Humboldt Bay: Planning for Offshore Wind, Equity, Resilience, and Economic Development

Humboldt: POWERED

Port of Humboldt, California

U.S. Department of Transportation / Maritime Administration

FY 2023 Port Infrastructure Development Program (PIDP) Grant Application

Project Narrative

Submitted by:
Humboldt Bay Harbor Recreation and Conservation District
Eureka, California

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

SUPPORTING DOCUMENTATION / ATTACHMENTS

Supporting documentation for this application, including a cost estimate, letter of funding commitment, and Letters of Support have been submitted on www.grants.gov as attachments, separate from this Narrative. Documents uploaded to the Attachments Form on www.grants.gov include:

1. Project Narrative: Humboldt POWERED_FY2023 PIDP Narrative.docx
2. Project Schedule: Humboldt FY2023 PIDP – Project Schedule (Gantt).pdf
3. Letters of Commitment: Humboldt FY2023 PIDP – Letters of Commitment.pdf
4. Project Engineering Drawings: Humboldt FY2023 PIDP – Project Engineering Drawings.pdf
    a. Overall Bay View (June 2022)
    b. Conceptual Site Plan Based on 10% Design (April 2023)
    c. Conceptual Master Plan (May 2022)
    d. Marine Terminal Redevelopment, Mitigation, and Construction Phasing Plan
5. Project Planning Documents: RMT Preliminary Basis of Design (2022).pdf
6. Project Planning Documents: Schatz Electrical Infrastructure and Green Port Conceptual Assessment Memorandum.pdf
7. Letters of Support: Humboldt FY2023 PIDP - Letters of Support.pdf
8. Other Documentation (Google Earth File): Baywide Master Plan Extents.kmz
9. Other Documentation (Google Earth File): Humboldt Wind Terminal Extents.kmz
10. Other Documentation (Google Earth File): Humboldt Wind Overall Bayview Image Overlay.kmz
11. Other Documentation (Google Earth File): RMT 10% Design Concept Image Overlay.kmz
12. Other Documentation: BOEM CA Floating OSW Regional Ports Assessment.pdf
13. Other Documentation: CEC OSW Energy Development off the CA Coast.pdf

INTRODUCTORY INFORMATION

Name of lead applicant	Humboldt Bay Harbor Recreation and Conservation District ("Port" or "Port Authority")
Applying jointly?	No. Though a private industry partner (Crowley Wind Services, Inc.) has prepared a Letter of Commitment.
Project Name	Humboldt Bay: Planning for Offshore Wind, Equity, Resilience, and Economic Development (Humboldt: POWERED)
Project Description	Humboldt: POWERED is a small port planning grant project in Humboldt Bay, California, that will achieve the objectives of the Port Infrastructure Development Program by investing in multifaceted planning, stakeholder engagement, design and engineering, and workforce development activities for the West Coast's floating offshore wind industry. The project will enhance the safety, efficiency, and reliability of moving goods by designing resilient, green infrastructure that enables the sustainable manufacture, transport, and installation of floating offshore wind turbines. The project will catalyze the domestic offshore wind industry, generating economic vitality at all levels while proactively addressing climate, equity, and environmental justice impacts.
Is this a planning project?	Yes
Coastal, Great Lakes, or inland?	Coastal Port
GIS Coordinates	40°49'03.2"N, 124°11'00.4"W
Urban or rural area?	Urban (Eureka, CA Urban Cluster)
Project Zip Code	95564
Is the project located in a Historically Disadvantaged Community (HDC) or a Community Development Zone?	Yes. The project is within a State of California Opportunity Zone (https://opzones.ca.gov/find-opportunity-zones/) and is within a HUD qualified opportunity zone, ID 06023001300.
Has the same project been previously submitted for PIDP funding?	Yes and No. FY2021 and FY2022 PIDP applications requested capital funding for small initial phases of the envisioned the Redwood Marine Offshore Wind Terminal. This proposal seeks planning grant funding for terminal redevelopment and creating a Baywide Master Plan.
Applying for other discretionary grant programs in 2023?	Likely yes, for future construction phases.
Previously received TIGER, BUILD, RAISE, FASTLANE, INFRA or PIDP funding?	No
PIDP Grant Amount Requested	$8,672,986
Total Project Cost	$10,926,060
Total Federal Funding	$8,672,986 (79.38%)
Total Non-Federal Funding	$2,253,074 (20.62%)
Use ofl RRIF or TIFIA funds?	No

I. PROJECT DESCRIPTION

A. Concise Project Description and Summary of Project Sites

The Humboldt Bay Harbor, Recreation, and Conservation District ("Port" or "Port Authority") is requesting $8,672,986 in Port Infrastructure Development Program (PIDP) funding for the following:

Task 1: Overall Project Management and Grant Administration
Task 2: Heavy-Lift Offshore Wind Terminal Project at RMT Site: Studies, Design, and Permitting
Task 3: Baywide Master Plan for Offshore Wind Development

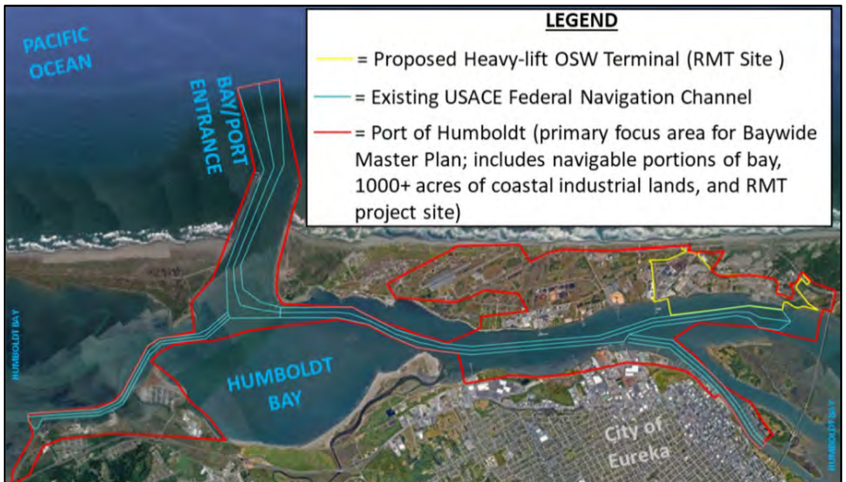

Figure 1: Summary of Proposed Project Areas (also includes existing Federal Navigation Channels). See Attachments for KMZ files.

The proposed Project has two primary sites: the Heavy-Lift Offshore Wind Terminal Project at the RMT Site and the Baywide Master Plan. As shown in Figure 1, the RMT site is displayed in yellow and falls entirely within the Baywide Master Plan Area. The primary extents of the Baywide Master Plan are shown in red, though potential recreation mitigation projects and ecological restoration projects may occur outside the red boundary. **The objectives of the Terminal Project at RMT ("RMT Project") (Task 2) are to: complete all remaining required special studies & data collection efforts; advance the already-in-progress design/engineering from ~10% to >30%; complete California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) documentation[1,2]; complete permitting; and complete final design for the site's access roads.** Using State and local funds, the Port is currently completing an approximate 10% design effort on the RMT Project and has completed many special studies. **The purpose of the Baywide Master Plan (Task 3) is to look beyond the RMT site, identify other potential offshore wind energy related projects within Humboldt Bay, and determine other west coast and regional needs that Humboldt Bay can satisfy.**

If awarded PIDP funding, this planning grant project will enable the Port to leverage its existing funding from the California Energy Commission to support shovel-ready design activities and broad community and stakeholder engagement for future port and harbor infrastructure projects that inform and enable the full-scale development of California's two offshore wind lease areas recently awarded by BOEM (Humboldt Offshore Wind Lease Areas and Morro Bay Offshore Wind Lease Areas) as well as future projects along the West Coast.[3]

[1] The Port has engaged in initial conversations with USACE and anticipates that the USACE will be the lead agency.
[2] CEQA, NEPA documentation is to be funded exclusively through matching funds and not with PIDP funds.
[3] https://www.boem.gov/renewable-energy/state-activities/california

B. Project Need in the National/State Context

On February 22, 2023, the Biden Administration announced a goal of deploying "15 GW of floating offshore wind by 2035." This goal faces substantial marine and systemwide transportation challenges. Unlike offshore wind development on the Atlantic and Gulf coasts, the Pacific Ocean is too deep for offshore wind platforms fixed directly to the ocean floor. Instead, Pacific Coast offshore wind will be deployed on **floating platforms**. Floating offshore wind (FOSW) platforms and the accompanying equipment (blades, towers, etc.) are all so massive that none of the primary equipment/components can be transported across land. Instead, nearly all FOSW components can only be transported via large marine vessels. Accordingly, all manufacturing and final assembly of FOSW must occur within ports at custom heavy-lift marine terminals that have large laydown areas and manufacturing areas and that are immediately adjacent to deep draft navigation channels. **Floating Offshore Wind will be a new and innovative industry in the U.S. and will require new specialized marine terminals.** Many of these terminals will need to be of a size and scale that does not currently exist on the west coast of North America. Adding to these challenges, manufactured equipment will need to be shipped between ports and thousands of fully-assembled floating wind turbines will need to be towed from ports, all without interrupting current cargo transport patterns or port cargo handling operations. The Port of Humboldt will be critical to addressing these challenges.

According to the "California Floating Offshore Wind Regional Ports Assessment" published by the Bureau of Ocean Energy Management (BOEM) in January of 2023, Humboldt Bay is the only California port capable of hosting each of the three critical facility types necessary to support offshore wind development and operation (see Figure 2).[4] In addition, the BOEM study specifies that only the Ports of Humboldt Bay, Los Angeles, and Long Beach are capable of conducting the final "vertical integration" stage of deploying offshore wind turbines. Among these three ports, only Humboldt Bay has immediately available developable space, meaning that **Humboldt Bay must serve as California's initial vertical integration port.** Without the development of a vertical integration terminal within Humboldt Bay, the State and Federal Government cannot achieve their offshore wind goals within the targeted timelines. Humboldt Bay is optimal for serving the FOSW industry because the bay: is

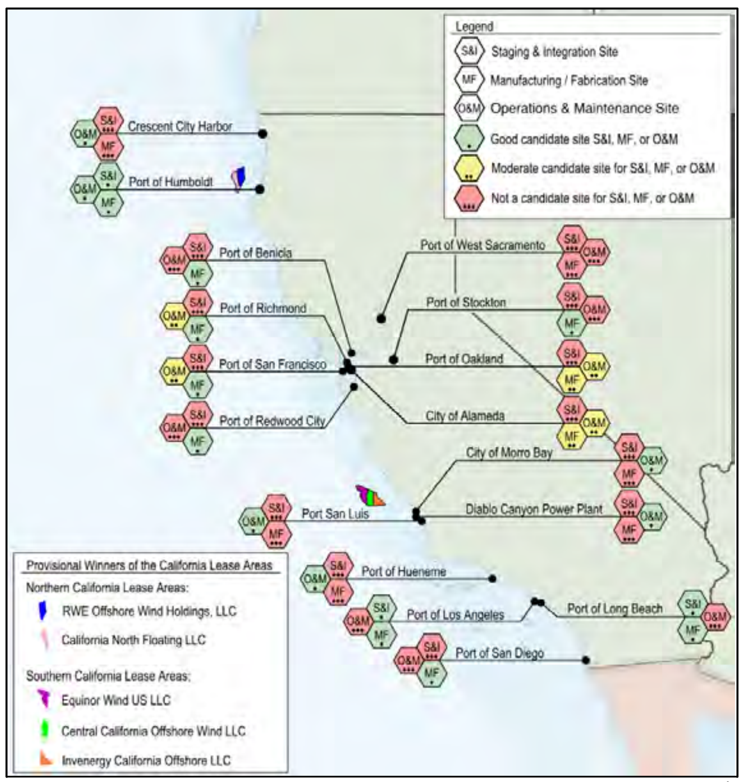

Figure 2. S&I, MF, and O&M Candidate Status for Each CA Port[4]

[4] https://www.boem.gov/sites/default/files/documents/renewable-energy/studies/BOEM-2023-010.pdf. The three facility types are 1) Staging and Integration (S&I) Sites, 2) Manufacturing/Fabrication (MF) Sites, and 3) Operations and Maintenance (O&M) Sites.

centrally-located to the current and future west coast offshore wind areas, has the required navigation channel widths/depths without any needed modifications to the Federal navigation channel, has no conventional containerized cargo operations, has no vertical obstructions (bridges, powerlines, or other), and contains substantial available and developable industrial space immediately adjacent to navigation channels. These features make the Port of Humboldt Bay uniquely and ideally suited for manufacturing/ marshalling FOSW components, assembling foundations, and vertically integrating all components into deployment-ready units.

Several west coast ports have vertical obstructions that will limit their ability to serve the FOSW industry. For instance, all of the ports within San Francisco Bay are limited by the relatively low height of Golden Gate Bridge. Other west coast ports have competing cargo needs, have very limited developable land area, and will likely be limited in their ability to serve the industry. Accordingly, the State has designated the Port of Humboldt Bay as a principal offshore wind marshalling port. In line with this finding, the California Energy Commission granted $10.45M to the Port in 2022 to utilize as matching funds for Federal grants and to fund development of a heavy-lift offshore wind terminal project at a 180-acre Port-Authority-owned site known as the Redwood Marine Terminal (RMT) (see Figures 1, 3, and 4). The California State Lands Commission also granted $576,191 to the Port to support the project. Notably, these investments by the State of California preceded BOEM's recent identification of Humboldt Bay as being the only "good candidate" port for supporting all aspects of developing and maintaining California's OSW industry (Figure 2).

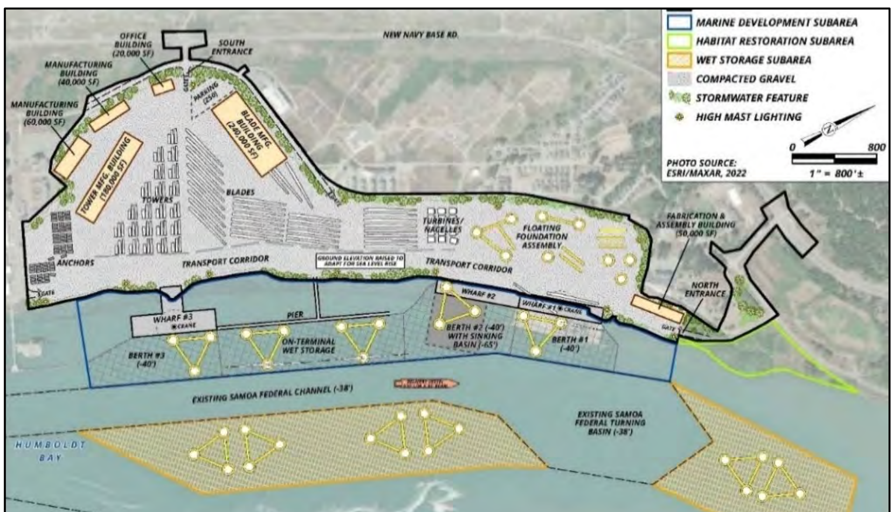

Figure 3. Previously completed 10% design effort on the RMT FOSW Terminal

The proposed heavy-lift offshore wind terminal project at the RMT site is envisioned to specialize in vertical integration, with room for manufacturing and other related uses (Figure 3). Thanks to the grant from the California Energy Commission, significant progress is already underway on planning and designing the terminal. Progress to date includes the development of a conceptual Master Plan (Attachment 4), preliminary engineering designs (Attachment 3), a Basis of Design (Attachment 5), field studies, preliminary environmental studies, and initial stakeholder engagement. This Project will leverage those funds provided by the State of California to advance design, permitting, and environmental compliance of the proposed site, establish and fortify lines of communication among diverse stakeholder groups to enhance project design and benefits, and design upgrades so the site will be resilient to sea level rise, all of which is designed to attract wind industry private investment and support Federal/State offshore wind and greenhouse gas reduction goals. The PIDP Project will also develop a Master Plan that will facilitate modernization of the port bay-wide to meet the needs of offshore wind energy development.

C. Project Need in the Regional and Local Context

The former wood product manufacturing/shipping site known as RMT was once one of the largest employment centers in a multi-county region, with hundreds of skilled workers employed at the site for several consecutive generations. Today, the site is almost entirely vacant. The timber industry was the primary employment sector throughout California's north coast, but began significantly declining in the 1980s. The RMT site stayed active and employed hundreds of workers until 2013, at which time the site completely shuttered and caused massive layoffs that the community still has not recovered from. This also led to a precipitous decline in the number of cargo ships (shipping wood products) leaving Humboldt Bay.

As outlined in the Demographics sections below, the project area and surrounding communities contain a much higher percentage of people unemployed and living below the poverty level than State and Federal averages. The median income for the area is almost half that of the statewide average. The region also has higher-than-national and higher-than-statewide percentage of American Indian population, providing opportunities for Tribal hiring preferences and Tribal-oriented job training. The Port Authority has been working with several Tribal governments and several stakeholders to act on these opportunities.

The future improvements made possible by the proposed PIDP funding will transition a nearly vacant industrial site to a modern multipurpose terminal that is needed to serve as a primary west coast facility for the manufacturing, import, staging, preassembly, and loadout of large offshore wind components, including both wind turbine generation components and floating foundation components. The Master Plan will further facilitate bay-wide Port development, recognizing that not all offshore wind development needs can be met at the RMT site. Port development will revitalize the local economy and rejuvenate Humboldt Bay's overall ship traffic and cargo tonnage by introducing an entirely new industry.

D. Planning Project

This proposal seeks to advance planning activities which have already received partial funding from the California Governor, State Legislature, California Energy Commission, and California State Lands Commission pursuant to AB 525 to establish the Port as the Northern California locus of offshore wind development, manufacturing, operations, maintenance, and training.[5]

E. Statement of Work / Project Components

The Project is designed to logically progress project readiness with multiple tasks occurring simultaneously (as outlined in the attached schedule). The Project Team will undertake Project management and administrative activities necessary for Project completion on time and within budget. See Section VI.A.iv for a detailed list of milestones and deliverables associated with each task. The Project has the following tasks:

TASK 1 – OVERALL PROJECT MANAGEMENT AND GRANT ADMINISTRATION

The Port Authority will directly oversee all Task 1 administrative activities, act as the lead permitting agency, and work with project partners to manage the Project. The Port will perform overall Project management, including project planning and control, permitting, subcontractor management, financial management, data management, management of supplies/equipment, risk

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[5] https://www.energy.ca.gov/news/2022-03/state-approves-105-million-prepare-port-humboldt-bay-offshore-wind

management, and reporting as required to successfully achieve the overall project objectives. This task will include the following sub-tasks:

- Ongoing project management, administration, and planning for the duration of the grant period
- Submission of FY2023 PIDP NEPA environmental documents (NEPA Documentation for Grant Award)
- Subcontractor procurement and contracting
- Monitoring grant awardee selection and Buy America compliance
- Grant agreement execution
- Kickoff meeting
- Project scheduling
- Quarterly reporting
- Draft and Final Report development

TASK 2: HEAVY-LIFT OFFSHORE WIND TERMINAL PROJECT AT THE RMT SITE

Task 2a – RMT Heavy-Lift Offshore Wind Terminal: Special Studies and Site Investigations

The Port Authority will lead and oversee contractors to complete the remaining needed special studies and site investigations as presented in the outline above. The only special study expected to require NEPA documentation is the geotechnical borings. The Port anticipates that a NEPA categorical exclusion will be required for the borings and that the other studies can proceed prior to NEPA documentation with MARAD approval. These activities will be developed through substantial coordination and engagement with port tenants, local utility providers, regional transportation stakeholders, industry stakeholders, community-based organizations, environmental and energy justice groups, cargo stakeholders, and advanced technology developers and manufacturers. This task will include the following sub-tasks:

- Coastal/Navigation/Hydrology/SLR/Tsunami Analysis
- Geotechnical Borings and Analysis (Land, Marine, Sediment Sampling)
- Sediment Testing, Analysis, and Sampling Plan
- ROW, Title Reports, Boundary Surveying, Site Surveying (Land & Bathymetry)
- Dredged Material Management Planning, Coordination, Analysis
- Air Quality Analysis, Terminal Electrification Plan, and Green Construction Plan
- Terrestrial/Wetland/Habitat Assessments/Mitigation Plan & Reporting
- Living Shoreline/Bank/Dredge Slope Stabilization Assessment/Analysis
- Off-Terminal Habitat Assessments/Surveys (Microgrid)
- USACE Sect 408 Analysis - Hydrodynamics, Sed Transport, Local Wet Storage[6]
- USCG Analysis - ATON, Vessel Maneuvering
- Land Transportation Analysis
- Agency Coordination

Task 2b – RMT Heavy-Lift Offshore Wind Terminal: 30% Engineering

The Port Authority will direct and oversee contractors engaged in the development of preliminary engineering (advancing from ~10% to 30% or beyond) for the Redwood Marine Terminal, resulting in the products listed in the outline above. This effort will inform the subsequent tasks

[6] The project does not include any plans to modify the existing Federal Navigation Channels since preliminary modeling indicates that such modifications will not be needed.

and will provide an engineering-based project description, illustrative graphics, site plans, a Basis of Design report, cost estimates, and material quantities. This will include the following sub-tasks:

- Civil Engineering and Site Design (Buildings, Power, Fire, Water, Sewer, Grading, Stormwater, Roads, Geotechnical, Electrical/Power)
- Marine Engineering Design (Structural, Wharf, Wet Storage, Shoreline Stabilization, Geotechnical)
- Design-based Documents, Graphics, and Site Plans
- Cost Estimates/Constructability/Quantities

Task 2c –RMT Heavy-Lift Offshore Wind Terminal: Complete NEPA, CEQA, Permitting, and Environmental Studies

The Port Authority will lead development of permit applications and support issuance of permits to enable the larger RMT modernization effort to proceed to construction in an expedited fashion. This will include the following sub-tasks:

- Environmental Constraints/Env Doc Settings
- CEQA
- NEPA
- Permit Applications (401, 404/10, WQ Cert, Coastal Development Permit, etc.)
- Stakeholder Outreach

Task 2d – Advanced Design for Access Roads, Roadway Connections, & Habitat Mitigation

The Port will oversee contractors in the development of advanced engineering studies supporting the surface transportation portions of the Project, including a raised, improved, and realigned access road from the county roadway that will enable greater access to the site for future phase construction activities. This will include the following sub-tasks:

- 90% plans and specifications
- Final plans and specifications
- Bidding plans and specifications

TASK 3: BAYWIDE MASTER PLAN FOR OFFSHORE WIND DEVELOPMENT

The Port will lead outreach, engagement, and assessments to develop a Baywide Master Plan that informs future holistic uses of the navigational channels of Humboldt Bay and its industrial tidelands. The Baywide Master Plan will seek to integrate the Humboldt Bay Offshore Wind Port (marshalling terminal) with the larger energy, logistics, operational, recreational, commercial, and navigational needs of the region, California, and the U.S. The Master Plan will review the linkages, logistics, technology, and potential manufacturing locations at the ports of San Diego, San Pedro, Hueneme, San Francisco, and Humboldt to ensure compatibility of functions, equipment, workforce, and energy production and transmission goals. This Baywide Master Plan will leverage ongoing activities and best practices for equitable and accessible stakeholder engagement to inform the development of various subplans (or Master Plan chapters) such as a *Terminal Electrification Plan; Workforce Development Gap Analysis*;[7] *Diversity, Equity, Inclusion, and Accessibility (DEIA) Plan*; *Community Benefits Plan*; and, *Domestic Procurement Gap Analysis*. These activities will support greater sustainability, equity, workforce readiness, technology and

[7] This effort is underway in partnership with Cal Poly Humboldt and College of the Redwoods under a local $800,000 grant.

knowledge transfer, and community and industry benefit while ensuring that OSW projects comply with forthcoming regulations and mandates. This will include the following sub-tasks:

a. **Chapter 1: Diversity, Equity, Inclusion, and Accessibility (DEIA) Plan**
   i. Stakeholder outreach
   ii. Humboldt: POWERED Project website
   iii. Development of Marketing Materials
   iv. Technology and Knowledge Transfer Plan
   v. DEIA Plan
b. **Chapter 2: West Coast Floating Offshore Wind Needs Evaluation**
   i. Data Compilation and Industry Outreach
   ii. Domestic Procurement Gap Analysis & Agency/Stakeholder Coordination
   iii. Workforce Development Gap Analysis & Agency/Stakeholder Coordination
   iv. Supply Chain, Manufacturing Ports Strategic Planning
   v. Wet Storage Needs Assessment
   vi. Project Case Studies Targeting Policy Makers, Fleets, and Technology Vendors
c. **Chapter 3: Opportunity and Options Analysis for Sites Throughout Port of Humboldt**
   i. Evaluation of offshore wind development options throughout the Port of Humboldt Bay beyond the RMT site
   ii. Strategic planning for supply chain and transport linkages to other manufacturing ports
   iii. Navigation and Environmental Conditions Assessment
   iv. Wet Storage - Case Study, Literature Review & Criteria Development
d. **Chapter 4: Impact Assessment and Evaluation of Mitigation Alternatives**
   i. Recreational Facility Mitigation Assessment
   ii. Mitigation Needs & Opportunities (Longfin Smelt, Estuary, Benthic, Intertidal Conversion)
   iii. Scoping and recommendations of next steps (including NEPA requirements)

Previously completed planning efforts funded by the State envision the ultimate development of the heavy-lift offshore wind terminal project at the RMT site to be constructed in phases as presented in Figure 4 (see also, Attachment 4).

Figure 4. Redwood Marine Terminal Redevelopment – Planned Construction Phases

F. Applicant Eligibility

Established by voters in 1973, the Port is a trustee agency with management authority granted by the California Legislature. It is a countywide agency with permit jurisdiction over all tidal, submerged and other lands granted to the Port, including all of Humboldt Bay. Per the California Harbors and Navigation Code, the Port is responsible for all natural resources and planned development within the harbors and ports of Humboldt Bay.

As the eligible lead applicant, the Humboldt Bay Harbor, Recreation, and Conservation District (UEI# KC13AZ47BGR3) will oversee and lead all project activities as described in Section I.H. As the sole eligible entity in this proposal, the Port Authority has not included a Memorandum of Understanding with this proposal as described in Section D(2)(b) of the Notice of Funding Opportunity (NOFO).

