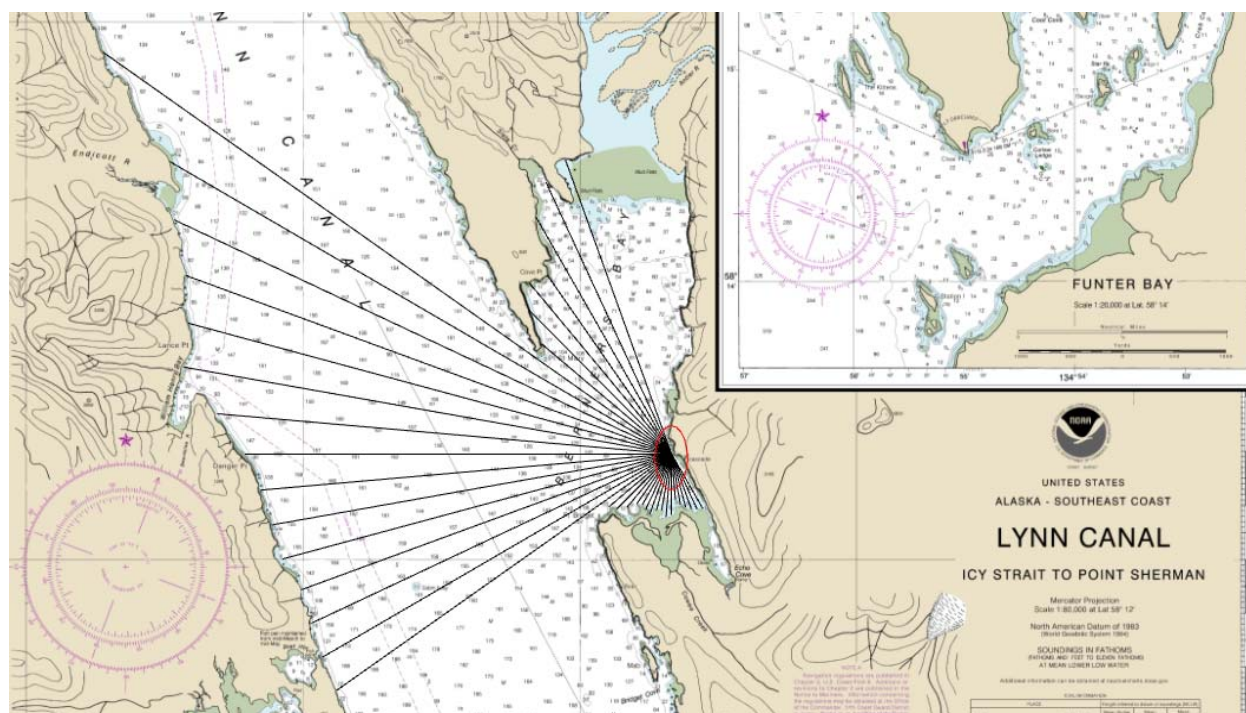


Figure 1 Fetch radials for Cascade Point

The resulting wave conditions are shown in Table 3.

Table 3 Design waves condition comparison

Direction (from)	PIE 25-yr RP ¹		New Study 25-yr RP		New Study 50-yr RP		New Study 100-yr RP		
	Hs (ft)	Fetch (ft)	Hs (ft)	Tp (s)	Hs (ft)	Tp (s)	Hs (ft)	Tp (s)	Fetch (ft)
S	1.6	6,336	2.3	3.0	2.5	3.2	2.8	3.3	7,035
SW (235°)	4.2	40,656	6.3	4.8	7.7	5.3	9.2	5.8	47,599
W	4.3	42,768	4.7	4.2	6.0	4.7	7.4	5.2	49,668
NW (305°)	9.0	71,808	9.4	5.8	11.1	6.3	13.0	6.8	80,835

¹ References 3, 7

The latest PND drawing package (Reference 7) refers to PND study update conducted in February 2010. The data set correlates to (Reference 3).

(Reference 2) also shows a wave height of 1.3ft at the end of the floats, reduced due to breakwater.

Tide

The following tide conditions are listed in (Reference 8):

- MLLW datum
- Highest Observed Water Level = 18.9 ft.
- Lowest Observed Water Level = -4.8 ft.

The current tide conditions (Reference 8) that include extreme tides after 1997 are listed below:

- MLLW datum.
- MHHW = 16.3 ft.
- MLLW = 0 ft.
- Max Tide (Highest Observed Tide) = 25.05 ft.
- Min Tide (Lowest Observed Tide) = -5.66 ft.
- Highest Astronomical Tide = 20.65 ft.
- Lowest Astronomical Tide = -4.88 ft.

Current

The following current speeds are listed in (Reference 8).

- Current speed (ebb) = 0.7 knots.
- Current speed (flood) = 0.3 knots.
- Wind-driven current speed 1.5 knot wind-driven (2 to 5% of wind speed for 45kt wind).
- Maximum potential current = $2.5+1 = 3.5$ knots.

As stated in (Reference 3), the wind-driven and tidal currents are not likely to be significant to the project site due to its location within the bay.

Recommended Design Conditions

The following table summarizes the recommended design conditions.

Table 4 Recommended design wind speeds and wave conditions

Return Period Direction (from)	25 years			50 years			100 years		
	Wind Speed (kt)	Hs (ft)	Tp (s)	Wind Speed (kt)	Hs (ft)	Tp (s)	Wind Speed (kt)	Hs (ft)	Tp (s)
S	54.6	2.3	3.0	57.9	2.5	3.2	61.2	2.8	3.3
SW	61.6	6.3	4.8	69.2	7.7	5.3	77.0	9.2	5.8
W	49.2	4.7	4.2	56.8	6.0	4.7	64.3	7.4	5.2
NW	69.0	9.4	5.8	76.4	11.1	6.3	83.6	13.0	6.8

The recommended tide conditions are listed below:

- MLLW datum.
- MHHW = 16.3 ft.
- MLLW = 0 ft.
- Max Tide (Highest Observed Tide) = 25.05 ft.
- Min Tide (Lowest Observed Tide) = -5.66 ft.
- Highest Astronomical Tide = 20.65 ft.
- Lowest Astronomical Tide = -4.88 ft.