G. Small Project at a Small Port

Humboldt Bay Harbor District is an underutilized **small coastal seaport** with deep water navigation channels and substantial development capacity. The primary project activities will take place within the **Eureka Urban Cluster**. The Port operates, leases, and/or maintains eight terminal/dock facilities, a boat yard, and marina within the Port Authority's jurisdiction. Current industrial activity throughout the Port is predominantly timber and wood chip exports, bulk fuel imports, commercial fishing, aquaculture, and mariculture. Occasionally, cruise ships call at Humboldt Bay, with five visiting within the last five years and four scheduled for 2023. The Port has the capacity and navigation channels to handle significant ship traffic and tonnage, but currently has a greatly reduced volume since the collapse of the regional timber industry in the 1980s. Today, **the Port of Humboldt Bay is a Small Port as defined in PIDP guidance, moving fewer than 8,000,000 short tons per year in each of the previous three calendar years.** Indeed, the Port handled only 462,310 short tons of cargo in 2020, 527,273 short tons in 2021, and 459,616 short tons in 2022—entirely comprised of fuel imports and wood chip exports. This proposal qualifies as a Small Project by seeking less than $11.25 million in PIDP funding.

H. Project Team, Key Roles, and Responsibilities

The Port Authority is led by Executive Director Larry Oetker, who has over 30 years of experience leading a wide range of development projects throughout the region. While serving as the Community Development Director of the nearby City of Arcata, he facilitated substantial industrial redevelopment. Mr. Oetker will serve as the overall Project Director. Rob Holmlund is the Port's Development Director and will serve as the Project Manager. The majority of Mr. Holmlund's professional career was in private consulting for global engineering firms. He has managed a wide range of development projects throughout the entire US West Coast and the South Pacific. Prior to his time at the Port, Mr. Holmlund served as the Community Development Director for the City of Eureka. Other District staff will also contribute to the project, including the individuals listed here: https://humboldtbay.org/staff.

Through the proposed planning efforts, the Port will be supported by Crowley, the nation's largest employer of Jones Act Mariners and a leading port terminal and vessel operator in the United States. Crowley recently entered into an Exclusive Right to Negotiate for the future redevelopment and operation of the existing Redwood Marine Terminal (RMT) which will become the west coast's premier vertically integrated offshore wind port. Further, Crowley opened an office in Eureka, CA in April 2023 to support its Wind Services team throughout development and operations of the facilities. Crowley will leverage its experience in developing the logistics, longshoremen and mariner workforces to coordinate the proposed *Offshore Wind Workforce Development Gap Analysis* with local and regional secondary schools, trade schools, community colleges, and universities. Additionally, Crowley will bring its substantial experience designing and operating port terminals—including the forthcoming Salem Offshore Wind Terminal in Salem, MA—and the vessels that call at them to support advancing engineering designs for the future terminal. Crowley has submitted a Letter of Support further describing its efforts to be a leader in developing the nation's offshore wind ecosystem and the diverse workforce enabling its growth and success.

The team is also supported by Moffatt & Nichol, a private engineering firm that was ranked by Engineering News-Record as the #1 Marine and Port Facilities Design Firm among its Top 500 Design Firms for 2022[8]. The District selected Moffat & Nichol through a competitive RFQ process in early 2022 to conduct the initial phases of the project. The Moffat & Nichol team is led by Shane Phillips,[9] coastal engineer with more than 27 years of experience with port development.

I. PROJECT HISTORY AND BACKGROUND

Aspects of the existing Redwood Marine Terminal were first constructed in the late 1800s for the forest products industry and the site was utilized as a lumber mill, pulp mill, and shipping port for a range of wood products. Following the decline of the timber industries in Northern California in the 1990s, the County, the Port, and nearby municipalities initiated several activities to improve the local economy. After a 12-year effort, the Humboldt Bay Channel Deepening Project was completed in April 2000, with new 48-foot-deep bar and entrance channels and 38-foot-deep North Bay and Samoa Channels. Over 23 years later, the Channel Deepening Project has helped establish the Port of Humboldt Bay as the only California seaport with sufficient water depth, developable land, and reasonably unimpeded access to the West Coast's offshore wind lease "call areas".

Project activities include support for redevelopment at the Redwood Marine Terminal, which was identified for redevelopment in the Port of Humboldt Bay Harbor Revitalization Plan (2003), the Humboldt Bay Management Plan (2007),[10] and the 2013 Samoa Industrial Waterfront Preliminary Transportation Access Plan. In 2017, Humboldt County initiated a land use planning study, and the Port Authority identified the market potential for an offshore wind port at the Port of Humboldt Bay as an ideal development alternative for the port, the county, and the region.[11] Since 2020, the Port has been developing initial design studies and has currently reached an estimated 10% engineering design status across most phases of the future offshore wind terminal development and associated facilities within the harbor. Yet, this development has received substantial attention that has resulted in the identification of numerous additional project components that would enhance the viability of the Port as the regional hub for the West Coast OSW industry while driving substantial, lasting benefits to the region and nearby communities. In addition to comprehensive design and engineering activities, this proposal seeks funding to further stakeholder engagement to ensure the equitable development of the envisioned projects while providing for the greatest beneficial use of Humboldt Bay and protecting its natural resources, wildlife, recreational opportunities, and ongoing commercial activities.

[8] https://www.moffattnichol.com/press/moffatt-nichol-is-proud-to-be-ranked-no-1-by-enr-in-marine-and-port-facilities
[9] https://www.moffattnichol.com/press/moffatt-nichol-welcomes-shane-phillips
[10] http://humboldtbay.org/sites/humboldtbay2.org/files/documents/hbmp2007/HumBayMgmtPLAN_print.pdf
[11] https://humboldtgov.org/DocumentCenter/View/64265/Humboldt-Bay-Maritime-Industrial-Use-Market-Study-2018-PDF

Since 2017, the Port Authority has focused on attracting offshore wind manufacturers, developers, operators, and service industries. The recent BOEM award of offshore wind leases underscores the policy and market needs for a heavy lift port to serve the nascent floating offshore wind industry in California and along the entire West Coast. In 2021, the State designated the Port of Humboldt Bay as a principal offshore wind marshalling port. In line with this finding, the California Energy Commission granted $10.45M to the Port in 2022 to utilize as matching funds for Federal grants and to fund development of a heavy-lift offshore wind terminal project at the RMT site (see Figures 1, 3, and 4). The California State Lands Commission also granted $576,191 to the Port to support the project. These investments by the State of California preceded BOEM's recent identification of Humboldt Bay as being the only "good candidate" port for supporting all aspects of developing and maintaining California's OSW industry (Figure 2).

J. Existing Conditions

Port Authority study efforts since 2017 include a Phase I site assessment, preliminary wetland delineations/biological assessments, eel grass surveys, cultural resource assessments, preliminary sea level rise studies, tsunami hazard studies, and screening level assessments of other potential impacts. The RMT site does not have any notable soil contamination, has a small pocket of wetlands that would need to be mitigated and contains a designated area for on-site wetland mitigation. Other existing site conditions are described in the Basis of Design report (Attachment 5). Bay-wide, there is similarly a large amount of underutilized coastal dependent industrial lands that could be utilized to support offshore wind energy development.

K. Transportation Challenges & Solutions

The Project faces two transportation-related challenges: short-term construction impacts on the surface and marine transportation systems; and long-term operational impacts on the harbor itself and the marine transportation system. The surface transportation portion of the Project will **complete 30% design** for a raised, improved, and realigned access road from the county roadway system into the RMT site. The design will elevate the roadway, yard, and laydown area grades to meet sea level rise design criteria for 2080 or 2100. The improved surface transportation access to the Port will help to manage the roadway access to the Port, especially during the heavy civil construction phase.

The long- term harbor and marine transportation needs will be addressed in the Baywide Master Plan. Floating offshore wind components are very large and too heavy to transport by truck or rail and will be delivered, assembled, installed, and maintained by marine transport. Certain components may be manufactured onsite at the Port, which would further enhance economic opportunity within the region, mitigate system-wide surface transportation impacts, and improve the availability of domestically-manufactured components for the OSW industry. The Baywide Master Plan will address multiple transportation challenges:

- The California supply chain for the entire offshore wind industry, and the Port of Humboldt role as the only location able to serve manufacturing, assembly, installation, and maintenance functions (Figure 1).
- Solutions for the safe movement of marine traffic, protection of navigation channels, and identification of "wet storage" areas to store marine foundations and completed assemblies prior to towing offshore (Figure 3).
- Identification and mapping of submerged and intertidal areas to evaluate any environmental or operational impacts of the offshore wind vessels and activities within Humboldt Bay.

The Baywide Master Plan will be built on community and stakeholder outreach to further identify and resolve community and stakeholder issues. As described in Section I.H, the project's community and stakeholder engagement will support development of multiple subplans including the *Terminal Electrification Plan*, *Workforce Development Gap Analysis*, and *Community Benefits Plan*. Surface transportation impacts, especially during the construction period, has been identified as a community issue. As a brand-new industry and supply chain, the Humboldt offshore wind project will need to resolve not only the harbor operational issues of the new industries but also those of existing port industries and the larger California offshore wind supply chain and maintenance industries.

The Project will allow the Port of Humboldt to address its community and stakeholder transportation issues in a transparent manner that links to the entire California OSW industry.

L. Project Benefits

The project will generate immense benefits to nearby communities, the region, the State, and the nation preparing the nation's first fully integrated hub for the floating OSW industry. The project's benefits are described in detail above under Project need. Generally, the project will be critical for the State and Federal governments to achieve their targets for offshore wind and reducing greenhouse gas emissions. At a local and regional level, the project will bring much-needed economic prosperity, the revitalization of a vacant blighted site, and a reinvigoration of the port.

M. Supports Related Infrastructure Investments

The Port is not seeking or making any additional transportation infrastructure investments at this time beyond the scope contemplated within this Small Port Planning Grant Project. However, the Humboldt: POWERED Project is a holistic planning study that will identify essential and additional transportation infrastructure investments that will be necessary to maximize the climate and economic benefits accruing to Humboldt as the primary hub for West Coast offshore wind development**. Notably, the State of California is currently investing $458 million for human capital development at California State Polytechnic University, Humboldt (Cal Poly Humboldt), including for a qualified and local offshore wind and logistics workforce.**[12]

N. Port Authority's Priorities for this Project

In furtherance of this project and the holistic development of the West Coast offshore wind industry, the Port Authority's priorities include:

- **Timeliness in contributing to Federal/State goals.** To meet State and Federal offshore wind energy goals, a west coast offshore wind port (especially a vertical integration terminal) must be developed immediately. Rapid timeframes for engineering design and permits are critical.
- **Strategic approach to meeting wind industry needs**. Early phase engineering will meet offshore wind industry needs and inform environmental reviews.
- **Inclusive, equitable, and accessible approach to advancing community needs.** Early and consistent involvement with community-based organizations, workforce development groups, Tribal governments, industry organizations, and other local and regional stakeholders will ensure offshore wind developments drive maximal benefit to all stakeholders.

[12] https://now.humboldt.edu/news/calpolyhumboldt.

- **Strategic approach to planning and permitting.** Early and consistent involvement with regulatory agencies and other stakeholders will gather support, streamline the regulatory process, and maximize future flexibility.
- **Design flexibility.** Designs will incorporate specific elements that include a wide range of port operations, such as specialty timber, breakbulk, and aquaculture, with the primary focus being for the offshore wind industry. Even among various offshore wind developers, there may be significant differences in the size of individual offshore wind components as well as the equipment and technology to load those components.
- **Green port development.** Marine terminal redevelopment design elements will incorporate the Port's desire to be the first purpose-built and operated carbon neutral port in California.
- **Sea level rise resiliency and low impact development.** Preparing the site for anticipated future changes in sea levels as well as design standards to minimize environmental impacts.
- **Developing a Humboldt Bay for all users.** The Baywide Master Plan will be an inclusive vision for balanced development that maximizes uses, safety, and accessibility for recreation, tourism, and commercial activities throughout the navigable waters and industrial areas within the tidelands.

II. PROJECT LOCATION

A. Port Location

The Port of Humboldt consists of all the navigable waters within Humboldt Bay, which is the second largest bay in California (see Figure 5 and Figure 1). The Port is entirely free of vertical draft restrictions and has over 1,000 acres of lands zoned for Coastal Industrial uses, all of which can be accessed by over six miles of existing federally maintained navigation channels that are accessible year-round. The Port has direct channel access to the Pacific Ocean, at 40.7195° N, 124.2426° W. The Port is on the northern coast of California, in Humboldt County, about 270 miles north of San Francisco and ~100 miles south of the Oregon border. The Port is centrally located on the US West Coast between San Diego and Vancouver and is the largest deep-water port in the 415+ mile stretch between San Francisco and Coos Bay, Oregon. The Port of Humboldt is the only port of sufficient size with the necessary parameters (e.g. channel width, channel depth, etc.) to support an offshore wind industry within approximately 175-miles to the north and 230 miles to the south. The Port has direct access to open water and the Pacific Offshore Continental Shelf and can provide transportation efficiencies for those responsible for turbine maintenance and operations over the long term. The BOEM Humboldt Offshore Wind Lease Area is 21 miles directly west of the Port, while the planned future Del Norte and Mendocino call areas are within 100 miles and can be fully supplied by the Project. The recently-leased Morro Bay Offshore Wind Lease Area is less than 370 miles from the Port of Humboldt Bay and can also be fully supplied by the Project. KMZ Shape Files accessible in Google Earth are included as Attachments 8, 9, and 10.

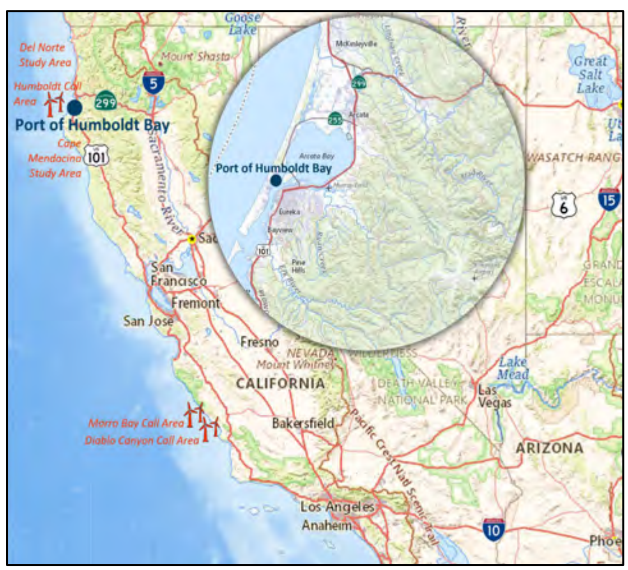

Figure 5. Project Location and BOEM Call Areas

B. Project Site

The bay has several significant assets to serve as the optimal location to support the West Coast offshore wind industry. The bay offers ideal conditions for the manufacture, assembly, marshalling, deployment, and operations and maintenance of offshore wind power equipment. The proposed RMT project site is a former wood products manufacturing site within the Port of Humboldt Bay, immediately adjacent to open water at the far north end of the USACE-maintained deep navigation channel. The RMT project site is zoned specifically for coastal-dependent industrial uses and has hosted a range of coastal industrial uses for decades, including nearly 100 years of timber and wood products ship-borne export. Both California State Polytechnic University, Humboldt (Cal Poly Humboldt) and College of the Redwoods are nearby, providing workforce training at all skill levels, from specialized manual labor to postgraduate-degree-level engineers. The bay is especially compelling because it is geographically the closest port to the Humboldt Call Area, which is about 20 nautical miles west of Humboldt Bay.

C. Transportation Connections

The Port of Humboldt Bay is accessible by air, sea, and road, with U.S. Highway 101 being the region's primary coastal transportation corridor, and State Route 299, a fully STA Truck-approved transportation corridor that provides the Port of Humboldt Bay with direct access to Interstate 5 and the rest of the nation's Federal Surface and Maritime Transportation Networks. The project site at RMT is directly served by State Route 255 (SR 255), a California highway that follows a loop as a local alternative route for U.S. Route 101 (Figure 5).

The Port is a longtime supporter and active user of the M-5 Marine Highway corridor as approximately 80% of fuel is shipped between the SF Bay Area to Humboldt. Forest products are also regularly shipped north to Coos Bay, Greys Harbor, and other international ports. Given the sheer mass and weight of the floating offshore wind components, the full buildout of the marshalling, manufacturing, and maintenance facilities will require extensive use of the M-5 Marine Highway, with potential connections to other Marine Highway spurs. The offshore wind project will expand the uses on the M-5 Marine Highway, which is a stated goal of MARAD.

D. Census Designations

The population of Humboldt County, as of the 2010 Census,[13] was 135,940 residents, with about 19.6 percent living below the poverty level. The Project and the County are in a Census-Designated Urban Cluster and a Qualified Opportunity Zone, pursuant to 26 U.S.C. 1400Z-1, which is intended to spur economic development and job creation in distressed communities.

The project area and surrounding communities have a higher percentage of people unemployed and living below the poverty level, compared to State and Federal averages (Table 1). The median income for the area is almost half that of the statewide level. These statistics are indicative of a population of the working poor. The Project and directly related offshore wind energy development will revitalize waterfront industry at the terminal and across Humboldt Bay while providing living wage jobs and the opportunity to join unions to nearby communities.

Humboldt County is home to eight federally-recognized Tribal governments and many tribal members reside in the project area. Humboldt Bay falls entirely within the ancestral territory of the Wiyot peoples, who today belong to three different federally-recognized Tribal governments

[13] https://data.census.gov/cedsci/table?q=Humboldt&g=1600000US0664392

clustered around the Bay. The Port Authority has positive ongoing relationships with each of these Tribal governments. The Wiyot Tribe is currently in a contractual and scientific partnership with the Port Authority in a multi-year endangered species sampling project. The Port Authority is also currently in a formal partnership with the Tribe managing a $7 million grant to conduct comprehensive habitat restoration and invasive species removal on the 300-acre Tuluwat Island, which is the cultural and religious heartland of the Wiyot Peoples.

Demographic	2019 American Community Survey, Census Data[14,15]					
	Samoa	Eureka	Arcata	Humboldt Cnty.	California	National
Population	212	26,512	18,178	135,940	39,512,223	328,239,523
Unemployment Rate	19.6%	4.0%	3.5%	6.6%	5.1%	4.5%
% Below Poverty Level	33.1%	21.8%	24.7%	19.6%	11.8%	12.3%
% Minority	41.0%	44.8%	41.9%	26.2%	63.7%	40.1%
Black or African American (alone)	0%	2.5%	2.6%	1.3%	5.5%	12.4%
Hispanic or Latino (of any race)	4.2%	16.4%	16.8%	12.1%	39.4%	18.4%
American Indian/Alaska Native (alone)	2.4%	1.8%	2.2%	4.6%	0.4%	0.7%
Asian (alone)	0%	5.7%	4.1%	2.6%	14.6%	5.6%
Native Hawaiian/Pacific Islander (alone)	1.4%	0.2%	1.2%	0.4%	0.4%	0.2%
Other Race (alone)	0%	7.2%	7.3%	0%	0.03%	0.03%
Two or more races	33%	11.0%	7.7%	5.2%	3.1%	2.5%
Median Household Income	$42,292	$46,926	$39,069	$51,662	$80,440	$65,712

Table 1. Demographic Information for the Project Area

Demographic data support a higher-than-national and higher-than-statewide percentage of American Indian population. The percentage of American Indians in Humboldt County is five times the national average. Tribal members suffer disproportionately from high regional unemployment and poverty rates. The Port Authority will work with Tribes and the county workforce investment board to seek employment opportunity for tribes and other disadvantaged communities in Humboldt County.

While the Town of Samoa registered only 212 residents in the 2019 Survey, there has been recent residential expansion with the construction of dozens of low-and moderate-income housing units near the RMT and more residential development is planned. This new residential construction is forecasted to triple the Town of Samoa's current population within 10 to 15 years.

E. Community Development Zones & Demographics

The Port of Humboldt Bay is all within a federally-designated, low-income opportunity zone (ID No. 06023001300), as is the surrounding community. It is one of eight opportunity zones in Humboldt County.[16]

III. GRANT FUNDS, SOURCES, AND USES OF PROJECT FUNDS

A. Project Costs

The total future cost of the Humboldt: POWERED project is estimated at $10,926,060. Matching funds will be allocated from the existing California Energy Commission grant in the amount of $2,253,074, representing a 20.62% local match share. This non-Federal match in State funding for the Port of Humboldt Bay was allocated to support the emerging offshore wind industry. Based

14 https://data.census.gov/table?g=160XX00US0664392&tid=ACSDP5Y2019.DP05&hidePreview=true
15 https://www.census.gov/quickfacts/fact/table/
16 https://www.irs.gov/pub/irs-drop/n-18-48.pdf

upon current 10% engineering design studies, the full buildout in Humboldt of a comprehensive ecosystem supporting all aspects of developing and maintaining floating OSW will exceed $1 billion in costs.

B. PIDP Funding Request, Matching Funds, and Sources

The Port Authority is requesting $8,672,986 in PIDP Small Port/Small Project Planning Grant funding for eligible future expenditures. The State of California has committed $2,253,074 to the Project, as shown in Table 2. All local funds will be available at initiation of the Project to ensure that the Project is completed according to the proposed schedule. There are no restrictions or conditional approvals that could impede their use for the Project. The proposed budget does not include any previously incurred expenses, nor does it include any expenses to be incurred prior to grant award announcement. Yet, the Port does intend to begin incurring eligible expenses upon grant award announcement as allowable under 46 U.S.C. 54301(b) and described at Page 47 of the NOFO and Section III.D. The proposed budget satisfies the statutory cost-sharing requirements by proposing $2,253,074 in non-Federal match share as described above, representing a 20.62% match share for the $10,926,060 Project. Table 2, below, provides a breakdown of Project costs by component and source of funds by PIDP, Other Federal, and Non-Federal.

Table 2: Project Costs & Funding Sources[17]

	Site →	Both	OSW Heavylift Terminal @ RMT Site				Baywide	TOTAL
Funding Source ↓	Task →	Task 1 PM	Task 2a Studies	Task 2b Engineering	Task 2c Permitting	Task 2d Roads PS&E	Task 3 Master Plan	
PIDP 2023	2023 PIDP Funds Requested	$328,725	$4,001,215	$1,185,788	$0	$1,802,500	$1,354,759	$8,672,986
PIDP 2023	Other Federal Funds Requested	$0	$0	$0	$0	$0	$0	$0
PIDP 2023	Non-Federal Funds (used as match to PIDP)	$0	$0	$0	$2,253,074	$0	$0	$2,253,074
PIDP 2023	**SUB-TOTAL (for 2023 PIDP project)**	**$328,725**	**$4,001,215**	**$1,185,788**	**$2,253,074**	**$1,802,500**	**$1,354,759**	**$10,926,060**
Non-PIDP	State $ Spent Prior to 2023 PIDP Award	*$285,970*	*$1,762,270*	*$985,439*	*$547,925*	*$0*	*$0*	*$3,581,604*
	TOTAL	**$614,695**	**$5,763,485**	**$2,171,227**	**$2,800,999**	**$1,802,500**	**$1,354,759**	**$14,507,664**

C. Documentation of Funding Commitment

The Port has documented all existing funding commitments for non-Federal funds to be used on eligible Project costs. Found in Attachment 3, this documentation includes the Letter of Commitment from the Humboldt Bay Harbor Recreation and Conservation District.

D. Previously Incurred Expenses

In order to meet aggressive California and Federal goals and timelines for offshore wind development, the Project will need to complete Preliminary Engineering, Site Investigations, Stakeholder & Community Outreach, NEPA/CEQA documentation, Baywide Master Planning, and Permitting, all by Q4 2025. This simplified schedule is discussed in Sections I.H and VI.A.iv. Assuming an October 2023 PIDP grant award announcement and a May 2024 obligation and grant agreement, the Port will be seeking authorization to use the following post-award and pre-obligation activities for the non-Federal cost share of the Project:

- Preliminary Engineering & Site Investigations – approximately $4,600,000
- NEPA/CEQA Documentation and Outreach – approximately $350,000
- Baywide Master Planning – approximately $500,000
- Final Permitting, Outreach and Documentation – next phase of development

[17] The Port Authority is able to provide a detailed cost breakdown upon request.

The Project team has developed procurement and project management systems to carefully segregate these costs from any pre-award costs. These assumed timelines and costs are likely to change as Project development, grant award dates, and grant agreement/obligations occur.

IV. MERIT CRITERIA

A. ACHIEVING SAFETY, EFFICIENCY, OR RELIABILITY IMPROVEMENTS

i. Protects Workers from Safety Risks

Given the needed size and complexity of the envisioned heavy-lift terminal at the RMT site, detailed seismic, structural, civil, and marine engineering will be needed to ensure that the site is constructed and operated safely. A key center point of the Project's planning activities will include looking to other floating offshore wind terminals and industry operations to identify safety hazards that are unique to this nascent industry to incorporate or establish best practices for minimizing safety risks. Establishing the best practices for minimizing safety risks will require planning level review of terminal, harbor-wide, bay-wide, and statewide operations and investments in the new offshore wind industry. The Project will result in preliminary designs and a Baywide Master Plan to ensure safety in loading and unloading operations; to identify and mitigate current risk issues; and to reduce the possibility of worker injuries.

The Project will advance the safety of manufacturing, transport, assembly, installation, and maintenance of floating offshore wind components in Humboldt Bay and California. This is essentially an entirely new industry, including the development of safety solutions and standards for highly specialized port facilities, vessels, and equipment.

The loading, unloading, and transport of offshore wind components will occur at the Redwood Marine Terminal, in the wet storage and maintenance areas of Humboldt Bay, and at the offshore installation sites. The Project's 30% plans and Baywide Master Plan will incorporate and/or establish safety standards for each phase of the development process. For example, the Project will determine:

- Transportation improvements for safe access of worker vehicles and trucks transporting supplies and small components from existing County roads to the marine terminal.
- What is the necessary separation between and among laydown uses, vertical assembly activities and equipment, and any manufacturing facilities or sites?
- How will vessel movements to and from the wet storage area affect loading operations at the heavy lift RMT?
- What separation distance between wet storage mooring areas and the edge of designated federal navigation channel and fairways would be required?
- Where and how will safe and secure vessel fueling/bunkering/charging operations occur?

The work to date has identified several safety risks, and the Project will address and hopefully mitigate those risks. For example, certain maintenance functions, such as blade replacement, are too unsafe to perform in the ocean environment. The Project will identify a Humboldt Harbor location where an entire offshore wind unit can be towed and those critical maintenance activities can be safely performed.

The Baywide Master Plan will investigate and consider navigational and operational impacts to local vessel operators, recreational users of Humboldt Bay and its tidelands, and local ecosystems to ensure that improving the safety, efficiency, or reliability of one stakeholder group does not adversely impair another stakeholder group. Also, a large portion of the RMT site is currently in the FEMA flood zone and is subject to sea level rise. The RMT terminal project will plan for raising the overall site elevation to rectify flood zone concerns and to prepare the site for SLR. The RMT terminal project also includes improvements to the access roads and connecting County/State roadway facilities, which will greatly improve the safety of those transportation networks as well as reduce truck turn times. The road projects will also make truck movements more efficient and increase heavy vehicle capacity. This should in turn reduce vehicle crashes on the local roads around the site.

ii. Impacts on Port Performance, Strengthening the Supply Chain

As outlined in the Project Needs section (Sections I.B and I.C), the project will contribute greatly to West Coast supply chains and goods movement. The FOSW industry will require an entirely new supply chain and will require substantial movement of cargo between ports. For instance, in order for California to reach its goal of deploying 25 GW of offshore wind by 2045, then 1,667 fully-integrated floating turbines will be needed (assuming that each is 15 MW). This means that the following will need to be manufactured and shipped between ports: 1,677 floating platforms (each larger than a city block); 1,677 nacelles/turbines (each as large as a house); 5,000 blades (each nearly 500 feet long); over 1,000,000 linear feet of steel towers; over 15,000,000 linear feet of mooring lines; over 5,000 anchor systems; and likely several million linear feet of transmission cables. If production of all of this equipment starts in 2027, then 93 turbines would need to be produced per year (or 1.8 full turbine systems per week) for 18 straight years. This is all just to meet California's offshore wind goals and does not account for additional Federal goals. The California Energy Commission estimates that this will require ten terminals dedicated exclusively to offshore wind. Humboldt Bay can provide at least two of these needed terminals at the RMT site. If the facilities planned for the RMT site were to be located in other ports, existing cargo operations may be interrupted or compromised. Thus, the proposed project could prevent impacts to the speed or throughput of cargo movements at other ports by concentrating the first FOSW terminals in a port that has the available space. Co-locating manufacturing and assembly facilities in Humboldt Bay will also greatly increase efficiency and reliability.

This Project is the foundational step toward rehabilitating a defunct marine terminal and revolutionizing the port and maritime industry in Humboldt Bay and across the West Coast. Many offshore wind turbine components are too large to be reliably and safely transported via land-based modes, necessitating local manufacturing and assembly of key components and use of Jones Act short sea shipping along the nation's Marine Highways System to deliver additional domestically-produced components. Accordingly, the Project seeks to determine the most efficient and effective ways to transport, assemble, and install floating offshore wind components. These determinations require a planning level review of terminal, harbor wide, bay wide, statewide, and nationwide operations and investments in the new offshore wind energy production industry and supply chain. The California Energy Commission and Department of Energy have both identified long term needs for the statewide and nationwide operations and investments in the emerging OSW energy production industry.[18,19] Notably, the project will also support workforce development initiatives that lead to future curricula that will provide the skills, knowledge, and experience needed to support all aspects of the OSW industry supply chain from manufacturing to logistics, construction, and operation. The Baywide Master Plan portion of the Project will help ensure

[18] https://slc.ca.gov/content-types/news/commission-releases-alternative-port-assessment-to-support-offshore-wind/.
[19] *See generally*, https://windexchange.energy.gov/news/7151.

optimization of the entire California offshore wind supply chain, from manufacturing to installation and to long term operations and maintenance. The Project will provide the special studies and 30% design for the efficient manufacture, installation, and operation of floating offshore wind foundations, towers, nacelles, and blades.

iii. Increases Cargo Throughput & Improves Dependability of Cargo

The projects that will ultimately result from the planning activities within Humboldt: POWERED will drastically increase total cargo volumes and movements at the Port and be designed to maximize operational efficiencies and dependability. However, throughput for offshore wind development is not a traditional cross-dock cargo handling operation. Instead, much of the future cargo handling operations would be confined to the terminal, wet storage areas, and within the immediate region due to transportation constraints of moving components which can measure over 200 meters. Investigations into other existing and emerging OSW port terminals will be undertaken to identify enhancements and practices that that would support the safe and dependable expansion of this new cargo type and the offshore wind industry. Absent funding Humboldt: POWERED and the future construction of this terminal, there is no other dependable mechanism identified to establish a west coast floating offshore wind industry within five years.

B. Supporting Economic Vitality at the Regional or National Level

Humboldt: POWERED and the ensuing offshore wind industry development will transform Humboldt Bay, nearby communities, the region, and the nation, inducing a variety of direct and indirect social, environmental, and economic benefits. Future offshore wind industry investments in Humboldt Bay, alone, are expected to exceed $1 billion, generating substantial direct and induced benefits for the region. A 2020 study by the American Wind Energy Association found that, "In a high scenario with 3,000 MW installed per year and 60% domestic content, these benefits could reach $25 billion per year and support over 83,000 jobs by 2030."[20] While specific investment needs for each aspect of the offshore wind ecosystem in Humboldt Bay have not been fully quantified, the cumulative benefit to economic vitality at the regional and national level will be substantial as demonstrated in Table 3 which shows the employment multiplier achieved by investing $1,000,000 in various industrial activities.

Table 3. Employment Multipliers per $1 Million in Final Demand[21]

Major industry group	Direct jobs	Supplier jobs[22]	Induced jobs[23]	Total indirect jobs
Utilities	1	4.5	5.9	10.4
Construction	5.5	4.8	6.1	10.9
Durable manufacturing	1.8	4.9	11.6	16.5
Transportation and warehousing	4.7	5.4	6	11.3
Finance and insurance	3.1	4.7	6.2	10.8
Professional, scientific, and technical services	4.3	4.8	10.4	15.3
Educational services	9.1	5.4	9.2	14.6
Other services (except public administration)	8.7	5.3	8.7	14

As shown in Table 1, the communities nearest to the Port have greater representation of minority populations than the national average and higher percentages of residents living below the poverty

[20] https://supportoffshorewind.org/wp-content/uploads/sites/6/2020/03/AWEA_Offshore-Wind-Economic-ImpactsV3.pdf.
[21] https://www.epi.org/publication/updated-employment-multipliers-for-the-u-s-economy/.
[22] *Id.* Includes materials and capital services supplier jobs.
[23] *Id.* Includes jobs supported by respending of income from direct jobs and supplier jobs, as well as public-sector jobs supported by tax revenue.

level—nearly two and three times the national average. With commodity markets upon which the region has long relied largely collapsing over the past two decades, the area is at severe risk of becoming economically depressed.

California has very aggressive clean energy and clean transportation targets. With the eminent adoption of the Advanced Clean Fleets (ACF) Rule[24] and Advanced Clean Trucks (ACT) Regulation[25], the Port and the region must plan for mass adoption of electric vehicles and equipment, including that used in construction and cargo handling. As such, this project will include gap analyses, strategies, and plans to support early compliance with these policies while delivering the renewable energy needed to power this fuel transition. Additionally, the Project will support the establishment of the nation's floating west coast offshore wind manufacturing supply chain, including locally within Humboldt Bay, the State of California, and the entire U.S. west coast—enabling communities near and far the opportunity to prosper.

Still, all of this remains a vision. Turning this vision into reality will require deep collaboration; diverse industry, community, and government stakeholder engagement; and the development of new joint ventures, public-private partnerships, high-road training partnerships, and centers of innovation and excellence. Humboldt: POWERED seeks to advance these and other efforts, some of which are underway, to ensure the totality of projects enabling timely development of the West Coast floating OSW industry will deliver benefits equitably and broadly while providing opportunity for all who wish to be engaged. Indeed, a key ancillary effort of this project is to help identify how these ascendant benefits can be best and most equitably achieved through the development of a *Community Benefits Plan* that will inform the future Community Benefits Agreement as required under the BOEM OSW lease terms.

i. Port's Economic Advantage, Contribution to Freight Transportation

The Port has an unprecedented opportunity to revolutionize the region due to its unique economic advantage as the only "good candidate" for hosting a vertically integrated floating OSW industry supply chain. Importantly, California has the healthiest incentive markets of any state which will be available to co-fund this and future phases alongside Federal opportunities such as those originating in the *Infrastructure Investment and Jobs Act* and the *Inflation Reduction Act*. While the region is remote, with limited access to Class I rail and the Interstate Highway System, the floating OSW industry is not expected to rely heavily on that infrastructure. Instead, this new industry will demand greater support from—and help revitalize—the nation's Jones Act fleet and merchant marine. Moreover, the project will lead to substantial systemwide benefits through the development of the numerous strategies and plans described at Sections I, I.H, and IV.A.

ii. Overcoming the Competitive Disadvantage of the Port

If funded, Humboldt: POWERED and the associated plans will create economies of scale, reduce and eliminate barriers to entry, and create more efficient physical access for labor, resources, customers, and recreational users to and around Humboldt Bay and the port. Barriers to entry are varied, including due to the remote location of Humboldt Bay, dilapidated infrastructure, lack of operational demand, and limitations on the availability of a skilled labor force. The future improvements—leveraging best practices from other leading port and OSW terminals—will be designed to maximize resilience to 100-year sea level rise, flood, king tides, earthquakes, wildfire,

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[24] *See generally*, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-fleets.
[25] *See generally*, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks.

and other weather events and natural disasters while also avoiding other potential points of failure across the OSW supply chain. With PIDP funding, facilities will be planned and designed to address systemic issues by establishing new secure maritime facilities and standards; creating new cargo operations and planning for additional cargo diversity across Humboldt Bay; supporting workforce development initiatives to address the longshoremen, logistics, mariner, and manufacturing labor shortages; and, providing for infrastructure redundancy to minimize failure points throughout construction and operations. Absent PIDP funding, the broad benefits of Humboldt: POWERED could likely be significantly delayed, impaired, or outright precluded due to timing, personnel, and local, State, Federal and private budgetary constraints. While tax credits may exist for certain aspects of this project, the Port Authority and the region do not have sufficient revenues to carry out these investments alone and recent national and global economic challenges are limiting the availability of private capital. The whole-of-government approach to establishing the nation's OSW industry will require the allocation of discretionary funds, formula funding, earmarks, rebates, and tax credits to catalyze the industry soon enough to meet interim State and Federal renewable energy generation capacity targets.

C. Leveraging Federal Funding to Attract Non-Federal Investment

As described at Section III.B, the Port, California Energy Commission, and State Lands Commission have committed substantial capital to this effort, yet new opportunities identified in recent studies are expanding the potential scope of local, regional, State, and private funding opportunities. The Humboldt: POWERED Project will provide 20.62% in non-Federal matching funds, and will help to identify future local, regional, State, and private funding sources.

i. Port Resilience

Resilience is a key focus of this planning effort and for the offshore wind industry—advancing resilience at the port, throughout the offshore wind supply chain, and for the communities that will rely on this variable baseload capacity for their electricity needs. In redeveloping the defunct marine terminal, the Port will establish new resilience metrics, such as 1) capacity utilization rate; 2) downtime duration; 3) emergency response plan effectiveness; 4) information sharing; 5) redundancy measures (operational and emergency); 6) training exercises; and, 7) financial resilience assessments. By monitoring these measures, the Port can assess the port's resilience and identify areas for improvement to ensure that the port can better anticipate, prepare for, withstand, respond to, and recover from inclement weather, natural disaster, cyberattacks, and other human-made disruptions while maintaining its critical functions (see, Section IV.B.i). Notably, Offshore wind will help the nation and the State of California reduce the long-term impacts of climate change. The Project aligns with Federal Executive Orders, California law, the California Integrated Energy Policy Report, the Humboldt General Plan, and California's Sustainable Freight Action Plan and Strategic Implementation Plan. The Project's planning activities will leverage leading planning, policy, and engineering tools to support incorporating resilience concepts and mitigation techniques in the subsequent projects, including those addressing sea level rise, seismic standards, tsunami, and safe harbor for operations and maintenance (O&M) vessels. Some of the proposed and potential resilience concepts and actions are discussed at Section IV.B. See Section IV.A.ii for a discussion of how the Project will plan for enhancing resilience to loss of life, injury, or other health impacts as well as damage and loss to property, infrastructure, or livelihoods. Likely more than any other PIDP proposal, Humboldt: POWERED will enable the Port to revolutionize and thereafter sustain its role in the local, regional, and national offshore wind supply chain as discussed throughout this narrative.

V. SELECTION CONSIDERATIONS

A. Climate Change, Sustainability and Environmental Justice

The inclusive development of the offshore wind industry is an essential element in the national and State climate change strategies as well as efforts to advance equity and inclusion throughout the energy and transportation sectors. The Project will help California and the U.S. reduce their carbon emissions, begin addressing the global problem of climate change, and ensure all interested stakeholders have the opportunity to participate and thrive in this challenge.

i. Project Planning and Implementation

Humboldt Bay and the surrounding shoreline are vulnerable to the effects of climate change-driven sea level rise, which has been recognized to potentially increase inundation, flooding, coastal erosion, increased wave force, changes in sediment supply and movement, damage to infrastructure, and, in low-lying areas, permanent inundation by high tides. The region is also at risk of operational impacts from climate change-induced wildfire and resulting smoke. Project designs are incorporating best practices to mitigate these and other risk exposures, such as by raising the terminal to 12'-17' above MLLW. Moreover, designs will include "green" infrastructure, such as terminal electrification for zero-emission cargo handling equipment and wharf electrification to minimize ships idling at berth. The Project will also identify opportunities to incorporate green construction materials in all phases and evaluate future manufacturing facilities and processes that could minimize lifecycle carbon emissions and airborne pollutants and use the maximum amount of renewable energy. Notably, the Port updates its emissions inventory which is used to monitor progress in achieving the goals and objectives of the Humboldt County Climate Action Plan (CAP).[26]

B. Equity and Justice40

The Project will be completed in accordance with Executive Order 12898, as required under NEPA and endorsed by the EPA.[27] Communities potentially impacted by the proposed project will be identified through review of existing studies (e.g. Humboldt Bay Management Plan, Samoa Town Master Plan, City of Eureka Community Background Report) and completion of an assessment of the project construction and operations relative to the communities in the area, particularly as it relates to potential impacts to low income and underrepresented communities. Environmental justice has been incorporated into the 2017 Humboldt County General Plan,[28] and because the Project will require a development permit from the county, the project will comply with county policy, specifically noting:

> *[Environmental Justice] is a civil rights matter, grounded in the Equal Protection Clause of the U. S. Constitution. The Fourteenth Amendment expressly provides that the states may not "deny to any person within [their] jurisdiction the equal protection of the laws." Both U. S. and California law includes directives to consider this issue in local decision making.*

i. Equity Assessment

The Project is located in the industrial area of Humboldt Bay. Multiple communities will be affected to various degrees by the development and operations of the future offshore wind terminal; however, the development will be within existing boundaries of the terminal property and will be

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[26] https://humboldtgov.org/2464/Climate-Action-Plan.
[27] https://ejscreen.epa.gov/mapper/.
[28] https://humboldtgov.org/205/General-Plan.

designed to minimize, avoid, and mitigate potential impacts to the surrounding communities. Section II.D summarizes the demographic makeup of the immediate region, which is more diverse and more likely to have residents living below the poverty level than the national average. The Project will include extensive outreach, engagement, and planning to ensure underrepresented populations are included in the design and implementation of Humboldt's future OSW industries. The Port Authority has strong ties to the local community and is committed to advancing an inclusive, accessible, and equitable engagement process, which will include developing a formal Equity Assessment and Equity Impact Analysis as part of the proposed *DEIA Plan*. The Port has no history of adverse compliance reviews, external lawsuits, investigations, or complaints alleging discrimination, of any kind, occurring in the last five years. The Baywide Master Plan will be a vehicle for ensuring equity during broader development throughout Humboldt Bay.

ii. Public Engagement, Mitigating Impacts to Communities

Public engagement—spanning, at minimum, industry, government agencies, residents, tribal members, community-based organizations, utilities, and workforce stakeholders—is a core part of Humboldt: POWERED. A wide range of meetings and workshops will be offered both in-person and virtually, and, where appropriate, include making meeting recordings available to the public, translating meeting materials to languages commonly used in the community (e.g., Spanish and Hmong), and providing for meals and childcare services to maximize participation and reduce conflict with the regular needs of all stakeholders. Due to the high poverty levels in the region, it is nearly impossible to fail in delivering at least 40 percent of the Project's benefits to low-income communities and those that are underrepresented, underserved, and/or overburdened. To further reduce adverse impacts to disadvantaged communities, the Project will include terminal electrification strategies, an inclusive workforce development gap analysis, and development of a green construction gap analysis—all of which will serve to reduce environmental and public health impacts of the future development and provide ample economic opportunity therein.

C. Workforce Development, Job Quality, and Wealth Creation

The Project will benefit from the designation of Humboldt State University in 2022 as a polytechnic institution, which is supported by a $458 million appropriation in the recent California State budget. The new funding will enable Humboldt State to launch as many as 10 new academic programs by fall 2023, with an emphasis on engineering, technology and applied sciences including additional resources to support renewable energy education. As a state university, Cal Poly Humboldt is highly diverse and among the campus's STEM majors, 56% are women and 40% are from underrepresented ethnic groups.[29] The Project offers the potential for these students to seek employment within the offshore wind industry after graduation from Humboldt State University and the College of the Redwoods.

In response to historic, disproportionate impacts on the county's American Indian population, Humboldt State University has actively reached out through its Indian Natural Resource, Science and Engineering Program (INRSEP), which serves Native American students majoring in the sciences and related disciplines. The program has been successful in placing nearly all of its students in graduate programs or career-related positions in private industry as well as Federal, State, tribal, and non-profit agencies.[30] **This program directly relates to the economic and**

[29] https://www.northcoastjournal.com/NewsBlog/archives/2021/07/13/hsus-polytech-push-receives-458-million-from-state.
[30] https://www.humboldt.edu/nativeprograms/.

employment benefits the Project will bring to the community and, specifically, to the indigenous peoples of Humboldt County.

Humboldt: POWERED will include meaningful community, workforce, and stakeholder engagement to ensure that these efforts drive local benefits, alleviate emissions burdens on neighboring communities, support economic vitality, and advance workforce development providing the local labor pool greater access to good-paying jobs and offering the free and fair choice to join a union.

i. Inclusive Hiring Practices, Use of DBE, MBE, and WBE firms

The Port and its project partners are committed to implementing hiring policies and workplace cultures that promote the entry and retention of a diverse workforce, including through hiring and contracting with members of underrepresented populations as well as Disadvantaged Business Enterprises, Minority-owned Businesses, Women-owned Businesses, and 8(a) firms receiving support from the SBA—all in alignment and furtherance of DOT's Equity Action Plan, California's DEIA efforts, and the project partners' own internal DEI, DE&I, and DEIA Plans. The Project Team recognizes that the distribution of workplace rights notices is an important and legally-required part of ensuring that employees are aware of their rights and that employers are in compliance with applicable laws and regulations. At minimum, distribution of workplace rights notices will be made by posting in the workplace, direct distribution to all employees, posting resources online such as on a company intranet, and by hosting regular training sessions.

VI. PROJECT READINESS

A. Technical Capacity

i. Experience and Understanding of Federal Requirements

The Project Team has the personnel, knowledge, skills, and expertise necessary to implement the Humboldt: POWERED Project on schedule and within budget to ensure the Project's benefits are rapidly realized. The Project Team has the requisite experience and understanding of Federal requirements, from contracting to project closeout, to ensure the Project can be delivered on time and within budget. Specifically, the Project Team as well as the USACE and MARAD have already begun discussing environmental review processes that will reduce the likelihood of any challenges to this Small Port Planning Project. The Project Team has reviewed other PIDP grant agreements in order to expedite the post-award grant agreement process. The Project Team has extensive experience procuring services and goods in compliance with the Federal Acquisition Regulation and is committed to maintaining open, competitive bidding and procurement processes for components proposed within this application. As needed, the Project Team will issue FAR-compliant bidding packages to enable this Project to progress quickly, ensuring timely delivery of the OSW terminal and waterside infrastructure. Lastly, the Project Team is committed to complying with the Build America, Buy America Act to the maximum extent possible and recognizes that obtaining a waiver for any Project components would be extremely challenging and detrimental to the goals of this funding opportunity, particularly as the Project seeks to support American businesses and industry during recovery from the recent tumult caused by the novel coronavirus COVID-19.

Cost data and pricing for Project components are reflective of March 2023 data or more recent data. All costs for this Project were compiled directly by the Project Team. Estimates are based upon historical expertise, sourced quotes from trusted service providers, and actual costs from similar Projects implemented at other seaports. The Project Team will continue to monitor costs related to equipment and supplies for the entirety of the procurement cycle.

ii. Experience with Federal Agencies and Federally-Funded Projects

The Port Authority has direct experience and understanding of Federal requirements, including NEPA, USACE Permitting, and USACE dredging projects. The Port has managed several U.S. Economic Development Administration (EDA) and U.S. Environmental Protection Agency (EPA) grant projects and studies. As a working port, the Port of Humboldt Bay has longstanding working relationships with USACE, the U.S. Coast Guards, and MARAD. The State and Federal offshore wind initiatives have required the Port to also work closely with the U.S. Department of Defense, the Bureau of Offshore Energy Management, and the Fish and Wildlife Service.

The Port Authority has no direct experience with BUILD, INFRA, or PIDP Awards to date. However, the Port has experience as a recipient of past grants from the EPA, Federal Emergency Management Agency (FEMA), U.S. Department of Homeland Security, USACE, EDA, CEC, California State Lands Commission, California Department of Fish and Wildlife, California Coastal Conservancy, Ducks Unlimited, and the California Division of Boating and Waterways. The Port Authority does not have any record of ever failing to complete a grant-funded project or to deliver the final product as described in the Port's grant applications. For the current PIDP grant application and associated Project, the Port has built a highly-experienced and qualified project team with expanded internal and external resources to help manage the Project, including direct experience with Federal aid projects, grant oversight, grant reporting, and overall State and Federal compliance. The team includes several licensed civil, structural, geotechnical, and mechanical engineers, as well as environmental and permitting specialists.

Similarly, Crowley carries deep expertise in working with Federal agencies and federally-funded projects through its position as a leading Jones Act vessel operator, logistics provider, and terminal developer and operator. Crowley's experience in collaborating with the U.S. Coast Guard and MARAD across all aspects of vessel lifecycles will bring substantial lessons to designing the terminal and Bay to maximize navigability and operational effectiveness. Likewise, Crowley's experience in designing, developing, and operating port terminals—including the forthcoming Salem OSW Terminal in Massachusetts—will lend direct expertise in complying with all aspects of developing a federalized project. Notably, Crowley has substantial experience working collaboratively with lead agencies and applicants to deliver projects funded under PIDP, BUILD, and TIGER as well as programs led by the EPA, DOE, FEMA, and the Department of Defense.

iii. Feasibility / Constructability

Humboldt: POWERED is a planning study of, and a 30% design process for, the most feasible and most constructible means to serve the California offshore wind industries and the California electricity market. The Project feasibility and planning studies will draw from the floating offshore wind projects and experience in Northern Europe[31] as well the extensive California Energy Commission and BOEM studies referenced above. The Project constructability will start with domestic preference requirements of the PIDP and general MARAD programs – how to manufacture offshore wind components, vessels, and specialized equipment in the U.S., and how

[31] *See generally*, https://www.equinor.com/energy/hywind-scotland and https://norwegianoffshorewind.no/.

to build and equip offshore wind terminals in compliance with domestic preference requirements and guidelines.

iv. Schedule

The Project schedule is feasible and designed so that key project activities can begin quickly upon obligation of PIDP funds, and that the grant funds will be spent expeditiously throughout the entirety of the Project. Table 4 summarizes key milestones and deliverables of Humboldt: POWERED and demonstrated in the attached Gantt chart (Attachment 2). Further discussion of relevant permits, approvals, and environmental reviews is included at Section VI.B.ii.

Table 4. Humboldt: POWERED Milestones & Deliverables

Milestone / Deliverable		Due Date
Task 1. Overall Project Management and Grant Administration		
1.1	MARAD Notification of Awardees	Q3/Q4 2023
1.2	NEPA Documentation for Grant Award	Q2 2024
1.3	Executed Grant Agreement Returned to MARAD	Q2 2024
1.4	Executed Subcontracts	30 Days After Milestone 1.3
1.5	Attend Kickoff Meeting	30 Days After Milestone 1.3
1.6	Internal Project Schedule	Q1 2024
1.7	Quarterly Progress Reports	15 Business Days after Quarter End
1.8	Draft Final Report	Q3 2026
1.9	Final Report	Q4 2026
Tasks 2a. RMT Heavy-Lift Offshore Wind Terminal: Special Studies & Site Investigations		
Complete all remaining studies and data collection efforts.		
2a.1	Coastal/Navigation/Hydrology/SLR/Tsunami Analysis	Q2 2025
2a.2	Geotechnical Borings and Analysis	Q4 2024
2a.3	Sediment Testing, Analysis, and Sampling Plan	Q4 2024
2a.4	ROW, Title Reports, Boundary Surveying, Site Surveying (Land & Bathymetry)	Q2 2024
2a.5	Dredged Material Management Planning, Coordination, Analysis	Q2 2025
2a.6	Air Quality Analysis, Terminal Electrification Plan, and Green Construction Plan	Q2 2025
2a.7	Terrestrial/Wetland/Habitat Assessments/Mitigation Plan & Reporting	Q2 2025
2a.8	Living Shoreline/Bank/Dredge Slope Stabilization Assessment/Analysis	Q2 2025
2a.9	Off-Terminal Habitat Assessments/Surveys	Q2 2025
2a.10	USACE Sect 408 Analysis - Hydrodynamics, Sed Transport, Local Wet Storage	Q3 2025
2a.11	Land Transportation Analysis	Q2 2025
2a.12	USCG Analysis – Aids to Navigation and Vessel Maneuvering	Q2 2025
2a.13	Agency Coordination	Ongoing, Q3 2025
Task 2b. RMT Heavy-Lift Offshore Wind Terminal: RMT Preliminary Engineering		
Advance already in progress design and engineering.		
2b.1	Civil Engineering and Site Design (Buildings, Power, Fire, Water, Sewer, Grading, Stormwater, Roads, Geotechnical, Electrical/Power)	Q2 2025
2b.2	Marine Engineering Design (Structural, Wharf, Wet Storage, Shoreline Stabilization, Geotechnical)	Q2 2025
2b.3	Design-based Documents, Graphics, and Site Plans	Q3 2025
2b.4	Cost Estimates/Constructability/Quantities	Q3 2025
Task 2c. RMT Heavy-Lift Offshore Wind Terminal: Permitting		
Complete permitting and CEQA/NEPA documentation.		
2c.1	Environmental Constraints/Environmental Setting	Q4 2024
2c.2	CEQA Environmental Impact Report	Q3 2025
2c.3	NEPA Environmental Impact Statement	Q3 2025

Milestone / Deliverable		Due Date
2c.4	Obtain Permits	Q4 2025
2c.5	Stakeholder Outreach	Q4 2025
Task 2d. RMT Heavy-Lift Offshore Wind Terminal: Advanced Design		
Further advance design to allow for construction of roads and habitat mitigation.		
2d.1	Prepare 90% Plans and Specifications	Q2 2026
2d.2	Prepare Final Plans and Specifications	Q3 2026
2d.3	Prepare Bidding Issue Plans and Specifications	Q3 2026
Task 3. Humboldt Harbor Bay Wide Wind Port Facilities Master Planning		
Develop a master plan to guide offshore wind related development throughout Humboldt Bay.		
3.1	Chapter 1: Diversity, Equity, Inclusion, and Accessibility (DEIA) Plan	Q3 2025
3.2	Chapter 2: West Coast Floating Offshore Wind Needs Evaluation	Q3 2025
3.3	Chapter 3: Opportunity and Options Analysis for Sites Throughout Port of Humboldt	Q3 2025
3.4	Chapter 4: Impact Assessment and Evaluation of Mitigation Alternatives	Q3 2025

v. Cost Data

Humboldt: POWERED is a planning and design project that is a continuation of previous planning and design contracts competitively awarded to a team of planners, engineers, environmental scientists, and NEPA/CEQA specialists. The summary of Project costs, proposed cost/match share, and previous expenditures are discussed at Sections III.A and III.D. Cost estimates were generated in Spring 2023 based upon relevant prior experience of the project team and through discussions with other leading stakeholders. Provided cost estimates include contingencies of 10%-30%.

vi. Regional Planning

The Project is directly supported by California Assembly Bill 525 which directs State agencies to develop a strategic plan and set statewide planning goals for maximum feasible offshore wind production by 2030 and 2045. Pursuant to this, the Port Authority has received planning grant funds from the California Energy Commission and the California State Lands Commission (see, Section I.F). Moreover, the Project advances development of Humboldt Bay to enable it to achieve its maximum potential as the only "good candidate" port in California capable of supporting all aspects of offshore wind manufacturing, construction, and operations and maintenance, as identified by BOEM (see, Section I). The Project has not been incorporated into the State Implementation Plan (SIP), State Sustainable Freight Plan, or Transportation Improvement Plan (TIP), but outreach to Caltrans and the California Transportation Commission is ongoing to advance the project's inclusion in these relevant planning efforts. The Project Team is also engaging the Department of Energy's Wind Energy Technologies Office (WETO) to garner their support and technical assistance.

vii. Risk Mitigation

The Project Team is undertaking a range of strategies to mitigate Project risks and manage any issues that may arise. The Project Team will apply the following risk mitigation strategies:

- ***Unforeseen Project Delays.*** One of the largest risks to the project's success is delay, in particular with reviewing agencies, tribal and community interests, and other relevant stakeholders. Early consultation, regular dialog, and open channels of communication with relevant agencies, community-based organizations, Tribal representatives, utilities, and other key stakeholders will ensure that challenges can be promptly identified and addressed.
- ***Quality Assurance and Quality Control (QA/QC).*** The Project Team will deploy its own internal standard QA/QC processes, such as ISO 9000, including but not limited to 1)

adherence to specifications and design; 2) regular (at least monthly) coordination and inspection of project activities by project managers; 3) adherence to best practice development and engagement strategies; 4) regular inspection of critical project checkpoints for quality, financial control, and schedule; and, 5) project managers will report to the project management team following each QA/QC event to identify and mitigate QA/QC issues or concerns as soon as identified.

- ***Lead Agency Identification for Environmental Reviews.*** The Project Team will continue discussions with the potential lead agencies for environmental reviews—the Army Corps of Engineers and the Maritime Administration—to understand processes for maintaining compliance with all required environmental permits and authorizations.
- ***Communications among Project Team.*** The Project Team will collaborate on grant administration activities on the proposed Project. The Project Team already maintains communication among Project participants, providing updates and proactive strategy development. The Project Team will coordinate regular contractor meetings and team reviews of appropriate deliverables while using the latest electronic project management sharing programs.
- ***Communications among Interested Stakeholders.*** Delivering equitable and maximal benefits to all members of the effected communities is a critical objective of this larger endeavor. The development of the West Coast's premier OSW hub must drive benefit back into the local community, providing for—among much more—meaningful and good-paying jobs, mitigating adverse traffic and environmental impacts during construction and operations, and ensuring reliable access to the Bay and its public tidelands for users. Accordingly, the Project Team will coordinate regular stakeholder meetings, providing inclusive and accessible opportunities to engage all interested parties, including in the development of the *Community Benefits Plan*.

The Project Team has included budget contingencies ranging from 10% to 30% and identified conservative budget estimates that will greatly reduce the likelihood of the Project encountering cost overruns. The Project schedule also has reasonable, built-in buffers that comply with all requirements for obligation and expenditure of funds as outlined within the PIDP requirements, well in advance of the encumbrance deadline.

B. ENVIRONMENTAL RISK

i. NEPA Status

The Project Team has reviewed guidance documents regarding the NEPA process for the grant agreement and met with the MARAD NEPA Coordinator to discuss the project. Based on the MARAD guidance memo titled Process on pre-NEPA Field Surveys Prior to Grant/Loan Award Execution, all RMT Project tasks can be completed with MARAD approval prior to NEPA documentation except for the geotechnical site investigation. The geotechnical site investigation will require a NEPA categorical exclusion for "Research Studies and Activities" as described in Maritime Administrative Order 600-1. The Port will be responsible for completing MARAD's NEPA documentation, in collaboration with MARAD's NEPA Coordinator in the Office of Environmental Compliance, prior to executing the grant agreement. The Baywide Master Plan will not require NEPA documentation.

A NEPA Environmental Impact Statement will be prepared for the RMT Project. The Project Team has begun strategizing with the Army Corps of Engineers and MARAD regarding the NEPA process. The Project Gantt chart (Attachment 2) shows the schedule for NEPA documentation relative to RMT Project construction.

ii. Environmental Permits and Reviews

No local, State, or Federal permits are required for the portion of the Project that would be funded by MARAD. However, based on past precedent, a waiver from the California Coastal Commission may be required for the RMT Project Marine Geotechnical Site Investigation.

The RMT Project will require numerous approvals (Table 5). The permitting and environmental documentation portion of the Project will be funded through matching funds from the State of California. The Project Gantt chart (Attachment 2) shows the schedule for permitting relative to RMT Project construction.

Table 5. Permits, Consultations, and Approvals

Permit/Review	Agency/Consultation	Trigger
Federal Approvals		
Section 10/404 of CWA	U.S. Army Corps of Engineers	Impacts to Waters of the U.S., wetlands, dredging
Section 408	U.S. Army Corps of Engineers	Potential impacts to navigation channel (USACE facility)
Section 7 ESA consultation; Biological Opinion	National Marine Fisheries Service U.S. Fish and Wildlife Service	Potential impacts to ESA species/habitat (bay is green sturgeon critical habitat)
Section 106 of National Historic Preservation Act	California Office of Historic Preservation/Tribes	Potential impacts to cultural or tribal cultural resources
Tribal Consultation AB 52	Interested Tribes/Native American Heritage Commission	Potential impacts to tribal cultural and/or treaty resources
CZMA concurrence	California Coastal Commission	Project in Coastal Zone
FAA Obstruction Evaluation	Federal Aviation Administration	Project is near an airport
PATON	U.S. Coast Guard	Construction of new in water structures and associated navigational aids.
MMPA	National Marine Fisheries Service	Potential impacts to marine mammals
Migratory Bird Treaty Act	California Department of Fish and Wildlife; U.S. Fish and Wildlife Service; Humboldt Bay Harbor, Recreation and Conservation District	Potential impacts to migratory birds
Bald/Golden Eagle Protection Act	California Department of Fish and Wildlife /U.S. Fish and Wildlife Service	Potential impacts to eagles
State and Local Approvals		
Section 401 WQC	Eureka Plain, North Coast Regional Water Control Board	Construction, wetland impacts, impacts to Waters of the US or State, turbidity impacts
1602 Streambed Alteration Agreement; Incidental Take Permit	California Department of Fish and Wildlife	Impacts to drainage features (Waters of the State); impacts to special status species
Lease Agreement	California State Lands Commission	Encroachment into State Lands
Coastal Development Permit	California Coastal Commission or authorized local permitting authority/	Coastal development. May be Humboldt County if they update their coastal program
Development Permit	Humboldt Bay Harbor, Recreation and Conservation District	Terminal development.
SWPPP and WQMP	Eureka Plain RWQCB	Construction and facility design.
California Air Resources Board Operating Permit	North Coast Air Quality Management District	Changes to operating facility emissions.

The Port Authority and many industry stakeholders have hosted numerous public engagement events to gather public feedback that is being incorporated into the early project designs. While there are no federally-designated Historically Disadvantaged Communities in the region, the Project Team has and will continue to engage diverse community stakeholder groups, including members of the Wiyot Tribe and the seven other federally-recognized Tribal governments. The Humboldt: POWERED Project will use best practices across all aspects of stakeholder engagement, such as providing for meals and childcare during public meetings, ensuring materials are translated to non-English languages commonly used in the community (including Spanish and Hmong), and other activities that maximize diverse, equitable, accessible, and inclusive coordination efforts. To achieve this, the Project Team will coordinate with leading agencies, such as the California Air Resources Board, Department of Transportation, and Department of Energy, to understand best practices for enacting meaningful and actionable engagement in furtherance of the Justice40 Initiative and the AB 617 Community Air Protection Program.

iii. State and Local Approvals

The Humboldt: POWERED Project does not, in and of itself, require any permits to advance planning, special studies, design and engineering, stakeholder engagement and workforce development activities. A waiver from the California Coastal Commission may be required for geotechnical studies. MARAD funding will contribute to an effort that will enable the Port Authority to obtain permits for future construction phases of the RMT Project. The permit/reviews, regulatory agencies, and triggers for the required permits are summarized in Table 5. The process will include consultation with local tribal entities under Section 10/404 of the Clean Water Act, Section 106 of the National Historic Preservation Act, and as required by California Assembly Bill (AB) 52 – Tribal Cultural Resources.

The key to minimizing regulatory risk and surprises is a robust scoping and outreach process at the outset of the NEPA/CEQA process. Indeed, the Port has already conducted extensive outreach and scoping with local agencies, Tribes and stakeholders. A key issue for the County of Humboldt is the need for amendments to the Humboldt Bay Area Plan to allow for required building heights. The Port and County are actively developing a strategy to address this in 2024. Additionally, there are errors in the County zoning maps that require correction. It is expected that these corrections will also be completed in 2024.

The Project team has worked closely with the community to provide education regarding Project benefits, including greenhouse gas reduction and economic benefits from wind energy development. The Project has broad public support as demonstrated by the provided support letters (Attachment 7).

iv. Environmental Reviews, Approval and Permits by Other Agencies

As described above, for the MARAD funded portion of the Project, a waiver from the California Coastal Commission will be required. This waiver will be for a geotechnical site investigation, which will also require a NEPA Categorical Exclusion for Research Studies and Activities.

US Army Corps Permits under Section 10 and 404 of the Clean Water Act will be required for impacts to wetlands (freshwater and marine) and work in waters of the US. The Port has identified and is currently designing compensatory mitigation (habitat restoration) projects for the wetland impacts. Additionally, Section 408 approval may be required for impacts to the Federal navigation channel, because dredging will occur adjacent to Federal navigation channel.

The RMT Project will require the approvals shown in Table 5 as well as a CEQA Environmental Impact Report and NEPA Environmental Impact Statement. The Port has engaged with the pertinent regulatory agencies to identify the special studies and compensatory mitigation that will be required to obtain approvals.

VII. DOMESTIC PREFERENCE

As a planning grant project, Humboldt: POWERED will not directly result in the procurement of any iron, steel, manufactured products, or construction materials during the period of performance. Yet, the Project will include development of a *Terminal Electrification Plan*, *Green Construction Gap Analysis*, and *Domestic Procurement Gap Analysis*, each of which will include strategies to cost-effectively maximize domestic content while achieving climate and public health benefits across the supply chain, construction activities, and ongoing operations. The Project Team will engage leading original equipment manufacturers (OEMs), emerging technology developers, and material and product suppliers to understand pathways to maximizing sustainable domestic content and reliance on domestic labor, innovation, and manufacturing capacity.

VIII. STATUTORY DETERMINATIONS

Project Determination	Guidance
1. The project improves the safety, efficiency, or reliability of the movement of goods through a port or intermodal connection to the port.	As discussed in depth at Section IV.A, Humboldt: POWERED will lead to major improvements to the safety, efficiency, and reliability of moving offshore wind cargoes through the port, Humboldt Bay, and to offshore locations. Plans will be developed and facilities (land-side and wet storage) designed to maximize the ability of Humboldt Bay to host an efficient, safe, and reliable, vertically-integrated OSW industry which will necessarily revolutionize the local economy.
2. The project is cost effective.	Humboldt: POWERED is extremely cost-effective for advancing a cumulative effort that will likely demand more than $1 billion in total direct investment. This small port planning effort will identify further efficiencies to reduce total project costs while delivering maximal economic benefit to the local workforce and tax base.
3. The eligible applicant has the authority to carry out the project.	As discussed at Sections I.C and I.D, the Humboldt Bay Harbor Recreation and Conservation District is an eligible applicant for a small project at a small port as a designated Port Authority moving fewer than 8,000,000 short tons of cargo per year.
4. The eligible applicant has sufficient funding available to meet the matching requirements.	The Port Authority has sufficient funding available to meet the matching requirements, relying primarily on an existing planning grant from the CEC to leverage as the primary match share. Any cost overruns will be easily managed from the Port's existing capital reserves and obligations. See the Port's Letter of Commitment, attached.
5. The project will be completed without unreasonable delay.	Humboldt: POWERED must and will be completed without unreasonable delay to meet State and national OSW deployment targets. Planning and preliminary design activities are already underway, fortifying the Port's ability to complete the project on time and within the proposed budget. As with any major project, agency reviews and local/tribal consultation can affect timely completion.
6. The project cannot be easily and efficiently completed without Federal funding or financial assistance available to the project sponsor.	Humboldt: POWERED is the critical initial phase for future public and private investments across Humboldt Bay that will exceed $1 billion to establish the vertically integrated offshore wind industry supply chain as needed to achieve State and national objectives. A lack of Federal funding, including in the immediate proposal and future phases, will impede certain activities necessary to equitably establish the West Coast floating offshore wind industry supply chain and achieve the many benefits that ensue (environmental, transportation, energy, economic, equity, etc.).

Humboldt Bay: Planning for Offshore Wind, Equity, Resilience, and Economic Development

Humboldt: POWERED

Port of Humboldt, California

U.S. Department of Transportation / Maritime Administration

FY 2023 Port Infrastructure Development Program (PIDP) Grant Application

Project Schedule

Submitted by:
Humboldt Bay Harbor Recreation and Conservation District
Eureka, California

Project Site	Task	Subtask or Milestone	Project Task	Funding Source	2023				2024				2025				2026			
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Both	1		TASK 1: OVERALL PROJECT MANAGEMENT & GRANT ADMINISTRATION	PIDP			PIDP Grant Award													
		1.1	MARAD Notification of Awardees																	
		1.2	NEPA Documentation for Grant Award																	
		1.3	Executed Grant Agreement Returned to MARAD																	
		1.4	Executed Subcontracts																	
		1.5	Attend Kickoff Meeting																	
		1.6	Internal Project Schedule																	
		1.7	Quarterly Progress Reports																	
		1.8	Draft Final Report																	
		1.9	Final Report																	
Heavy-Lift Offshore Wind Terminal Project at RMT Site	2a		TASK 2a: RMT SPECIAL STUDIES & SITE INVESTIGATIONS	PIDP																
		2a.1	Coastal/Navigation/Hydrology/SLR/Tsunami Analysis																	
		2a.2	Geotechnical Borings and Analysis																	
		2a.3	Sediment Testing, Analysis, and Sampling																	
		2a.4	ROW, Title Reports, Boundary Surveying, Site Surveying (Land & Bathymetry)																	
		2a.5	Dredged Material Management Planning, Coordination, Analysis																	
		2a.6	Air Quality Analysis, Terminal Electrification Plan, and Green Construction Plan																	
		2a.7	Terrestrial/Wetland/Habitat Assessments/Mitigation Plan & Reporting																	
		2a.8	Living Shoreline/Bank/Dredge Slope Stabilization Assessment/Analysis																	
		2a.9	Off-Terminal Habitat Assessments/Surveys																	
		2a.10	USACE Sect 408 Analysis - Hydrodynamics, Sed Transport, Local Wet Storage																	
		2a.11	Land Transportation Analysis																	
		2a.12	USCG Analysis - Aids To Navigation (ATON), Vessel Maneuvering																	
		2a.13	Agency Coordination																	
	2b		TASK 2b: RMT PRELIMINARY ENGINEERING	PIDP																
		2b.1	Civil Engineering and Site Design																	
		2b.2	Marine Engineering Design																	
		2b.3	Design-based Documents, Graphics, and Site Plans																	
		2b.4	Cost Estimates/Constructability/Quantities																	
	2c		TASK 2c: RMT PERMITTING[1]	Match (State)																
		2c.1	Environmental Constraints/Environmental Setting																	
		2c.2	CEQA Environmental Impact Report																	
		2c.3	NEPA Environmental Impact Statement																	
		2c.4	Obtain Permits																	
		2c.5	Stakeholder Outreach																	
	2d		TASK 2d: RMT ADVANCED DESIGN FOR ACCESS ROADS & HABITAT MITIGATION	PIDP			PIDP Grant Award													
		2d.1	Prepare 90% Plans and Specifications																	
		2d.2	Prepare Final Plans and Specifications																	
		2d.3	Prepare Bidding Issue Plans and Specifications																	
Baywide	3		TASK 3: HUMBOLDT HARBOR BAY WIDE WIND PORT FACILITIES MASTER PLANNING	PIDP																
		3.1	Chapter 1: Diversity, Equity, Inclusion, and Accessibility (DEIA) Plan																	
		3.2	Chapter 2: West Coast Floating Offshore Wind Needs Evaluation																	
		3.3	Chapter 3: Opportunity and Options Analysis for Sites Throughout Port of Humboldt																	
		3.4	Chapter 4: Impact Assessment and Evaluation of Mitigation Alternatives																	

Planned Future Project Tasks (Separate from PIDP project)

Project Site		Project Task	Funding Source	2023				2024				2025				2026				2027				2028			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Heavy-Lift Offshore Wind Terminal Project at RMT Site	Planned Future Project Tasks (after PIDP project)	**PROCUREMENT, BIDDING, AND CONTRACTOR SELECTION - ACCESS ROADS & HABITAT MITIGATION (Phase 0)**	TBD																								
		CONSTRUCTION - ACCESS ROADS & HABITAT MITIGATION (Phase 0)																									
		Contractor Mobilization																									
		Access Road & Yard Preparation																									
		Wetland Mitigation[2]																									
		FINAL DESIGN - PHASE 1 (Wharf, Berth, and Uplands)	TBD																								
		Prepare 90% Plans and Specifications																									
		Prepare Final Plans and Specifications																									
		Prepare Bidding Issue Plans and Specifications																									
		PROCUREMENT, BIDDING, AND CONTRACTOR SELECTION - PHASE 1 (Wharf, Berth, and Uplands)	TBD																								
		CONSTRUCTION - PHASE 1 (Wharf, Berth, and Uplands)																									
		Contractor Mobilization																									
		Wharf Demolition																									
		Dredge																									
		Rip Rap																									
		Wharf Construction																									
		Upland Works																									
		Contractor Demobilization																									

[1] CEQA, NEPA, and environmental documentation is to be funded exclusively through matching funds and not with PIDP funds.

[2] The duration for environmental mitigation is an estimate for mitigation construction/planting only. Mitigation monitoring will also be required.

Humboldt Bay: Planning for Offshore Wind, Equity, Resilience, and Economic Development

Humboldt: POWERED

Port of Humboldt, California

U.S. Department of Transportation / Maritime Administration

FY 2023 Port Infrastructure Development Program (PIDP) Grant Application

Letters of Commitment

Submitted by:
Humboldt Bay Harbor Recreation and Conservation District
Eureka, California

COMMISSIONERS
1st Division: Aaron Newman
2nd Division: Greg Dale
3rd Division: Stephen Kullmann
4th Division: Craig Benson
5th Division: Patrick Higgins

Humboldt Bay Harbor, Recreation and Conservation District
(707) 443-0801
P.O. Box 1030
Eureka, California 95502-1030

Date: **April 28, 2023**

To: **The Honorable Pete Buttigieg**
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Re: **Letter of Commitment, Humboldt Bay: Planning for Offshore Wind, Equity, Resilience, and Economic Development (Humboldt: POWERED)**

Dear Secretary Buttigieg,

Humboldt Bay Harbor Recreation and Conservation District (District) is excited to propose a powerful small port planning grant in partnership with Crowley Wind Services, Inc. (Crowley) with this application to the 2023 Port Infrastructure Development Program (PIDP). The title of our planned project is "Humboldt Bay: Planning for Offshore Wind, Equity, Resilience, and Economic Development" (Humboldt: POWERED).

The State of California has appropriated $10.45 million to initiate development of an offshore wind marshalling port in Humboldt Bay's Redwood Marine Terminal (RMT) as the hub of California's floating offshore wind industry to meet the state's objectives of deploying floating offshore wind capacity of 5 GW by 2030 and 25 GW by 2045 and the nation's objectives of 15 GW by 2035. The Port of Humboldt Bay—and the floating offshore wind industry at large—requires federal assistance from PIDP as part of the necessary whole-of-government approach to catalyze progress on this critical multi-year, multi-phase climate, energy, and employment initiative.

The planning, stakeholder engagement, design and engineering, and workforce development investments proposed for Humboldt: POWERED will support each of the PIDP program objectives. First, the project will directly improve the safety, efficiency, and reliability of moving goods by advancing special studies and design activities for future resilient infrastructure developments enabling the sustainable and domestic manufacture, assembly, transport, and installation of floating offshore wind turbines. Second, Humboldt: POWERED will generative economic vitality at the national and regional levels by unlocking the West Coast's floating offshore wind industry as the only California seaport recognized by the Bureau of Ocean Energy Management as a "good candidate" for hosting all aspects of the floating offshore wind supply chain. Third, this planning project addresses climate and environmental justice impacts in a multi-faceted capacity, from planning for green construction practices and sustainable terminal operations through to supporting the delivery of the zero-carbon renewable electricity that will power the transition from fossil fuels. Fourth, the project advances equity and opportunity for all through expansive workforce development, planning, and community and stakeholder engagement activities. Lastly, Humboldt: POWERED will leverage the requested Federal funding to attract and induce further state, local, and private investment in future construction phases as well as throughout the nation's domestic wind energy supply chain, the maritime and logistics industries, and the advanced energy and logistics workforce of tomorrow.

The proposed $10,926,060 Project will accelerate development and significantly increase the competitiveness of the U.S. offshore wind industry. To support this, the District will commit $2,253,074 from an ongoing planning grant awarded by the California Energy Commission in 2022. These State funds—representing 20.62% of total eligible project costs—are available immediately. If the Humboldt: POWERED Project is awarded funding under the PIDP, the District guarantees the availability of the staff and resources necessary to complete the activities described in the application, including ensuring timely reporting and compliance with all PIDP requirements and all local, state, and federal laws and regulations.

On April 6, 2023 the elected Board of Commissioners of the Humboldt Bay Harbor District unanimously adopted Harbor District Resolution 2023-07, which authorizes the District to submit this 2023 PIDP application and authorizes the expenditure of the matching funds. A copy of that Resolution can be found in Attachment 1 to this letter. On March 6, 2023, the elected Board also passed District Resolution 2023-05, which acknowledges the District's commitment to supporting offshore wind related port/terminal development. A copy of that Resolution can be found in Attachment 2 to this letter.

In partnering with Crowley, the District is committing to catalyze the development of the nation's floating offshore wind industry. Together, we form a powerful team capable not only of planning such an ambitious and important project, but also of executing it in a timely, cost-effective, equitable, and inclusive manner. For these reasons and more, I urge you to fund the Humboldt: POWERED Project. If you have any questions at all, please do not hesitate to contact me.

Sincerely,

Larry Oetker, Executive Director
loetker@humboldtbay.org
707-443-0801

ATTACHMENTS:

1. Harbor District Resolution 2023-07, which authorizes the District to submit this 2023 PIDP application and authorizes the expenditure of the matching funds
2. Harbor District Resolution 2023-05, which acknowledges the District's commitment to supporting offshore wind related port/terminal development

CROWLEY

April 28, 2023

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Subject: Letter of Commitment, Humboldt Bay: Planning for Offshore Wind, Equity, Resilience, and Economic Development (Humboldt: POWERED)

Dear Secretary Buttigieg:

Crowley Wind Services, Inc. (Crowley) is excited to partner with the Humboldt Bay Harbor Recreation and Conservation District (District) to propose a powerful small port planning grant with this application to the 2023 Port Infrastructure Development Program (PIDP).

The State of California has appropriated more than $10 million to initiate development of an offshore wind marshalling port in Humboldt Bay's Redwood Marine Terminal (RMT) as the hub of California's floating offshore wind industry to meet the state's objectives of deploying floating offshore wind capacity of 5 GW by 2030 and 25 GW by 2045 and the nation's objectives of 15 GW by 2035. The Port of Humboldt Bay—and the floating offshore wind industry at large—requires federal assistance from PIDP as part of the necessary whole-of-government approach in order to catalyze progress on this critical multi-year, multi-phase climate, energy, and employment initiative.

The planning, stakeholder engagement, design and engineering, and workforce development investments proposed for Humboldt: POWERED will support each of the PIDP program objectives. First, the project will directly improve the safety, efficiency, and reliability of moving goods by advancing special studies and design activities for future resilient infrastructure developments enabling the sustainable and domestic manufacture, assembly, transport, and installation of floating offshore wind turbines. Second, Humboldt: POWERED will generative economic vitality at the national and regional levels by unlocking the West Coast's floating offshore wind industry as the only California seaport recognized by the Bureau of Ocean Energy Management as a "good candidate" for hosting all aspects of the floating offshore wind supply chain. Third, this planning project addresses climate and environmental justice impacts in a multi-faceted capacity, from planning for green construction practices and sustainable terminal operations through to supporting the delivery of the zero-carbon renewable electricity that will power the transition from fossil fuels. Fourth, the project advances equity and opportunity for all through expansive workforce development, planning, and community and stakeholder engagement activities. Lastly, Humboldt: POWERED will leverage the requested Federal funding to attract and induce further state, local, and private investment in future construction phases as well as throughout the nation's domestic wind energy supply chain, the maritime and logistics industries, and the advanced energy and logistics workforce of tomorrow.

The proposed $10,926,060 Project will accelerate development and significantly increase the competitiveness of the U.S. offshore wind industry. As the prospective operator of the RMT and a committed service provider to the offshore wind, maritime, and logistics industries, Crowley will make its staff and personnel available to coordinate across all relevant aspects of the Project. While this substantial, ongoing effort on behalf of Crowley is not being captured as match share in the immediate proposal, Crowley remains committed to the Project and supporting its maximal success. If the Humboldt: POWERED Project is awarded funding under the PIDP, Crowley guarantees the availability of the staff and resources necessary to advance the activities described in the application.

In partnering with the District, Crowley is committing to catalyze the development of the nation's floating offshore wind industry. Together, we form a powerful team capable not only of planning such an ambitious and important project, but also of executing it in a timely, cost-effective, equitable, and inclusive manner.

For these reasons and more, I urge you to fund the Humboldt: POWERED Project. If you have any questions at all, please do not hesitate to contact me.

Sincerely,

Jeffrey M. Andreini

Jeffrey M. Andreini
Vice President Crowley Wind Services, Inc
832-953-6878
jeffrey.andreini@crowley.com

Humboldt Bay Harbor,
Recreation and Conservation District
(707) 443-0801
P.O. Box 1030
Eureka, California 95502-1030

ATTACHMENT 1:
Harbor District Resolution 2023-07, which authorizes the District to submit this 2023 PIDP application and authorizes the expenditure of the matching funds

Humboldt Bay
Harbor, Recreation and Conservation District
(707) 443-0801
P.O. Box 1030
Eureka, California 95502-1030

STAFF REPORT
HARBOR DISTRICT MEETING
April 13, 2023

TO: Honorable Board President and Harbor District Board Members

FROM: Rob Holmlund, Development Director

DATE: April 6, 2023

TITLE: Consideration of Resolution 2023-07, A Resolution to Authorize the Execution of a Grant Agreement and Accept Funds from the Maritime Administration of the US Department of Transportation for a 2022 Port Infrastructure Development Program Grant for the Humboldt Offshore Wind Terminal Project

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STAFF RECOMMENDATION: Staff recommends the Board: Adopt Resolution 2023-07 and then direct staff to work with the Ad Hoc Offshore Wind Committee to review/revise the application. Alternatively, the Board can evaluate the concept during this Board meeting, provide direction regarding modification of the application, and then direct staff to bring this item back to the Board at a special meeting during the week of April 24.

SUMMARY: This item is regarding an application for an approximately $10M grant from the Federal Port Infrastructure Development Program due on April 28, 2023. Attachment A to this staff report is a Resolution authorizing submittal of that grant application.

DISCUSSION: Offshore California wind development represents an economic opportunity for the Port, the Pacific region and the entire U.S. Offshore wind developers require the assurance of available heavy lift marine terminal facilities and upland infrastructure/laydown areas in order to bid on offshore wind leases and to finance the onshore manufacturing and logistic facilities necessary to help meet national goals of installing and deploying 30 GW of offshore wind power by 2030, as well as the State goal of 25 GW of offshore wind power by 2045.

As presented to the Board at several past meetings, the Harbor District is redeveloping the existing Redwood Marine Terminal to support the offshore wind industry in the Pacific region (see Attachment B for a Conceptual Project Development Plan). These improvements will create a multipurpose terminal that can support existing industry as well as serve as a primary facility for the manufacturing, import, staging, preassembly, and loadout of large offshore wind components, including both wind turbine generation components and floating foundation components. Receiving grant funds for design, permitting, and construction is a critical step to accomplishing the envisioned project.

Attachment C presents a timeline of Board actions to date related to this project. The most consequential event from Attachment C is the March 2022 acceptance of a grant of $10.45M from the California Energy Commission to support the project. The CEC encouraged the District to utilize that $10.45M as matching funds for Federal grants. A likely source of additional grant funds is the Port Infrastructure Development Program (PIDP), which is administered by the Maritime Administration of the US Department of Transportation (MARAD).

In mid-2021, the District applied for a $56M PIDP grant. The District was not awarded the grant. In mid-2022, the District re-applied to the same PIDP program for a substantially scaled-down version of the project. The District was also not awarded that grant. In early 2023, District staff and staff from Crowley Wind Services participated in a debrief with MARAD staff to review the District's previous PIDP grant applications. Based on feedback from MARAD, the District has been working in close collaboration with Crowley and Moffat & Nichol to reformulate a new strategy. Crowley and Moffatt & Nichol are currently preparing an application for an approximately $10M grant for the 2023 round of the PIDP. Attachment A to this staff report is a Resolution authorizing submittal of that grant application.

The 2023 PIDP grant application requests up to approximately $10 million in Port Infrastructure Development Program (PIDP) funding to finalize all of the required studies and permitting. Some of the major elements include:

- Marine Structural/Wharf Analysis/Wet Storage Engineering
- Shoreline Stabilization Design Engineering
- Geotechnical Engineering Design Engineering
- Electrical/Power/Utility Analysis & Engineering
- PG&E Upgrades Assessment Engineering
- Water/Sewer Provider Upgrade Assessment Engineering
- Cost Estimates/Constructability/Quantities Engineering
- Final Site Surveying - Land & Bathymetry
- ROW, Boundary Surveying/Title Reports
- Geotechnical Borings (Land, Marine, Sediment Sampling)
- Sediment Sampling Plan
- Sediment Testing & Analysis
- Dredged Material Management Planning, Coordination, Analysis
- Coastal/Navigation/Hydrology/SLR/Tsunami Analysis
- Terrestrial/Wetland/Habitat Assessments/Mitigation Plan & Reporting
- Living Shoreline/Bank/Dredge Slope Stabilization Assessment/Analysis
- Air Quality Analysis
- USACE Sect 408 Analysis - Hydrodynamics, Sed Transport, Local Wet Storage
- USCG Analysis - ATON, Vessel Maneuvering
- Baywide Master Plan
- Wet Storage Strategic Plan

The District intends to match the approximately $10M request with a 20% match (approximately $2M) of CEC-granted District funds to be drawn from the $10.45M grant issued to the District by the CEC.   The grant application is due on April 28, 2023. At the time of the drafting of this staff report (4/6/23), staff is still evaluating the exact cost estimates and anticipates that some items may slightly change prior to application submittal.

Staff estimates that the results of the 2023 round of the PIDP grants will be announced in November of 2023, with project award allocations issued between March and September of 2024.

ATTACHMENTS:

- **A** Resolution 2023-07
- **B** Conceptual Project Development Plan
- **C** Timeline of Board actions to date related to this project

HUMBOLDT BAY HARBOR, RECREATION,
AND CONSERVATION DISTRICT

RESOLUTION NO. 2023-07

A RESOLUTION AUTHORIZING THE SUBMISSION OF A PORT INFRASTRUCTURE DEVELOPMENT GRANT APPLICATION FOR THE CONSTRUCTION OF A PHASE OF A NEW HEAVY LIFT MULTIPURPOSE TERMINAL TO SUPPORT THE OFFSHORE WIND INDUSTRY

WHEREAS, on March 29th, 2021, the President Biden Administration announced a whole of government approach to catalyze offshore wind energy, strengthen the domestic supply chain, and create good-paying jobs, and

WHEREAS, as part of the Administration's announcement, the federal Department of Transportation's Maritime Administration announced funding under the Port Infrastructure Development Program (PIDP) to invest in port infrastructure to support offshore wind, and

WHEREAS, the PIDP grants are intended to support projects that strengthen and modernize port infrastructure and can support shore -side wind energy projects, such as storage areas, laydown areas, and docking of wind energy vessels to load and move items to offshore wind farms, and

WHEREAS, the Federal Government has established a goal of 30 gigawatts of offshore wind by the year 2030 and the State of California has established a goal of 25 gigawatts of offshore wind by the year 2045, and

WHEREAS, in December of 2022 the federal Bureau of Energy Management (BOEM) received bids totaling $757,100,000 from five international energy companies for two offshore wind areas (five sub-areas) off the coast of Humboldt and off the coast of Morro Bay, and

WHEREAS, BOEM has identified future offshore wind lease areas of the coast of Oregon with up to 16 gigawatts that are to be leased at the end of 2024;

WHEREAS, studies by NREL and others have also identified future offshore wind lease areas off the Cape Mendocino and Del Norte Coast which are approximately 122 miles from Humboldt Bay and capable of producing a combined total of approximately 12.8 gigawatts of electricity;

WHEREAS, the California Energy Commission formally awarded $10.45 million in funding to support the Port of Humboldt Bay's project, and

WHEREAS, the Port has identified and prepared a master plan on approximately 180+ acres of existing coastal dependent industrial lands to develop a new heavy lift terminal, upland tarmac, and manufacturing facilities which when fully developed will make Humboldt Bay the west coast hub for offshore wind, and

WHEREAS, the Port has prepared a 2023 PIDP grant application to cover the remaining soft costs of the project,

NOW, THEREFORE, THE BOARD OF COMMISSIONERS OF THE HUMBOLDT BAY HARBOR, RECREATION, AND CONSERVATION DISTRICT DOES HEREBY RESOLVE AS FOLLOWS:

SECTION 1. Authorizes the submission of a grant application under the Port Infrastructure Development Program to permit and develop strengthened and modernized port facilities to accommodate the full spectrum of offshore wind activities.

SECTION 2. Authorizes the Executive Director to sign all documents associated with the grant application.

SECTION 3. Authorizes the Executive Director to commit up to $2 million of the $10.45 million grant from the California Energy Commission.

PASSED AND ADOPTED by the Humboldt Bay Harbor, Recreation and Conservation District Board of Commissioners at a duly called meeting held on the **13th day of April 2023** by the following polled vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

ATTEST:

____
Greg Dale, President
Board of Commissioners

____
Aaron Newman, Secretary
Board of Commissioners

CERTIFICATE OF SECRETARY

The undersigned, duly qualified and acting Secretary of the HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT, does hereby certify that the attached Resolution is a true and correct copy of RESOLUTION NO. **2023-07** entitled,

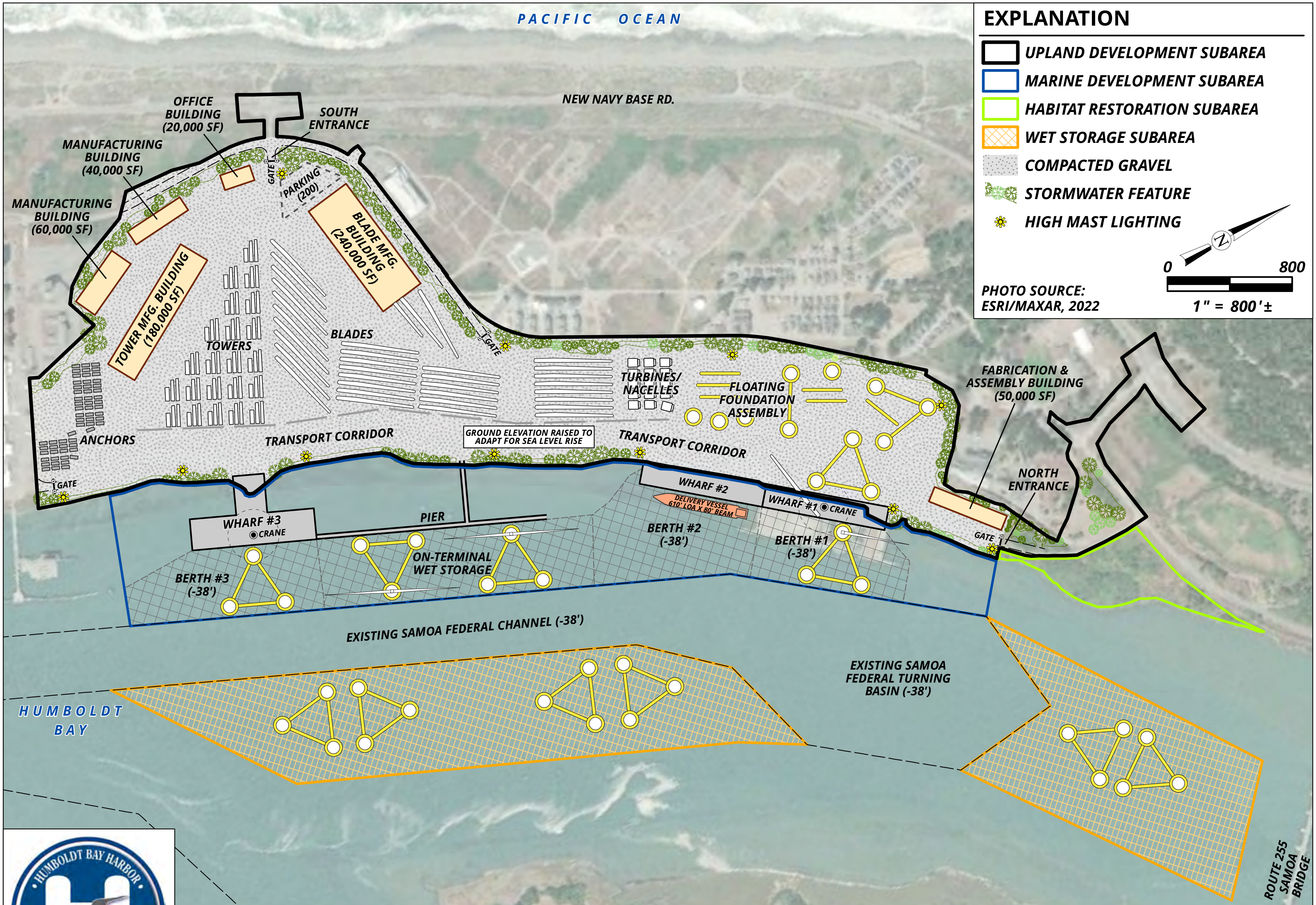
A RESOLUTION AUTHORIZING THE SUBMISSION OF A PORT INFRASTRUCTURE DEVELOPMENT GRANT APPLICATION FOR THE CONSTRUCTION OF A NEW HEAVY LIFT MULTIPURPOSE TERMINAL TO SUPPORT THE OFFSHORE WIND INDUSTRY

as regularly adopted at a legally convened meeting of the Board of Commissioners of the HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT, duly held on the **13th day of April 2023**; and further, that such Resolution has been fully recorded in the Journal of Proceedings in my office, and is in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this **13th day of April 2023**.

____

Aaron Newman, Secretary
Board of Commissioners



moffatt & nichol

Humboldt Bay Offshore Wind Heavy Lift Marine Terminal

Project Example #1

April 2023

Figure 3.1

Attachment B: Conceptual Project Development Plan

Below is a timeline of Board actions to date related to this project:

- **2/4/21**: Board of Commissioners Approved a Contract with LACO Associates to Develop a Conceptual Master Plan for a New Multipurpose Terminal and Associated Upland Facilities Between Redwood Marine Terminal I and II. See Attachment B for the product that resulted from that contract.
- **4/2/21**: Board of Commissioners Reviewed Potential Funding Opportunities to Support the Development of a New Multipurpose Terminal to Support the Emerging West Coast Offshore Wind Industry.
- **5/7/21:** Board of Commissioners Reviewed Conceptual Master Plan for Development of a New Multipurpose Terminal to Support the Emerging West Coast Offshore Wind Industry and Approved Contract with Moffatt & Nichol to Prepare Grant Application (see Attachment B).
- **6/10/21**: Board of Commissioners Reviewed Preliminary Cost Estimates for Conceptual Master Plan for Development of a New Multipurpose Terminal to Support the Emerging West Coast Offshore Wind Industry; Requested Financial Assistance from The Board of Supervisors; and Amended Contract with Moffatt & Nichol to Prepare Grant Application.
- **7/1/21**: Board of Commissioners Reviewed Preliminary Cost Estimates for Development of a New Multipurpose Terminal to Support the Emerging West Coast Offshore Wind Industry, Provided Direction Regarding Size of the Planned Terminal, and Committed Funds/Staffing.
- **8/6/21**: Board of Commissioners Amended the Contract with Moffat & Nichol to Prepare a $56 Million Grant Application for a New Heavy Lift Terminal by Increasing the Contract by $20,000.
- **10/14/21**: Board of Commissioners Authorized the Release of Request for Qualifications for Engineering Services and Preparation of CEQA/NEPA Environmental Documents for the 168-Acre New Multipurpose Heavy Lift Dock and Upland Facilities to Support the Emerging Offshore Wind Industry.
- **3/3/22**: Board of Commissioners Approved a Contract with the California Energy Commission to Receive a $10,450,000 Grant to Repurpose the Redwood Marine Terminal to Support Offshore Wind Energy Development.
- **3/3/22**: Board of Commissioners Approved a Contract with Moffatt & Nichol in the Amount of $3,567,500 for Design, Permitting, and Coordination Services for the District's Multipurpose Terminal Replacement Project at Redwood Marine Terminal I and Navigation Channels.
- **4/8/22**: Board of Commissioners Received a Report Regarding Upcoming Grant Application for Port Infrastructure Development Program.
- **5/6/22**: Board of Commissioners Adopted Resolution 2022-04, A Resolution to Authorize the Execution of a Grant Agreement and Accept Funds from the Maritime Administration of the US Department of Transportation for a 2022 Port Infrastructure Development Program Grant for the Humboldt Offshore Wind Terminal Project.

- **8/9/22**: Board of Commissioners Received a Report and Provide Direction Regarding the Potential to Enter into a Project Labor Agreement Regarding the Development of the New Heavy Lift Marine Terminal to Support the Offshore Wind Industry.
- **9/8/22**: Board of Commissioners Adopted Resolution No. 2022-08 thereby Adopting the "Property Acquisition and Disposition Plan for the Multipurpose Marine Terminal Master Plan".
- **2/3/23**: Board of Commissioners Received a Report Providing Status Update of Contracts and Budgets Associated with the District's Offshore Wind Heavy Lift Marine Terminal Project.
- **3/6/23**: Board of Commissioners Adopted Resolution 2023-05 Concerning Offshore Wind Development off the West Coast of the United States and around Humboldt Bay.

ATTACHMENT 2:
Harbor District Resolution 2023-05, which acknowledges the District's commitment to supporting offshore wind related port/terminal development

Humboldt Bay
Harbor, Recreation and Conservation District
(707) 443-0801
P.O. Box 1030
Eureka, California 95502-1030

STAFF REPORT
HARBOR DISTRICT MEETING
March 9, 2023

TO: Honorable Board President and Harbor District Board Members

FROM: Rob Holmlund, Development Director

DATE: March 6, 2023

TITLE: Consider Adopting Resolution 2023-05, A Resolution Concerning Offshore Wind Development Off the West Coast of the United States and Around Humboldt Bay

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STAFF RECOMMENDATION: Staff recommends that the Board receive a staff report, receive public comment, and adopt Harbor District Resolution No. 2023-05 that supports the State's goals regarding offshore wind, commits to working with Tribal nations regarding their concerns with offshore wind, recognizes a suite of interested stakeholders, acknowledges that offshore wind development will have direct impacts on select stakeholders, recognizes that offshore wind development will provide many local benefits, seeks District partnerships in developing a regional vision and roadmap for offshore wind development, and directs staff to continue a range of activities in support of offshore wind development.

SUMMARY: On 11/29/22, the Humboldt County Board of Supervisors (BOS) adopted County Resolution 22-1584 associated with offshore wind. District staff used that County Resolution as a template to develop a slightly modified Resolution that is being presented to the District Board of Directors.

BACKGROUND: The State of California has committed to a carbon neutral vision for 2045, which is to be achieved through a number of types of renewable energy projects, including solar, land-based wind farms, and offshore wind. In August 2022, the California Energy Commission set planning goals of five gigawatts (GW) of OSW by the year 2030 and 25 GW by 2045. The Federal government has also established goals for offshore wind, including 30 GW of offshore wind by 2030 and 15 GW of floating offshore wind energy by 2035. In December of 2022, the Federal Department of the Interior's Bureau of Ocean Energy Management (BOEM) leased five sub-areas off the California Coast (two off the coast of Humboldt and three off the coast of Morro Bay). The state and federal governments are also investing in port and supply chain development as critical to the success of the OSW industry.

In March 2022, the Harbor District Board accepted a $10.45M grant from the California Energy Commission to permit, design, and develop the Humboldt Bay Offshore Wind Heavy Lift Marine Terminal. In October of 2022, the District Board approved an Exclusive Right to Negotiate with

Crowley Wind Services to develop the terminal, which will serve as a west coast hub for the offshore wind industry.

On 11/29/22, the Humboldt County Board of Supervisors (BOS) adopted County Resolution 22-1584, which commits the County to

- Work collaboratively with stakeholders to prepare for the unique opportunities presented by offshore wind;
- To ensure local communities experience the full scale of potential benefits of hosting this industry;
- To lower risk for vulnerable communities, to shift old patterns of harmful boom-and-bust natural resource extraction;
- to prepare local communities, governments, and economies for the transition.

Throughout the past year, the District has worked closely with the County in all of the commitments outlined in the County Resolution. The attached District Resolution is based on the County Resolution and allows the District to make similar commitments.

ATTACHMENTS:

A. Resolution No. 2023-05

HUMBOLDT BAY HARBOR, RECREATION, AND CONSERVATION DISTRICT

RESOLUTION NO. 2023-05

A RESOLUTION OF THE BOARD OF DIRECTORS CONCERNING OFFSHORE WIND DEVELOPMENT OFF THE WEST COAST OF THE UNITED STATES AND AROUND HUMBOLDT BAY

WHEREAS, offshore wind energy development is a crucial strategy to address global climate change and to meet the state and federal administrations' ambitious climate and renewable energy targets; and

WHEREAS, it is essential that the offshore wind industry develops and operates equitably and sustainably, and in partnership with the region's communities, to address the area's unique assets, needs, and connections with natural resources; and

WHEREAS, the Humboldt Bay Harbor, Recreation and Conservation District (District) is deeply committed to ensuring that the development of the offshore wind industry in this region yields a strong slate of community benefits, minimizes and mitigates impacts wherever possible, compensates communities for unavoidable impacts, and generates robust and sustainable economic opportunities for the region's communities; and

WHEREAS, the Bureau of Ocean Energy Management's (BOEM) offshore wind Final Sale Notice for wind lease areas off the coast of Humboldt County offers tremendous opportunities to pursue and achieve community benefits, including through a 20% workforce and/or supply chain development credit, a 5% General Community Benefit Agreement (CBA) credit, and a 5% Lease Area Use CBA credit; and

WHEREAS, concentrated and coordinated effort will be required to ensure that the offshore wind industry in the Humboldt region is developed sustainably in a way that benefits Tribal Nations and underrepresented communities, advances racial equity, protects the environment and builds a thriving, equitable, and sustainable local economy, including through the development and negotiation of CBAs and other agreements; and

WHEREAS, in collaboration with the County of Humboldt, the District has engaged with and plans to continue to engage with multiple stakeholders including Tribal governments, the City of Eureka, CalPoly Humboldt, the Workforce Development Coalition of Humboldt County, Redwood Coast Energy Authority; the State Building and Construction Trades Council, the Humboldt and Del Norte Construction Trades Council, the Redwood Region Climate and Community Resilience Hub (CORE Hub), the broader North Coast Offshore Wind Community

Benefits Network (Network), commercial fisheries, the Peninsula Community Collaborative, private property owners, various non-governmental organizations and environmental groups, and other regional communities and stakeholders to work toward a broad vision and roadmap for offshore wind development in our region; and

WHEREAS, the CORE and the Network represent a diverse group of Tribal Nations, local government agencies and educational institutions, labor leaders, local community-based organizations, and community residents, and has participated in BOEM's offshore wind lease sale process to seek robust community benefits stipulations and bid credits; and

WHEREAS, Tribal Nations; Black, Indigenous, and Communities of Color; commercial fisheries, and frontline communities bear the brunt of devastating impacts of climate catastrophe, energy vulnerability, and long-term impacts of extractive over-harvesting of natural resources, and are therefore critical partners and leaders in developing an equitable and sustainable path to offshore wind development; and

WHEREAS, the District recognizes Tribal sovereignty, self-determination, and other rights of Native American Tribes, as well as the specific and intentional historic trauma to Tribal Nations and Peoples by the federal, state, and county/local governments and previous destructive natural resource industries in the North Coast region; and

WHEREAS, the County of Humboldt and the surrounding region have rich fisheries, which are foundational to Tribal Nations, the commercial fishing economy, and marine species, and which will be affected by this new industry; and

WHEREAS, Humboldt Bay was historically one of California's largest fishing port, with North Coast fisheries currently contributing forty million ex-vessel dollars to the local community; and

WHEREAS, the cumulative loss of community fishing grounds and port fishing infrastructure by offshore wind development will impact fishermen, the fishing industry, Tribal fisheries and underserved North Coast fishing communities; and

WHEREAS, the District recognizes that BOEM's recently completed Humboldt and Morro Bay wind lease area auctions were a key step in the path to offshore wind development and is merely the beginning of what will hopefully be a long, productive, and collaborative partnership with wind developers and the region's diverse communities and constituencies; and

WHEREAS, necessary infrastructure investments throughout the greater Humboldt Bay region needs to be planned, prioritized, and sequenced in order to prepare for and maximize economic opportunities for projects related to offshore wind energy in particular, and the blue/green economy more generally; and

WHEREAS, investments in port, peninsula, and bay infrastructure are a critical early step in the District's overall economic development strategy for offshore wind, and are needed to minimize adverse community and environmental impacts; and

WHEREAS, to stimulate job creation, equitable economic development and prosperity for a diverse population, the District and various stakeholders must collaborate to prioritize early investments in such infrastructure, without which the site development for an array of economic development projects will not be possible; and

WHEREAS, offshore wind development, if pursued thoughtfully and in genuine partnership with the District, the County of Humboldt, Tribal Nations, and the region's other local governments, communities, commercial fisheries, and stakeholders, can help promote a diverse and thriving economic landscape

NOW, THEREFORE, THE BOARD OF COMMISSIONERS OF THE HUMBOLDT BAY HARBOR, RECREATION, AND CONSERVATION DISTRICT DOES HEREBY RESOLVE AS FOLLOWS:

SECTION 1. The District believes that offshore wind energy development is a key strategy to fight global climate change. Accordingly, the District supports the State's goals of reaching 5 gigawatts of offshore wind energy by the year 2030 and 25 gigawatts by 2045, as well as the national goal of 30 gigawatts of offshore wind energy by 2030. The District also supports the State's efforts to plan for the necessary supplemental steps required to achieve the offshore wind energy goals, including enhancing power transmission infrastructure, preparing a capable workforce, and upgrading port infrastructure. The District is prepared to do its part to ensure the equitable and sustainable economic development of this new industry in the County and region, while helping ensure that any unavoidable impacts are mitigated and minimized. Offshore wind energy development provides a unique opportunity for diversification of the County's economic engines, and should be developed in full collaboration with local stakeholders, including Tribal Nations, local organizations and industries, fisheries and local government entities.

SECTION 2. The District recognizes that offshore wind development will affect Tribal Nations and their citizens. The District commits to working collaboratively with and supporting the leadership of Tribal Nations in addressing the effects of and advancing Tribal interests in offshore wind development.

SECTION 3. The District recognizes that the County of Humboldt is taking the lead in working with multiple stakeholders, including several Tribal governments, the City of Eureka, CalPoly Humboldt, the Workforce Development Coalition of Humboldt County, Redwood Coast Energy Authority, the State Building and Construction Trades Council, Humboldt and Del Norte Construction Trades Council, the Redwood Region Climate and Community Resilience Hub (CORE Hub), the broader North Coast Offshore Wind Community Benefits Network (Network), commercial fisheries, the Peninsula Community Collaborative, private property owners, various non-governmental organizations and environmental groups, and other regional communities and stakeholders in advocating for offshore wind workforce development and community benefits, and have raised important issues before BOEM, other federal agencies and the State of California. The District supports these efforts, and will continue to participate as partners with the County in advocacy and negotiation of community benefits related to offshore wind development.

SECTION 4. The District acknowledges that offshore wind development will have unavoidable impacts on regional fisheries, including Tribal fisheries. The District intends to work collaboratively with representatives of affected local fishermen, businesses, industries and Tribal Nations to ensure that any impacts are mitigated, and to ensure compensation and support regarding unavoidable impacts, and to inform the region's transition process.

SECTION 5. The District recognizes that many other local stakeholders and residents will be directly and indirectly affected by offshore wind development in our region. The District intends to engage in sustained and proactive outreach to receive input from these communities regarding offshore wind development, and to help ensure that this new industry is a net benefit for the District and the region, with broadly-beneficial community benefits, and avoidance of concentrated negative impacts.

SECTION 6. Offshore wind development offers tremendous opportunities for employment, training, career development, and other workforce systems. The District will work collaboratively with resource partners and future employers, Tribal Nations, and labor and industry representatives, to help establish and support sustainable workforce development pathways for onshore and offshore construction, operations, and associated activities.

SECTION 7. For these reasons, the District Board of Directors strongly supports continued and enhanced engagement in all processes described above, including partnering to create: a regional vision and roadmap for offshore wind development, advancing funding opportunities to support regional agency and regional capacity, a community benefit plan, local outreach and engagement, and taking other steps appropriate to facilitating the offshore wind industry's long-term and sustainable development, for the benefit of our community.

SECTION 8. The District staff are therefore directed to
continue or undertake the following activities related to offshore wind development:

a) work collaboratively with local stakeholders in creating a regional vision and roadmap for offshore wind development to prepare our community for sustainable and equitable development of the offshore wind industry;
b) collaborate and engage with Tribal Nations regarding offshore wind development and its effect on and opportunities for Tribal Nations and their citizens;
c) collaborate with the commercial fishing communities, Tribes, recreational users of the Bay, and other directly impacted stakeholder groups, as well as the County, the CORE Hub, the Offshore Wind Community Benefit Network, and others in pursuing community benefits agreements with offshore wind development leaseholders and other developers;

d) support and/or participate in negotiations of community benefits agreements or similar agreements related to community benefits, workforce development, procurement, and mitigation of impacts, with offshore wind development leaseholders and other project developers, participants and affected stakeholders which advances the District's goals for Humboldt Bay and the regional vision and roadmap for offshore wind development which will be developed;
e) engage in outreach and stakeholder input efforts to ensure that all affected and interested members of the Humboldt County community and region are aware of offshore wind development activities and can participate in public processes regarding such activities;
f) work with the County of Humboldt to draft a Memorandum of Understanding regarding community benefits opportunities, including bay-wide master planning, project labor agreements, workforce development, and other County activities related to offshore wind;
g) coordinate with other state, federal, Tribal and local government entities to shape offshore wind development to maximize environmental and economic benefits, and minimize adverse impacts;
h) assist in planning and advancing onshore infrastructure upgrades that are essential for development of the industry, and are needed to minimize adverse impacts;
i) on behalf of the District Board, submit letters of support and requests for funding and regulatory or legislative frameworks related to regional agency and growing regional capacity to facilitate sustainable development of the offshore wind industry in the region;
j) take all reasonable additional steps to support offshore wind development in a manner that maximizes the benefits to the region, while minimizing and mitigating any unavoidable impacts, as described herein; and
k) report to the District Board of Directors as needed regarding negotiations, initiatives, and efforts as described herein.

PASSED AND ADOPTED by the Humboldt Bay Harbor, Recreation and Conservation District Board of Commissioners at a duly called meeting held on the **9th day of March 2023** by the following polled vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

ATTEST:

____

Greg Dale, President
Board of Commissioners

____

Aaron Newman, Secretary
Board of Commissioners

CERTIFICATE OF SECRETARY

The undersigned, duly qualified and acting Secretary of the HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT, does hereby certify that the attached Resolution is a true and correct copy of RESOLUTION NO. **2023-05** entitled,

A RESOLUTION OF THE BOARD OF DIRECTORS CONCERNING OFFSHORE WIND DEVELOPMENT OFF THE WEST COAST OF THE UNITED STATES AND AROUND HUMBOLDT BAY

as regularly adopted at a legally convened meeting of the Board of Commissioners of the HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT, duly held on the **9th day of March 2023**; and further, that such Resolution has been fully recorded in the Journal of Proceedings in my office, and is in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand this **9th day of March 2023**.

____

Aaron Newman, Secretary
Board of Commissioners

HUMBOLDT BAY: PLANNING FOR OFFSHORE WIND, EQUITY, RESILIENCE, AND ECONOMIC DEVELOPMENT

HUMBOLDT: POWERED

PORT OF HUMBOLDT, CALIFORNIA

U.S. DEPARTMENT OF TRANSPORTATION / MARITIME ADMINISTRATION

FY 2023 PORT INFRASTRUCTURE DEVELOPMENT PROGRAM (PIDP) GRANT APPLICATION

PROJECT ENGINEERING DRAWINGS

Submitted by:
Humboldt Bay Harbor Recreation and Conservation District
Eureka, California

HUMBOLDT BAY HARBOR RECREATION & CONSERVATION DISTRICT

moffatt & nichol

HUMBOLDT BAY OFFSHORE WIND & HEAVY LIFT MULTIPURPOSE MARINE TERMINAL

OVERALL BAY VIEW

JULIAN BERG DESIGNS
ARCHITECTURE & PLANNING
julianbergdesigns.com
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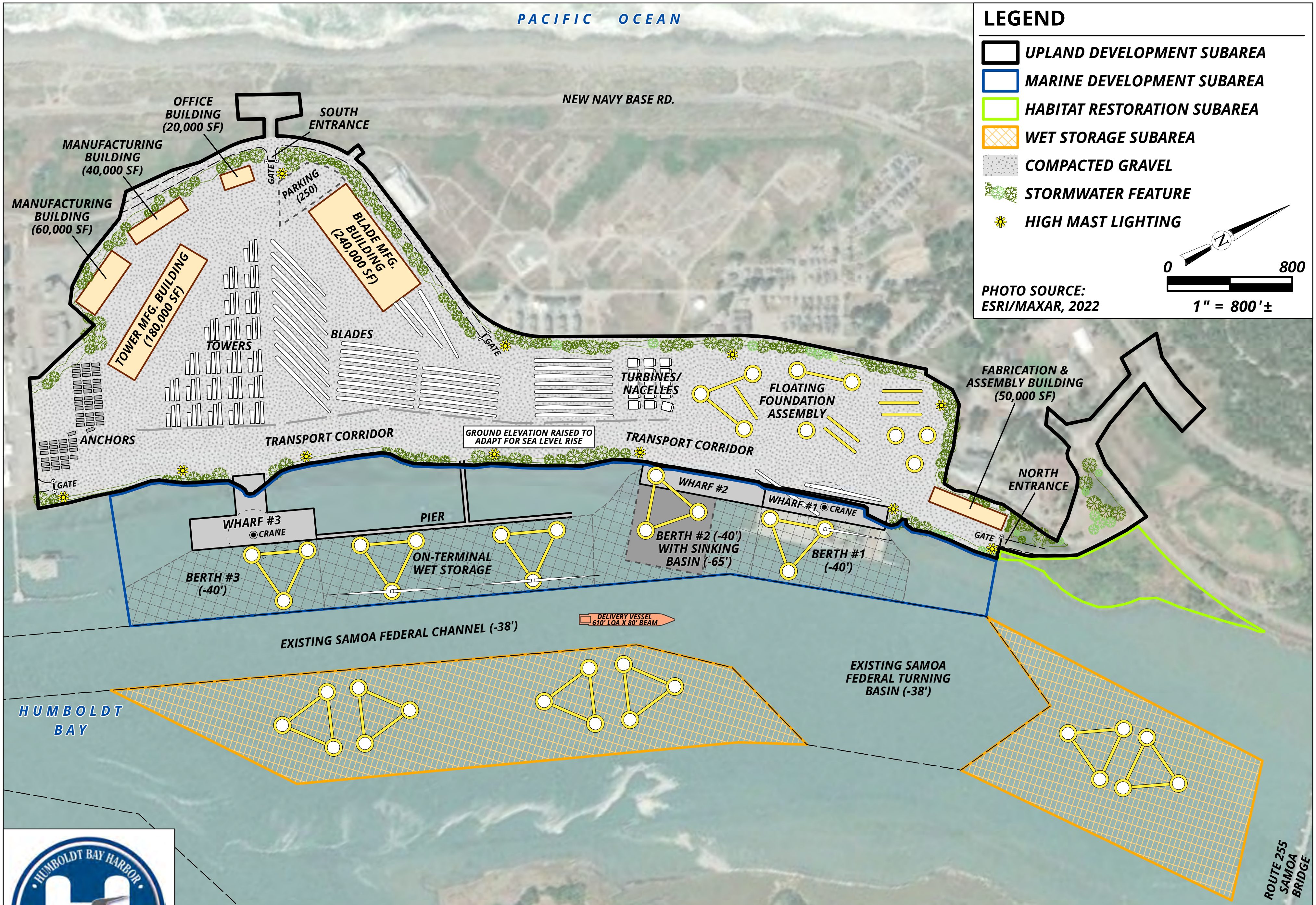
6.5.22



Humboldt Bay Harbor Recreation & Conservation District

moffatt & nichol

SHN

Humboldt Bay Offshore Wind Heavy Lift Marine Terminal

Conceptual Site Plan Based on 10% Design

April 2023

Figure 3.1

HUMBOLDT BAY HARBOR RECREATION & CONSERVATION DISTRICT

moffatt & nichol

HUMBOLDT BAY OFFSHORE WIND & HEAVY LIFT MULTIPURPOSE MARINE TERMINAL

CONCEPTUAL MASTER PLAN

JULIAN BERG DESIGNS
ARCHITECTURE & PLANNING
julianbergdesigns.com
707 • 407 • 8870

5.7.22

Marine Terminal Redevelopment, Mitigation, and Construction Phasing Plan

REPORT
Humboldt Bay Harbor, Recreation, and Conservation District
October 2022

moffatt & nichol

REDWOOD MULTIPURPOSE MARINE TERMINAL PROJECT

Preliminary Basis of Design

Document Verification

Client	Humboldt Bay Harbor, Recreation, and Conservation District
Project name	Redwood Multipurpose Marine Terminal Project
Document title	Preliminary Basis of Design
Status	Draft Report
Date	October 2022
Project number	212991-01
File reference	MN-Preliminary Basis of Design-20220919

Revision	Description	Issued by	Date	Checked
00	Preliminary Basis of Design	ME, SF, YN	20221007	SH, MT, SP

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Table of Contents

List of Figures

List of Tables

Attachments

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Moffatt & Nichol devoted effort consistent with (i) the level of diligence ordinarily exercised by competent professionals practicing in the area under the same or similar circumstances, and (ii) the time and budget available for its work, to ensure that the data contained in this report is accurate as of the date of its preparation. This study is based on estimates, assumptions and other information developed by Moffatt & Nichol from its independent research effort, general knowledge of the industry, and information provided by and consultations with the client and the client's representatives. No responsibility is assumed for inaccuracies in reporting by the Client, the Client's agents and representatives, or any third-party data source used in preparing or presenting this study. Moffatt & Nichol assumes no duty to update the information contained herein unless it is separately retained to do so pursuant to a written agreement signed by Moffatt & Nichol and the Client.

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This study is qualified in its entirety by, and should be considered in light of, these limitations, conditions and considerations.

Glossary

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute for Steel Construction
ASCE	American Society of Civil Engineers
ASD	allowable stress design
AWS	American Welding Society
BFE	base flood elevation
BOEM	Bureau of Ocean Energy Management
CBC	California Building Code
CCR	California Code of Regulations
CEC	California Electrical Code
CGP	Construction General Permit
CMC	California Mechanical Code
CPT	cone penetration test
FAA	Federal Aviation Administration
FIRM	FEMA Flood Insurance Rate Map
GHG	greenhouse gas
GW	gigawatts
Harbor District	Humboldt Bay Harbor, Recreation, and Conservation District
HAT	Highest Astronomical Tide
IES	Illumination Engineering Society
IGP	Industrial General Permit
LAT	Lowest Astronomical Tide
LID	Low Impact Development
LRFD	Load Resistance Factor Design
MBL	minimum breaking load
MEG4	Mooring Equipment Guidelines, 4th Edition
MHHW	Mean Higher High Water
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NFPA	National Fire Protection Association
NOAA	National Oceanic and Atmospheric Administration
OCIMF	Oil Companies International Marine Forum
OCS	Outer Continental Shelf
OSHA	Occupational Safety and Health Administration
PIANC	Permanent International Association of Navigation Congresses
PV	photo-voltaic
RCP	Representative Concentration Pathway
RMT	Redwood Marine Terminal
ROW	right of way
SIC	Standard industrial Classification
SLR	sea level rise
SPMT	self-propelled modular transporter
SWL	safe working load
SWPPp	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
UFC	Unified Facilities Criteria
UHMW	ultra-high molecular weight

US	United States
USACE	United States Army Corps of Engineers
USCS	United States Customary System
WTG	wind turbine generation
WWTP	Wastewater Treatment Plant

1. Introduction

1.1. Background

The offshore wind industry in the Pacific Outer Continental Shelf (OCS) region in the United States (US) is a relatively new industry that is poised for significant growth and development. Multiple states, including California, have passed legislation creating a market for the offshore wind industry. The federal government announced in May 2021 a goal to deploy 30 gigawatts (GW) of offshore wind in the US by 2030. California Assembly Bill 525, amended June 17, 2021, directs state agencies to develop a strategic plan and to set statewide goals for offshore wind production by 2030 and 2045. These production goals will drive industry development, including development of port infrastructure, that is purpose built to support the deployment of offshore wind projects in the Pacific Ocean. Due to water depths, traditional fixed foundations of offshore wind turbines are not feasible and floating foundations are to be used.

The project objective is to develop Humboldt Bay marine infrastructure and upland space into a Marshalling and Integration port to support the Offshore Floating Wind Industry in the Pacific OCS region. This project seeks to redevelop the existing Redwood Marine Terminal Berth 1 (RMT1), and its associated uplands so that it can serve as the primary facility for the manufacturing, import, staging, preassembly, and loadout of large offshore wind components, including both wind turbine generation (WTG) components and floating foundation components. RMT1 is located within the Port of Humboldt Bay and is uniquely located with no air draft restrictions and direct access to a federally maintained deep water channel. It is comprised of approximately 160 acres of useable upland space. Upgrades to the existing uplands, utilities, and marine infrastructure are required for RMT1 to serve as the regional WTG staging port and component and foundation manufacturing port.

A new berth, RMT2, is required to accommodate an additional offshore wind energy developer. The facility’s existing size, location, and direct unimpeded access to open water, as well as vicinity to the Bureau of Ocean Energy Management (BOEM) offshore wind Humboldt Call Area make it an ideal candidate to serve as an offshore wind hub (co-location of marshalling and manufacturing terminals) in this region. Additionally, the terminal can support future BOEM lease areas in Oregon and Central California, including the Morro Bay and Diablo Canyon call areas.

The RMT1 site was developed as a lumber mill on the Samoa Peninsula in the 1890s. The Samoa Pulp mill was built on the site of the lumber mill in 1965. In 1993 the pulp mill was closed, then reopened in 2000. By that time most of the buildings on the mill site had been demolished. The pulp mill was closed for good in 2008. The Humboldt Bay Harbor, Recreation, and Conservation District (Harbor District) purchased the site in 2013, and much of the facility has since been demolished. (Humboldt Bay Maritime Industrial Use Market Study, 2018).

Once Offshore Floating Wind Industry demand decreases, the terminal would serve as a multi-use or multi-industry facility as other business opportunities arise.

1.2. Existing Site Description and Location

The existing RMT1 is located on the Samoa Peninsula in the Port of Humboldt Bay, California; see Figure 1-1, Figure 1-2, and Figure 1-3. The site has two main areas: the wharf and the uplands. The uplands generally consist of both paved and unpaved surfaces. The existing wharf is constructed of timber and provides an approximately 1,136-foot-long berth. The site was previously used to support the timber industry and currently services commercial fishermen, an aquaponics research facility, and a hagfish processing / shipping operation.

FIGURE 1-1: REDWOOD MARINE TERMINAL LOCATION

FIGURE 1-2: REDWOOD MARINE TERMINAL (RMT) – PROJECT SITE (GOOGLE EARTH 2019)

1.3. Project Description

The proposed RMT Project will serve as an import, storage, pre-assembly, and loadout facility for wind towers, nacelles, and blades to service the offshore wind market. This marshalling port will have the potential to import, stage, pre-assemble, manufacture, and integrate components for offshore wind turbine systems on the order of 15 – 25 MW .

The design effort will include consideration of later development phases of the larger hub with a focus on vertical integration and onsite fabrication of device base. Other uses are developed at a programmatic level and design of those uses (such as manufacturing buildings) would be outlined under a supplemental Basis of Design at a future date..

The proposed site plan for the terminal is shown on Figure 1-2.

This project includes the following site upgrades:

Uplands

- Execution of wetlands mitigation project
- Demolition of various buildings
- Demolition of existing site utilities
- Grading and compaction of soil
- Ground improvement
- Installation of site storm water collection and treatment system
- Installation of potable and fire suppression water systems
- Installation of perimeter fencing and associated lighting and security
- Installation of new high mast lighting grid
- Installation of electrical service to meet site requirements
- Installation of elevated outlet racks for nacelles
- Installation of dense graded aggregate top surface to support operational loading

Marine Infrastructure

- Execution of wetlands mitigation project
- Demolition of 200,000 SF existing timber pile-supported wharf structure
- Installation of two pile-supported wharves (steel piles & concrete superstructure)
- Dredge to accommodate delivery vessels and floating foundations at wharf berth
- Placement of dredge material on southern section of RMT1
- Placement of slope protection (rock revetment)
- Installation of mooring dolphins for vessel berthing
- Installation of mooring dolphins for wet storage of floating foundation and fully integrated devices
- Dredge a sinking basin to accommodate semi-submersible barge
- Dredging the designated wet storage areas around the navigation channels[1]

[1] *The owner and operator or the terminal can choose to eliminate this area from the design and use an off-site location to store the semi-sub barge*

1.4. Scope of Basis of Design

This BOD states the basis for the specific design criteria adopted for the RMT development for incorporation into the basic design. It consists of design data assembled and developed during the preliminary design phase and identifies required codes and references for the design of individual project elements. The BOD is a living document and will be updated as the design matures. RMT project / future development requirements for design life, materials, and operational performance will be added in future revisions of this document. Reference to a value of 'TBD' indicates a design parameter or decision that is still under development.

1.5. Functional Requirements

The following requirements represent the functional aspects that shall be incorporated into the basic design:

1. Site designed for minimum top of subgrade elevation of +17.0 ft NAVD88. Cutting and filling the site will be required to achieve the finished grade elevation. This subgrade elevation is above the FEMA 100 year flood elevation and meets the medium high risk aversion for 2080 as dictated by the State of California Sea-Level Rise Guidance 2018 Update and the California Coastal Commission Recent Update to Best available Science Rising Seas Science Report and OPC State of California Sea-Level Rise Guidance, 2018 Update.
2. Site drainage will be in compliance with the State of California storm water collection and treatment regulations.
3. Site lighting will be in compliance with OSHA and US Coast Guard regulations. It is assumed that high mast lighting will be used. Supplemental lighting will be used where occasional work tasks require additional light greater than what is provided in the area. The lighting must be located or shielded so it is not mistaken for, or interferes with, marine navigational lights.
4. The access road will be designed to meet the county road standards at the connection to existing county roads and in areas outside the Harbor District property. Within the Harbor District property, an alternative road design section may be selected. Three access points to the site will be provided: north access from Vance Avenue, a west entrance from Navy Base Road and a south access point.
5. All areas accessible for crawler cranes shall be designed with a flexible pavement of well graded crushed rock of a minimum thickness of 3 ft (to be confirmed) on the uplands and 3 ft on the wharf.
6. The wharf and uplands shall be designed to accommodate the design vessels and the heavy lifting, transport, and storage loading associated with both WTG components and floating foundations (i.e., cranes and SPMTs). Based on anticipated site use, the design uniform live loading criteria shall be 3,000 psf for the uplands and 6,000 psf (to be confirmed) on the wharf.
7. The berth shall be designed to accommodate the delivery vessel and/or the semi-submersible barge. The berth shall also be designed to accommodate a fully assembled floating foundation. The berth shall be dredged to an elevation of -40 ft MLLW with a 2-ft over dredge allowance to accommodate a 35-ft draft vessel with a minimum under keel clearance of 3 ft at MLLW. Dredging footprint shall extend to the navigation channel.
8. The berth shall accommodate roll-on / roll-off (RORO) vessels for offload of wind components directly from a delivery vessel. The berth shall be designed to accommodate only one RORO vessel at berth at a time and shall have adequate fendering and mooring points to accommodate this operation.
9. The semi-submersible barge lay-by area shall be designed to accommodate only the semi-submersible barge. This area shall be dredged to an elevation of -21 ft MLLW with a 2-ft over dredge allowance to accommodate a 19-ft draft semi-submersible barge with a minimum under keel clearance of 2 ft. This dredge depth is intended to accommodate the semi-submersible barge

only. The turbine foundation will be placed on the semi-submersible barge at the berth. Dredging footprint shall extend to the navigation channel.

10. The marine structures are not designed for vessel or barge impact, vehicular impact, blast loading, or other impact loads.
11. The marine structures shall be designed to minimize environmental impact by minimizing berth deepening and maximizing overlap with existing wharf footprint to minimize impacts on bay bottom habitat.
12. Fenders shall be generally spaced at 50 ft maximum and bollards shall be generally spaced at 75 ft maximum. This spacing requirement shall be used as guidance when laying out the fenders and bollards. It is recognized that in some instances the spacing will be exceeded as needed to match structural or operational requirements.
13. The site will be designed to prevent local settlement that would inhibit SPMT movement. It is understood that the site will settle over time, and that additional gravel may be required to be placed on site in the future to compensate for settlement over time. The upland bearing capacity, settlement criteria, and differential settlement criteria will be determined in the next design phases, after discussion with the device components manufacturer(s).

2. Datums and Units

The horizontal coordinate system shall be North American Datum of 1983 (NAD83), California State Plane Zone 1.

The vertical coordinate system shall be North American Vertical Datum of 1988 (NAVD88), Geoid 12B.

United States Customary System (USCS - feet, inches, pounds, etc.) units shall be used.

3. Codes, Standards, and References

3.1. Codes & Standards

The following codes, standards, and references shall govern the design of the facility.

American Association of State Highway and Transportation Officials (AASHTO):

- AASHTO LRFD (Load Resistance Factor Design) Bridge Design Specifications, Ninth Edition, 2020
- AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, Sixth Edition, 2013

American Concrete Institute (ACI):

- ACI 224R-01, Control of Cracking in Concrete Structures
- ACI 318-19, Building Code Requirements for Structural Concrete

American Institute for Steel Construction (AISC):

- AISC 303-16, Code of Standard Practice for Steel Buildings and Bridges
- AISC 341-16, Seismic Provisions for Structural Steel Buildings
- AISC 360-16, Specification for Structural Steel Buildings

American Society of Civil Engineers (ASCE):

- ASCE 7-16, Minimum Design Loads for Buildings and Other Structures
- ASCE 61-14, Seismic Design of Piers and Wharves

American Welding Society (AWS):

- AWS D1.1, Structural Welding Code, 2020

California Code of Regulations (CCR):

- 2019 California Building Code (CBC)
- 2019 California Electrical Code (CEC)
- 2019 California Mechanical Code (CMC)

Illumination Engineering Society (IES):

- The Lighting Handbook, 10th edition

National Fire Protection Association (NFPA):

- NFPA 307, Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves

Oil Companies International Marine Forum (OCIMF):

- Mooring Equipment Guidelines (MEG4), 4th Edition, 2018

Permanent International Association of Navigation Congresses (PIANC):

- PIANC WG 33, Guidelines for the Design of Fenders Systems, 2002
- PIANC WG 34, Seismic Design Guidelines for Port Structures, 2001
- PIANC WG 153, Recommendations for the Design and Assessment of Marine Oil and Petrochemical Terminals, 2016

United States Army Corps of Engineers (USACE):

- USACE EM 1110-2-1100, Coastal Engineering Manual, 2002
- USACE EM 1110-2-2502, Retaining and Flood Walls, 1989

Unified Facilities Criteria (UFC):

- UFC 4-152-01 Design: Piers and Wharves, 2017
- UFC 4-159-03 Design: Moorings, 2020

Occupational Safety and Health Administration (OSHA)

- Occupational Safety and Health Standards for Shipyard Employment 1915.82

3.2. References

Available reports previously prepared for the project site are as follows:

- BST Associates, 2018. *Humboldt Bay Maritime Industrial Use Market Study DRAFT REPORT*.
- LACO, 2013. *Samoa Industrial Waterfront Preliminary Transportation Access Plan*
- LACO, 2021. *Humboldt Bay California's Wind Energy Port – HBHRCD Conceptual Master Plan*
- PB Ports & Marine, Inc., 2003. *Port of Humboldt Bay Harbor Revitalization Plan*
- Shatz Energy Research Center, 2020. *Port Infrastructure Assessment Report*
- SHN Preliminary Geotechnical Data Report, Redwood Multipurpose Marine Terminal, Samoa, California, 09/08/2022
- EMI, Summary of Geotechnical Study, 09/01/2022
- EMI, Preliminary Site-Specific Acceleration Response Spectra Recommended for Seismic Design of Redwood Multipurpose Marine Terminal, Humboldt Bay, Samoa, California, 09/22/2022.

Other references include:

- BOEM, 2016. *Determining the Infrastructure Needs to Support Offshore Floating Wind and Marine Hydrokinetic Facilities on the Pacific West Coast and Hawaii (BOEM 2016-011)*
- California Ocean Protection Council & California Natural Resources Agency, 2018. *State of California Sea-Level Rise Guidance: 2018 Update*
- California Coastal Commission, 2018. *Recent Updates to Best Available Science: Memo to Staff, May 7, 2018*
- NOAA, Nautical Chart No. 18622
- USACE, 2021. *Humboldt Bay Samoa Channel Condition Survey, 22 April 2021*

4. Operational Criteria

After construction the site will be turned over to an operator who will be responsible for all activities at the site for the specified term of their contract. The operator may change over the life of the facility. The high-level concept of operations for the site is as follows.

WTG and floating foundation components, including blades, nacelles, tower sections, and foundation elements, are imported at the berth via a delivery vessel. Two methods for transfer from the delivery vessel onto the wharf will be accommodated. The first method consists of using a vessel or wharf-based crane to lift the components from the vessel to the wharf. The second method consists of a RORO operation. This method uses SPMTs to drive onto the vessel, onboard the components, and then transport the components off the vessel and onto the wharf. In both methodologies, SPMTs are used to transport the component from the wharf to the upland storage area.

This methodology is used extensively in the offshore wind industry due to its ability to handle and efficiently spread significant loads to achieve manageable applied loads on the structures and/or subgrade below.

The terminal design will accommodate the fabrication of floating offshore wind turbine foundations on the uplands. This activity can also occur at an alternative site. If the foundation is fabricated at this facility, a serial production line will likely be used. This type of production will start at the western extent of the terminal and move east as structural elements are added to the unit. When the foundation unit is complete, it is stationed at the southern end of the wharf for roll-out onto a semi-submersible barge. The foundation can be loaded out using a ramp system or a semi-submersible barge. In this study, the semi-submersible barge option is used as it provides maximum flexibility. The semi-submersible barge will be moored at the berth. The completed foundation unit is moved onto the semi-submersible barge via SPMTs, an example of this procedure is shown in Figure 4-1. The semi-submersible barge then transports the foundation to a predetermined deep water area and performs a “float-off” operation in which the semi-submersible barge ballasts down until the foundation becomes buoyant. The foundation is towed back to the berth area, where it is outfitted with the WTG components (tower, nacelle, and blades), an example of this procedure is shown in Figure 4-2. These components are typically placed onto the foundation using a large land-based crawler crane. The fully assembled wind turbine (foundation and WTG components) is towed out to the wind farm installation site and anchored in place.

FIGURE 4-1: SEMI-SUBMERSIBLE FOUNDATION BEING LOADED ONTO A SEMI-SUBMERSIBLE BARGE USING SPMTS
(Source: Wilson Offshore & Marine)

FIGURE 4-2: WTG COMPONENTS ASSEMBLED ON SEMI-SUBMERSIBLE FOUNDATION AT QUAYSIDE
(Source: Principle Power)

5. Environmental Criteria

5.1. Metocean Conditions

Figure 5-1 presents the location of metocean gauges discussed in this section.

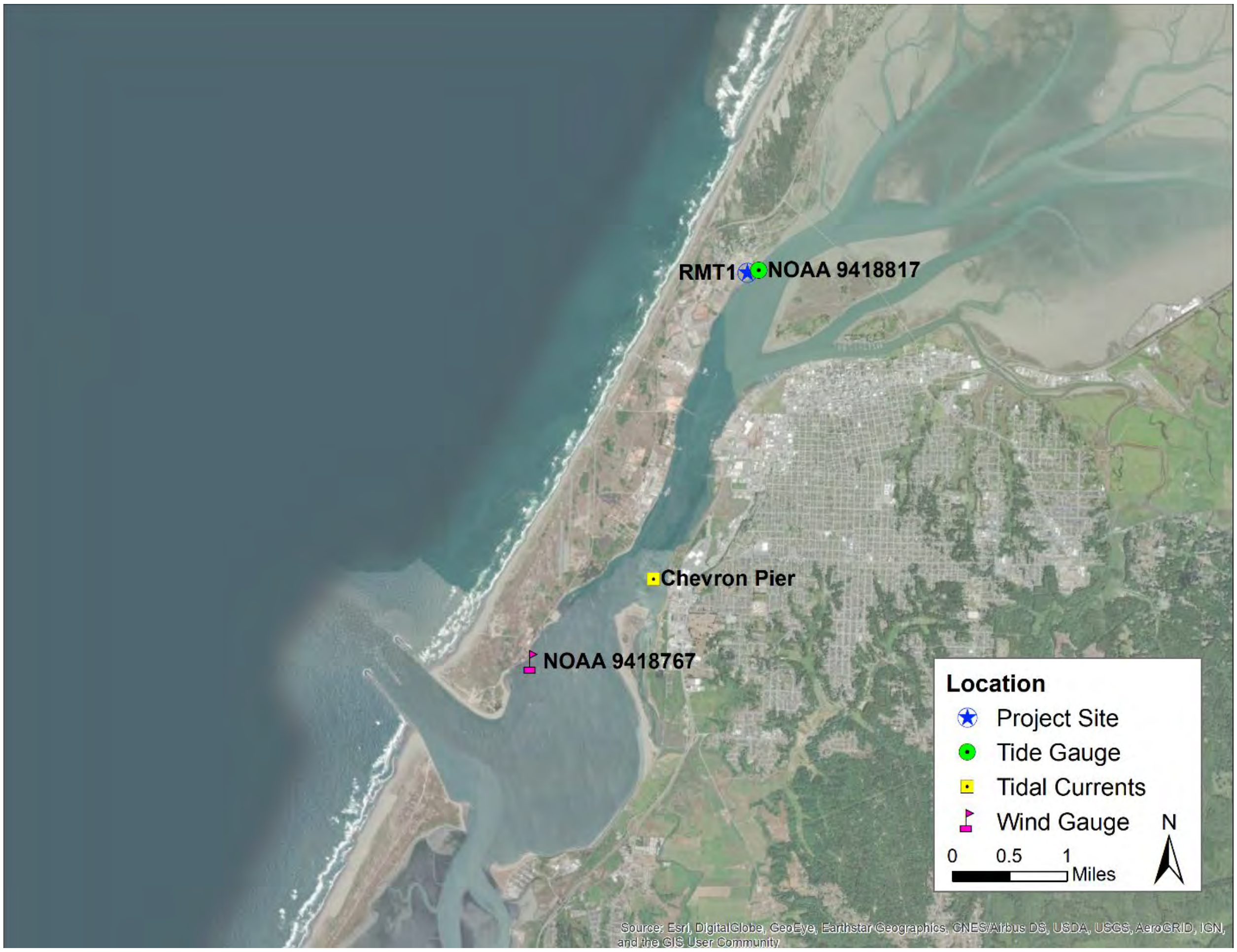


FIGURE 5-1: LOCATION OF METOCEAN GAUGES

5.1.1. Tides

The National Oceanic and Atmospheric Administration (NOAA) Station 9418817 at Samoa, Humboldt Bay, CA is the closest tidal station to the project site. The location of this gauge is shown in Figure 5-2. Tidal datums are provided in Table 5-1 and are based on the National Tidal Datum Epoch 1983-2001.

FIGURE 5-2: LOCATION OF NOAA TIDE STATION 9418817

TABLE 5-1: TIDAL DATUMS

Tidal Parameter	Elevation (ft MLLW)	Elevation (ft NAVD88)
Highest Astronomical Tide (HAT)	+9.36	+8.64
Mean Higher High Water (MHHW)	+7.37	+6.65
Mean High Water (MHW)	+6.65	+5.93
Mean Low Water (MLW)	+1.30	+0.58
North American Vertical Datum of 1988 (NAVD88)	+0.72	0.00
Mean Lower Low Water (MLLW)	0.00	-0.72
Lowest Astronomical Tide (LAT)	-2.43	-3.15

5.1.2. FEMA Flood Levels

Per FEMA Flood Insurance Rate Map (FIRM) Number 06023C0835G, effective June 21, 2017, a portion of the existing site is in an AE zone. The upland section of this facility has a base flood elevation (BFE) of +10 ft NAVD88. The existing wharf has a BFE of +12 ft NAVD88.

5.1.3. Sea-Level Rise Projections

Table 5-2 summarizes sea level rise (SLR) projections at the North Spit. The columns reflect varying risk levels, including the 50% probability, the likely range, the 5% probability (equivalent to 1-in-20 chance), the

0.5% probability (1-in-200 chance), and the extreme H++ scenario. The rows reflect two emissions scenarios, called Representative Concentration Pathways (RCPs). Low emission scenarios represent RCP 2.6, a scenario that leads to very low greenhouse gas (GHG) concentration levels. High emissions represent RCP 8.5, a business-as-usual scenario that leads to high GHG concentration levels.

Under the high emission scenarios, the 0.5% probability of SLR projection for year 2080 is 5.1 feet. Year 2080 is selected because the marine structures shall be designed for a 50-year service life.

TABLE 5-2: SEA-LEVEL RISE PROJECTIONS AT NORTH SPIT

		Probabilistic Projections (in feet) (based on Kopp et al. 2014)					H++ scenario (Sweet et al. 2017) *Single scenario
		MEDIAN	LIKELY RANGE		1-IN-20 CHANCE	1-IN-200 CHANCE	
		50% probability sea-level rise meets or exceeds...	66% probability sea-level rise is between...		5% probability sea-level rise meets or exceeds...	0.5% probability sea-level rise meets or exceeds...	
				Low Risk Aversion		Medium - High Risk Aversion	Extreme Risk Aversion
High emissions	2030	0.6	0.5 -	0.7	0.8	1	1.2
	2040	0.9	0.7 -	1.1	1.2	1.6	2.0
	2050	1.2	0.9 -	1.5	1.7	2.3	3.1
Low emissions	2060	1.3	1.0 -	1.7	2	2.8	
High emissions	2060	1.5	1.2 -	1.9	2.2	3.1	4.3
Low emissions	2070	1.6	1.2 -	2	2.4	3.5	
High emissions	2070	1.9	1.4 -	2.4	2.9	4	5.6
Low emissions	2080	1.8	1.4 -	2.4	2.9	4.4	
High emissions	2080	2.3	1.7 -	2.9	3.5	5.1	7.2
Low emissions	2090	2.1	1.5 -	2.7	3.4	5.3	
High emissions	2090	2.7	2.0 -	3.5	4.3	6.2	8.9
Low emissions	2100	2.3	1.7 -	3.1	3.9	6.3	
High emissions	2100	3.1	2.3 -	4.1	5.1	7.6	10.9
Low emissions	2110*	2.5	1.9 -	3.3	4.2	7.1	
High emissions	2110*	3.3	2.6 -	4.3	5.2	8	12.7
Low emissions	2120	2.7	2.0 -	3.7	4.8	8.2	
High emissions	2120	3.7	2.9 -	4.9	6.1	9.4	15.0
Low emissions	2130	3	2.1 -	4	5.3	9.4	
High emissions	2130	4.2	3.1 -	5.5	6.9	10.9	17.4
Low emissions	2140	3.2	2.3 -	4.4	5.9	10.7	
High emissions	2140	4.6	3.4 -	6.2	7.8	12.5	20.1
Low emissions	2150	3.4	2.3 -	4.8	6.6	12.1	
High emissions	2150	5	3.7 -	6.8	8.7	14.1	23.0

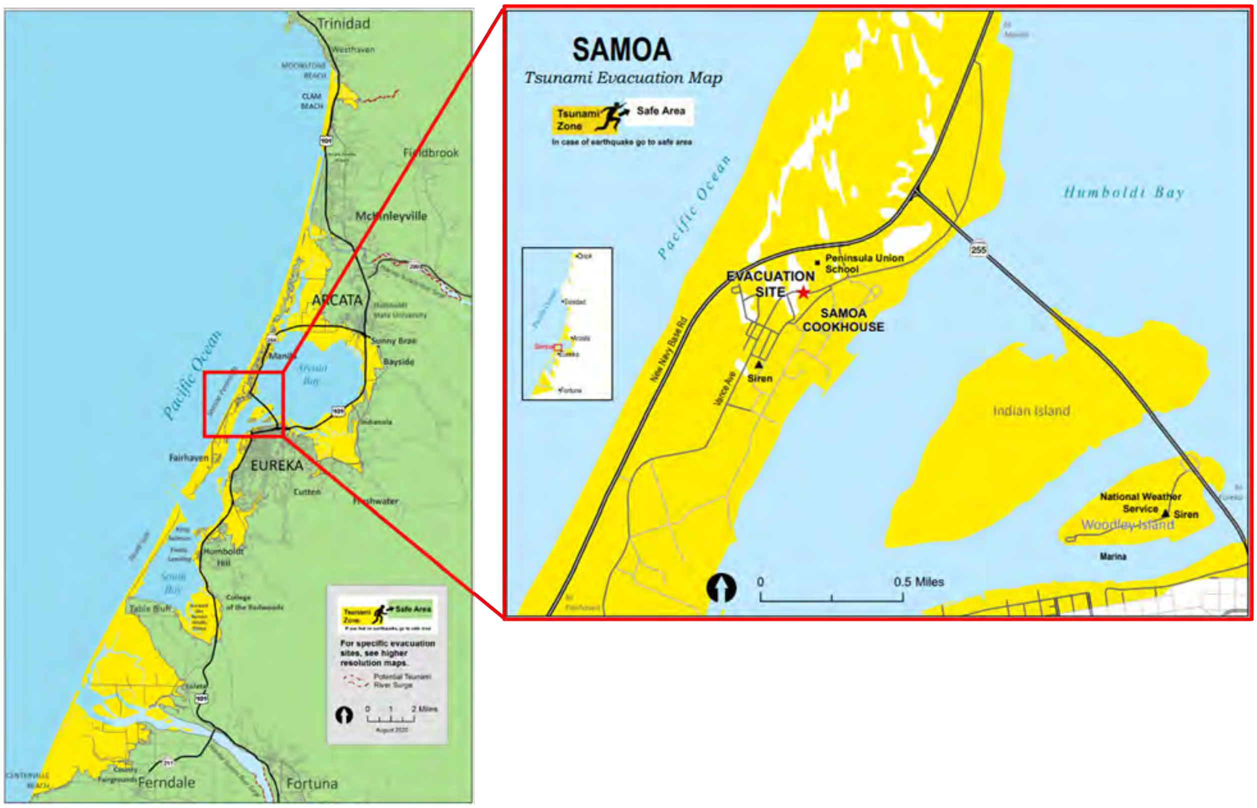
5.1.4. Tsunamis

Publicly available tsunami hazard assessments for the Humboldt Bay area were compiled. Figure 5-3 illustrates the tsunami hazard and evacuation map in the project area. Based on these assessments, several conclusions were made, including:

- Tsunami inundation depths could vary between 0 and 3 ft at the RMT1 project area.
- Tsunami waves come from the Pacific Ocean, over-wash the Samoa Peninsula, then flow into Humboldt Bay.

- Tsunami travel time depends on the location of earthquake sources and can vary from 10 to 20 minutes.
- The official Samoa evacuation site is located on high ground, near the Peninsula Union School.

FIGURE 5-3: TSUNAMI HAZARD AND EVACUATION MAP



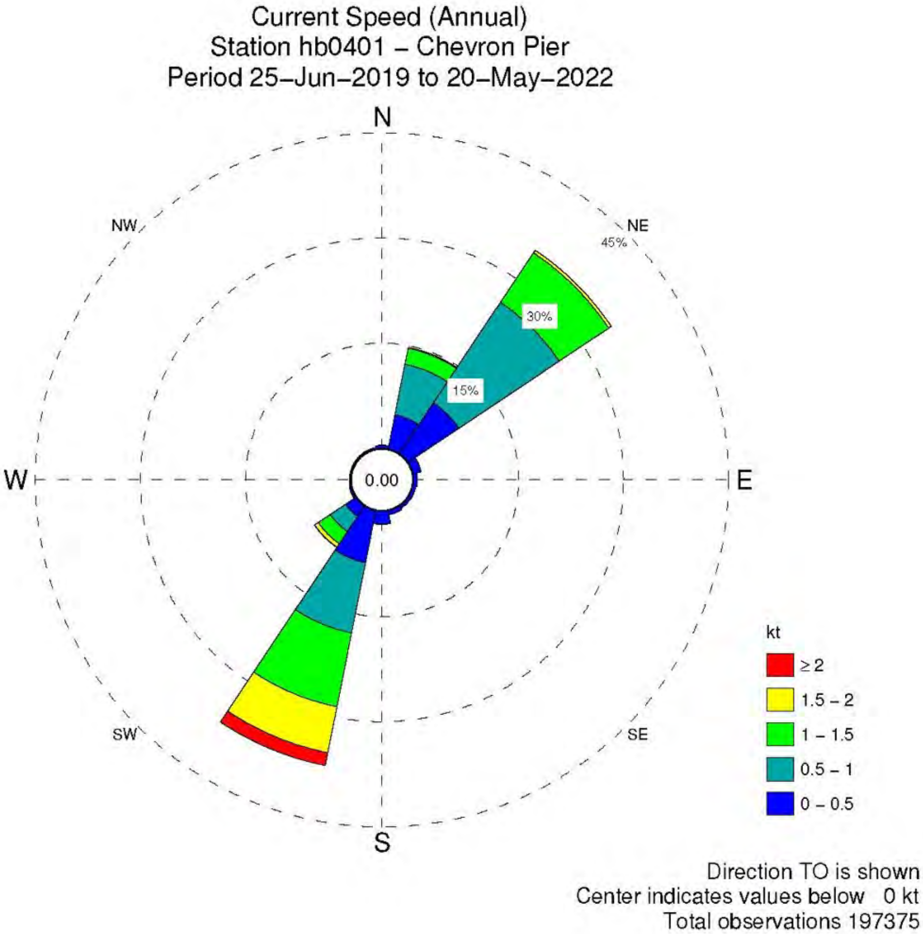
5.1.5. Currents

Tidal current measurements inside Humboldt Bay were analyzed at the Chevron Pier in North Bay (see Figure 5-1), which is located between the bay entrance and RMT1 and represents the general flow field to/from the project site. Figure 5-4 illustrates the annual current rose at Chevron Pier. The prevailing flood currents flow in the northeast direction and ebb currents in the southwest direction. Ebb currents are stronger, with a maximum of up to 3.4 knots. Maximum flood currents can reach 1.9 knots.

TABLE 5-3: TIDAL CURRENTS AT CHEVRON PIER

Parameter	Current Velocity (knots)
Max. Ebb	3.4
Mean Ebb	0.9
Max. Flood	1.9
Mean Flood	0.7

FIGURE 5-4: ANNUAL SURFACE CURRENT ROSE AT CHEVRON PIER

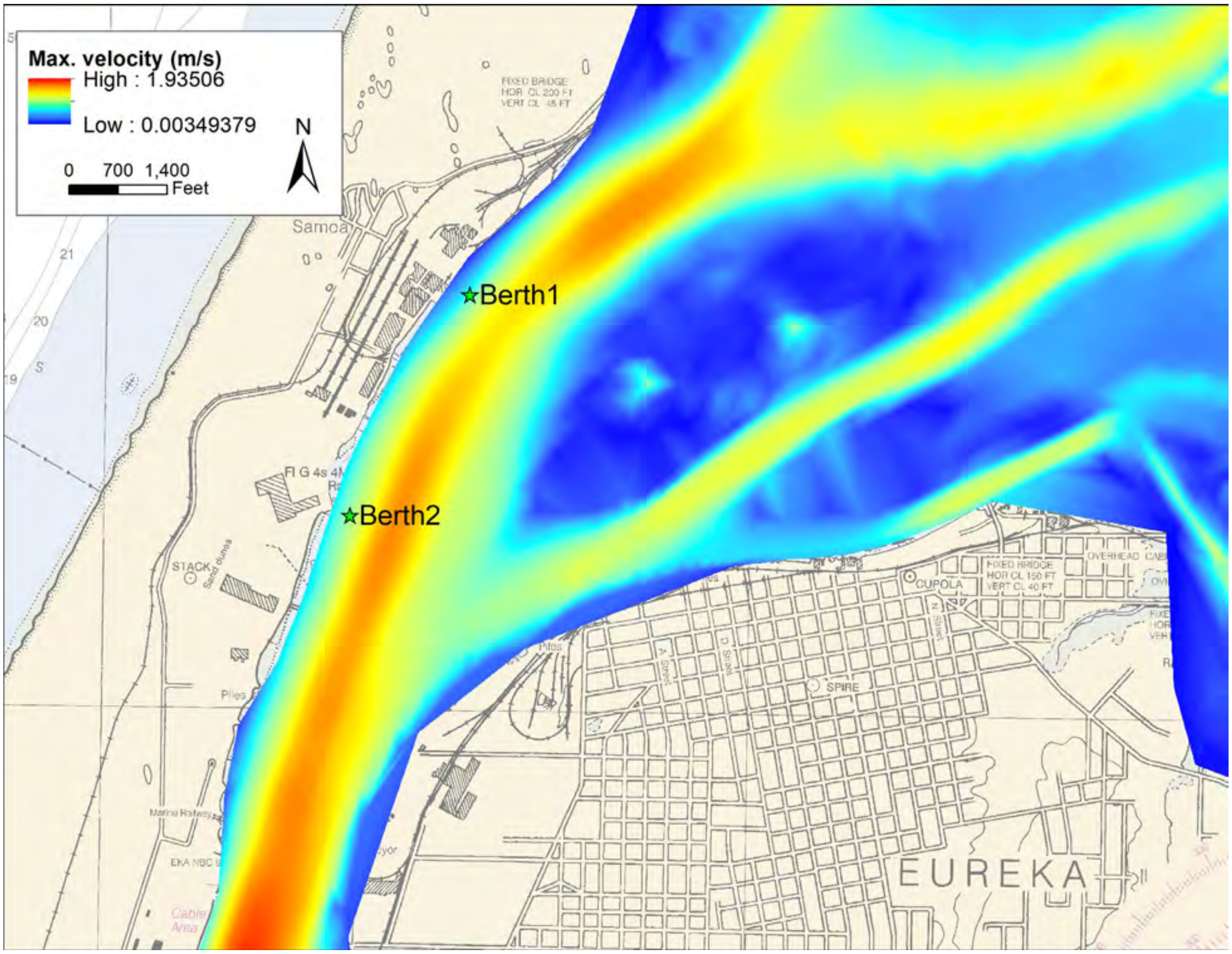


% of Occurrence

Current Speed, kt	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
Total	0.45	14.76	34.88	1.19	0.55	0.41	0.39	0.59	1.85	37.04	7.09	0.27	0.13		0.12	0.18	100.00
2+										1.86							1.90
1.5–2		0.15	0.44							6.69	0.62						7.90
1–1.5		2.31	8.50							10.72	2.07						23.60
0.5–1		7.34	17.23							10.20	2.62						37.50
0–0.5	0.43	4.97	8.71	1.18	0.55	0.41	0.39	0.58	1.80	7.56	1.76	0.26	0.13		0.12	0.18	29.11

A hydrodynamic model simulates tidal circulation inside Humboldt Bay during the strong El Niño year of 1982/83. Figure 5-5 illustrates a raster interpolation of the maximum current velocity that shows stronger currents generally follow the deeper channel. The maximum current velocity at RMT 1 and RMT 2 are 1.0 and 1.3 knots, respectively.

FIGURE 5-5: HYDRODYNAMIC RESULTS AT RMT1 DURING 1982/83 EL NINO



5.1.6. Wind Statistics

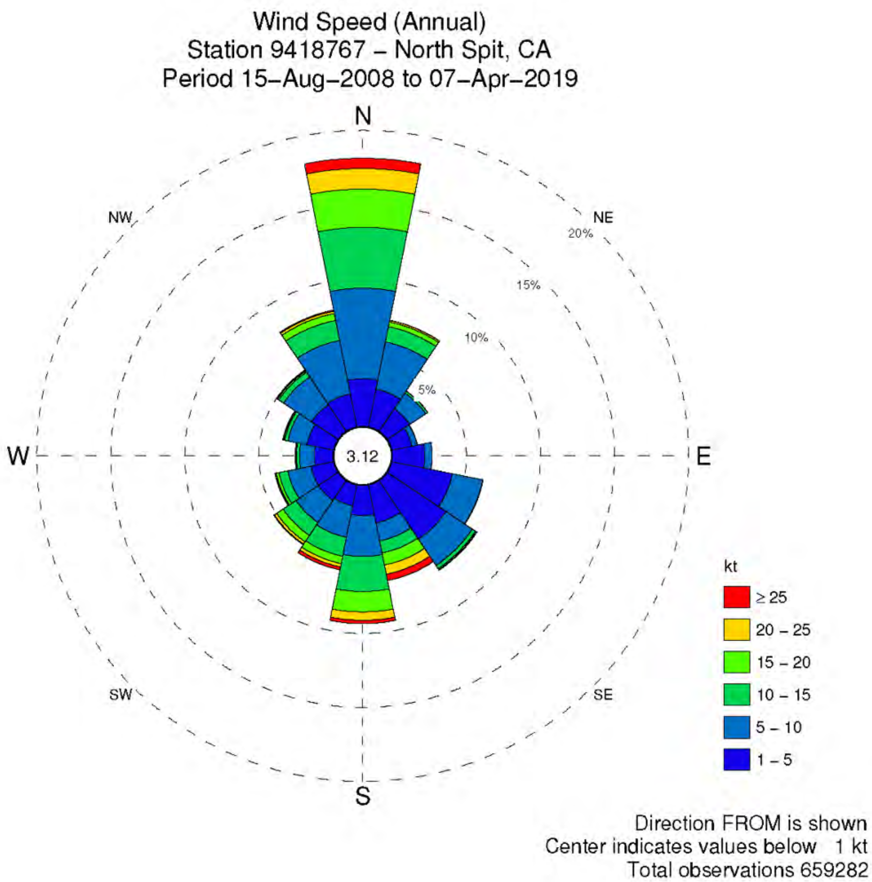
NOAA's 9418767 North Spit gauge is the most representative wind station for the RMT1 due to their close proximity and similar bay water exposure. The annual wind rose is presented in Figure 5-6. The results show that the prevailing and strongest winds are aligned well with the Bay orientation.

Table 5-4 summarizes the extreme wind speeds for varying return periods. The 100-year return period wind is 52.1 knots.

TABLE 5-4: EXTREME WIND SPEEDS AT NORTH SPIT

Return Period (years)	Wind Speed (knots)
1	39.8
5	43.5
10	45.3
25	47.9
50	50.0
100	52.1

FIGURE 5-6: ANNUAL WIND ROSE AT NORTH SPIT



% of Occurrence

Wind Speed, kt	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
Total	18.12	7.34	3.28	1.76	2.69	6.29	7.28	6.59	9.33	5.85	5.21	4.04	2.56	3.50	4.99	8.05	96.88
≥ 25	0.69							0.43	0.22	0.21							1.79
20 – 25	1.40	0.11						0.63	0.56	0.23	0.19					0.16	3.50
15 – 20	2.58	0.32						0.83	1.38	0.51	0.52	0.18				0.48	7.12
10 – 15	4.11	1.05	0.15				0.25	0.83	2.37	1.30	1.05	0.61	0.20	0.23	0.39	1.39	14.00
5 – 10	6.12	3.26	1.29	0.37	0.49	2.09	2.15	1.25	2.77	2.16	1.81	1.59	1.00	1.30	2.26	3.68	33.59
1 – 5	3.21	2.59	1.83	1.38	2.19	4.17	4.76	2.60	2.02	1.44	1.60	1.56	1.26	1.84	2.16	2.27	36.89

5.1.7. Waves

The project site is sheltered from ocean swells and exposed to local wind waves. Preliminary analysis indicates a peak wave height (H_{mo}) of 2.2 Ft and period (T_p) of 2.7 seconds.

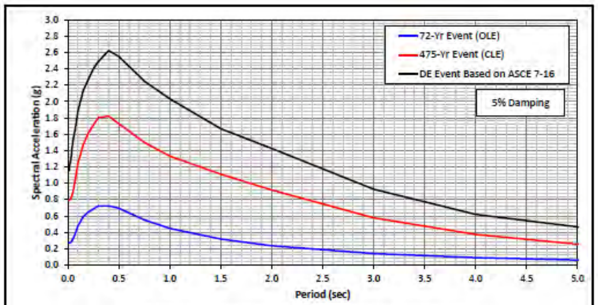
5.2. Earthquake Design

Wharf seismic design shall comply with CBC-ASCE 7-16 for wharf structure accessible by general public which include life safety and no collapse requirements under rare ground motion. For wharves structures not accessible to general public, the wharf seismic design shall comply with ASCE-61. ASCE-61 specifies two levels of ground motions: Operating Level Earthquake (OLE) with 72-year return period and Contingency Level Earthquake with 475 return period. The structure performance criteria under each ground motion level depends on the structure's classification.

Structure classifications and acceptable performance criteria under each level of ground motion will be confirmed by the District during the next phase of the project.

EMI has developed a preliminary site-specific response spectrum for the specified ground motion levels. Figure shows the preliminary acceleration response spectra (SRA). Detailed seismic hazard analyses will be performed and the findings will be documented in a complete seismic hazard study report during the next phase of the project.

FIGURE 5-7: RECOMMENDED PRELIMINARY ACCELERATION RESPONSE SPECTRA



Period	72-Yr Event (OLE)	475-Yr Event (CLE)	DE Event Based on ASCE 7-16
(sec)	SA (g)	SA (g)	SA (g)
0.010	0.271	0.787	1.151
0.020	0.270	0.807	1.233
0.030	0.277	0.813	1.296
0.050	0.314	0.889	1.517
0.075	0.395	1.066	1.686
0.100	0.478	1.246	1.888
0.150	0.590	1.471	2.133
0.200	0.647	1.611	2.267
0.250	0.685	1.713	2.400
0.300	0.724	1.803	2.491
0.400	0.722	1.822	2.624
0.500	0.694	1.729	2.550
0.750	0.551	1.500	2.250
1.000	0.448	1.332	2.033
1.500	0.316	1.112	1.668
2.000	0.235	0.917	1.425
3.000	0.139	0.577	0.927
4.000	0.089	0.373	0.619
5.000	0.060	0.255	0.466
7.500	0.029	0.122	0.312
10.000	0.016	0.071	0.186

Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	Recommended Preliminary Acceleration Response Spectra
Humboldt Redwood Multipurpose Terminal Redevelopment	
EMI Project No: 22-120 Date: September 2022	Figure 1

6. Geotechnical and Survey Criteria

6.1. Geotechnical

The initial information used to establish existing subsurface conditions and soil properties for design was obtained from SHN's preliminary subsurface investigations draft report, issued on 23 August 2022. The investigation was completed to inform conceptual planning for the proposed terminal and is intended as the first of multiple phases of geotechnical investigation. Additional geotechnical investigation will follow conceptual planning and preliminary design and will become increasingly focused as specific design elements become more refined.

The preliminary geotechnical investigation was focused along the Humboldt Bay shoreline, where little existing geotechnical data is available. Previous geotechnical investigations for neighboring sites provide useful data relative to upland portions of the site, but data along the waterfront has not been developed to date.

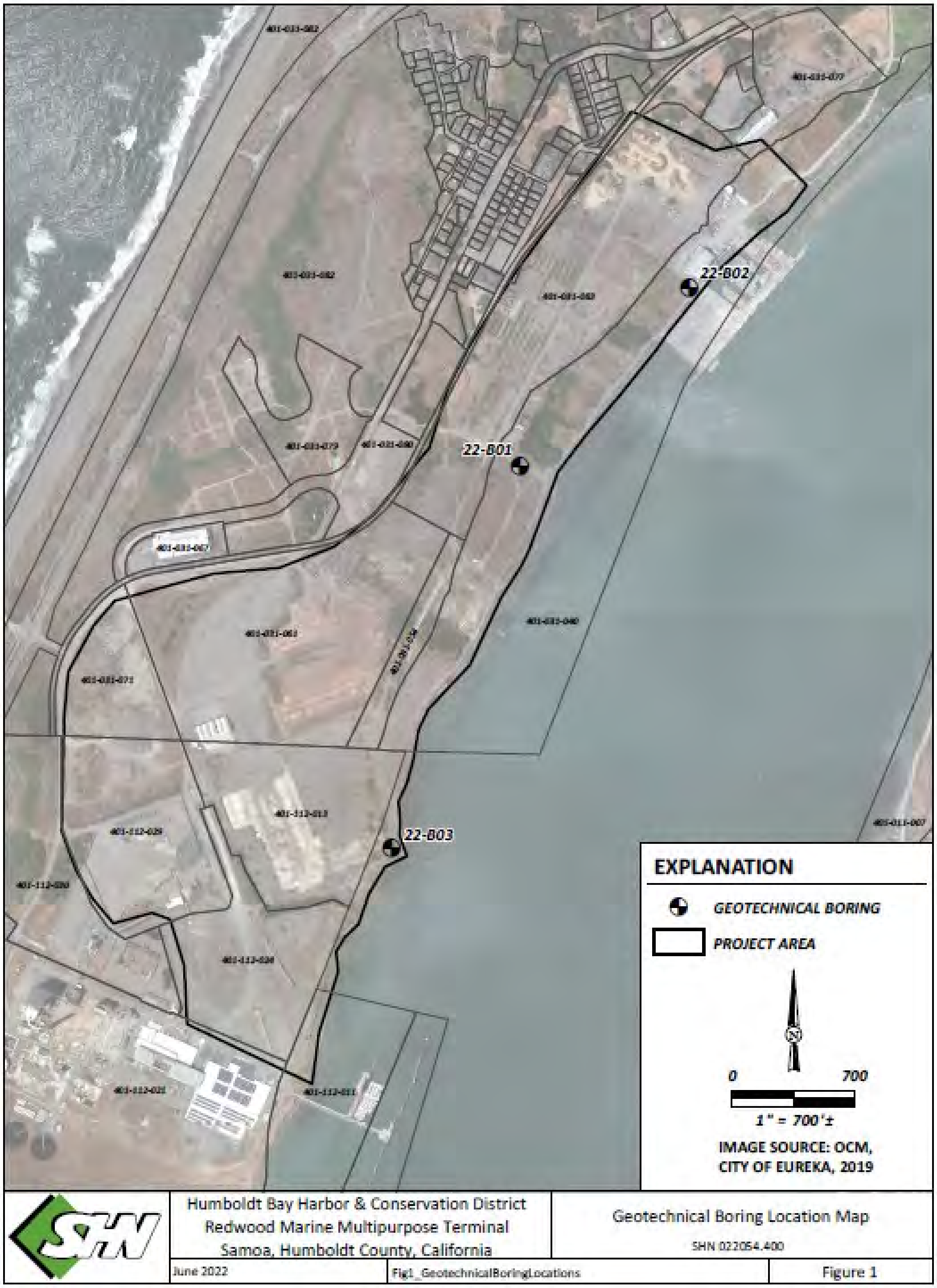
6.1.1. Subsurface Investigations

The preliminary geotechnical field investigation consisted of 10 cone penetration tests (CPTs) and three machine borings. CPT and drilled boring locations are shown on Figure 1-1. The geotechnical boring locations are also shown on Figure 6-2 to show their location relative to the historic shoreline (note that all but CPT 22-C10 occurred within filled areas bay-ward of the historic shoreline). The CPTs were completed first, between April 19 and 22, 2022, followed by the machine borings, which occurred between May 31 and June 3, 2022. Based on conceptual development plans, the preliminary geotechnical field exploration was focused in the central and northern parts of the site; a single exploration site occurs at the southern end of the site.

Exploration locations were developed collaboratively with the RMT geotechnical team and staffed in the field by SHN geologists.

FIGURE 6-1: CPT AND DRILLED BORING LOCATIONS

FIGURE 6-2: GEOTECHNICAL BORING LOCATION



6.1.2. Geologic Setting

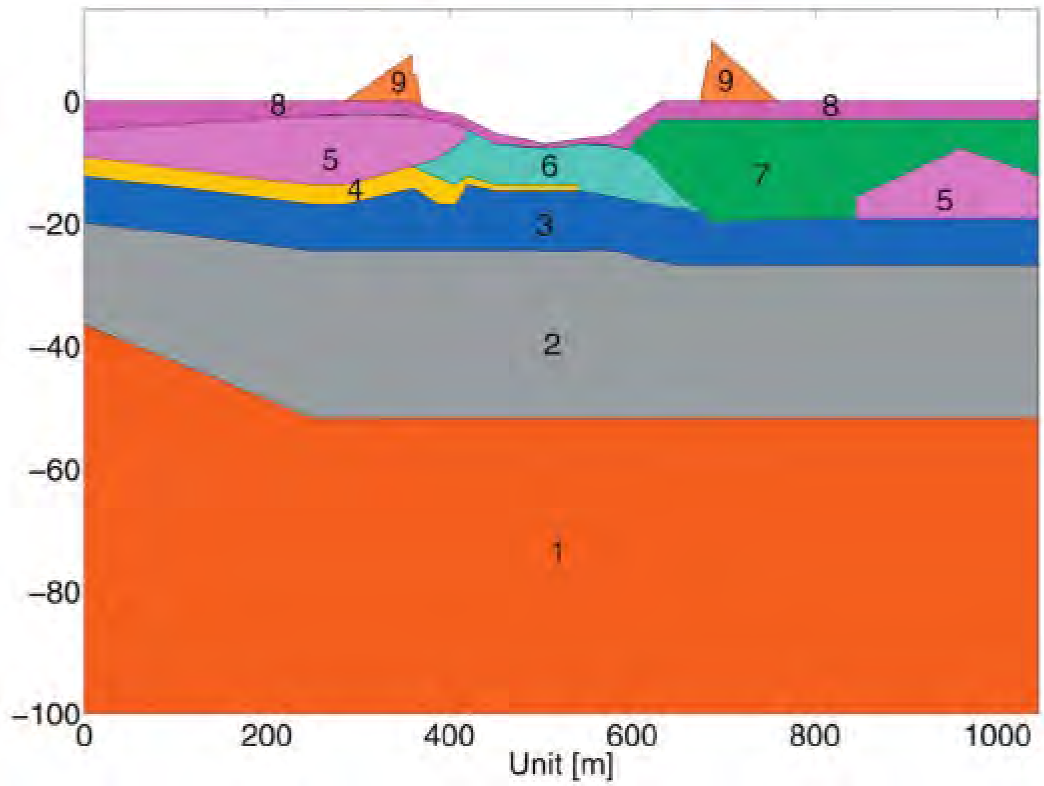
This summary of site geologic conditions is based on review of the recent CPT investigations in the context of other previous geotechnical investigations in the area. The 1994 Geomatrix report for the Samoa bridges is particularly useful, as it compiles all the Caltrans drill data across the bay into a series of profiles. For reference, see below a colorful soil profile across the “middle” channel of the three bay channels crossed by the Samoa bridges (note the metric scale).

A fundamentally important horizon within the bay is the contact between Pleistocene and Holocene sediments, which is typical in a coastal setting such as this. During the late Pleistocene, during the most recent glaciation, sea level was much lower and the shoreline was far to the west. Not much would have been happening in the area during this interval (geologically speaking!), with the exception of the drainage of the paleo-Mad River, which likely flowed through the Samoa channel (the westernmost of the three bay channels; closest to the site). The Pleistocene/Holocene boundary occurs on Figure 6-3 between Units 2 and 3; it occurs around the bay at an elevation of about -60 feet (+-20m, Figure 6-1). Below this horizon, across most of the bay is a stiff silt/clay unit (Unit 2 on Figure 6-1) and the Hookton Fm. (Unit 1), a thick dense sand unit. The Pleistocene clay unit (Unit 2) appears to have been present in the recent CPT’s as the “lower” clay unit, below about 65 feet Below Ground Surface (BGS). The Hookton Fm. occurs below about 80 feet BGS; it is several hundred feet thick and all the recent CPT’s bottomed out in this material. We can expect a continuation of the dense sandy conditions to the intended boring depth (150 feet).

During the latest Pleistocene and early Holocene marine transgression, the bay filled in with a variety of sediments, illustrated on the figure by Unit 3 and the laterally discontinuous lenses of sediment above (Units 4 through 8). At the RMT site, the CPT’s identified sandy intervals consistent with other areas of the bay, but also indicated a relatively thick clay deposit that appears localized to the subject site and the adjacent Town of Samoa. This “upper” clay unit is very soft, organic-rich, and occurs between about 22 feet BGS and 50 to 60 feet BGS; it is 20 to 42 feet thick across the site, except at CPT-08, where it thins extensively. The “upper” clay unit was thickest in CPT-04 and -05.

The entire Samoa Peninsula is covered with a veneer of windblown dune sand, much of which has been reworked during previous industrial developments. See the historic photo below to see what the RMT and Samoa Peninsula looked like in the 1930s.

FIGURE 6-3: TWO-DIMENSIONAL SOIL PROFILE OF HBMC BRIDGE SITE



Two-dimensional soil profile of HBMC Bridge site (layer 1: Tertiary and Quaternary Alluvial deposits; layer 2: medium dense organic silt, sandy silt and stiff silty clay; layer 3: dense sand; layer 4: silt; layer 5: medium dense to dense silty sand and sand with some organic matter; layer 6: dense silty sand and sand; layer 7: soft or loose sandy silt or silty sand with organic matter; layer 8: soft to very soft organic silt with clay; and layer 9: abutment fill. Layers 5 and 7 are susceptible to soil liquefaction (Geomatrix, 1994).

SHN note: the Pleistocene/Holocene unconformity occurs between Units 2 and 3.

6.1.3. Subsurface Conditions

A subsurface investigation program to support the conceptual design effort was performed. Figure 6-1 shows the locations of CPT and drilled borings. Figure 6-4 and Figure 6-5 show a preliminary soil profile at RMT1, as projected form the shoreline geotechnical data.

FIGURE 6-4: PRELIMINARY SOIL PROFILE AT NORTH WHARF SITE

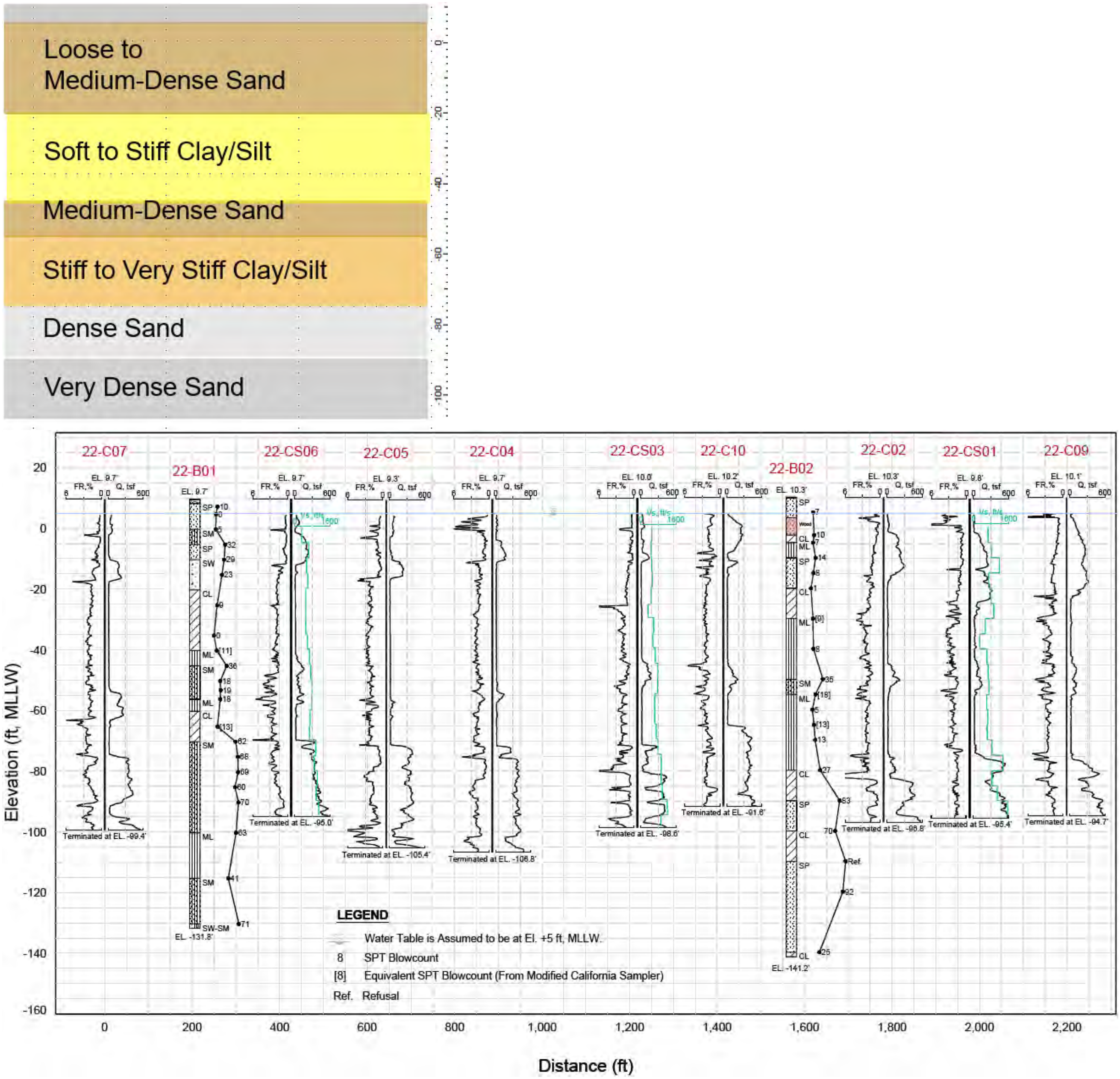
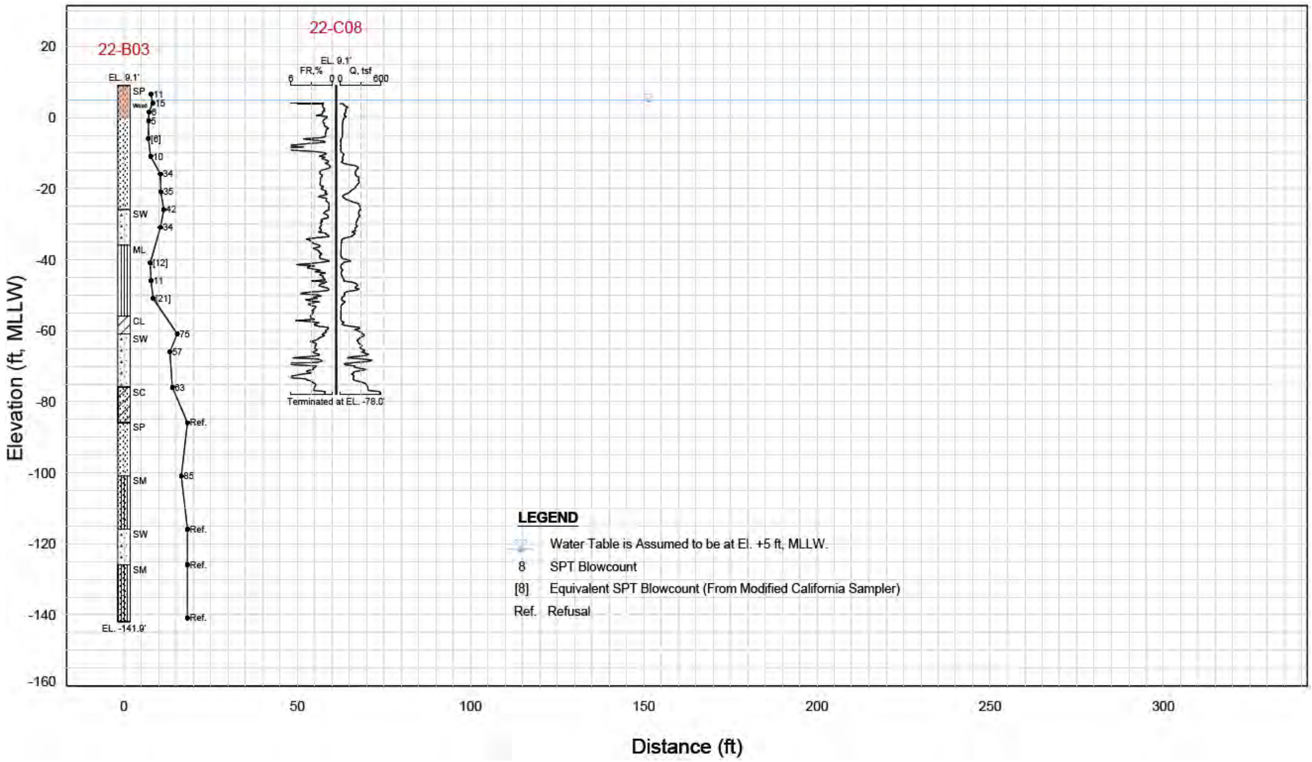


FIGURE 6-5: PRELIMINARY SOIL PROFILE AT SOUTH WHARF SITE



6.1.4. Geotechnical Design Considerations

6.1.4.1. Dredging

The material within the proposed dredge prism is expected to be soft silts and loose to medium dense sands/silty sands. Dredge materials characteristics and viable dredging method will be included in new versions of this document based on the future marine geotechnical investigation program.

6.1.4.2. Yard Area

The calculated maximum uniform pressure imposed by a 60-t SPMT axle is 3,000 psf. The settlement criteria will be evaluated in the subsequent phases of the project. The short term and long term settlement criteria will be discussed with OEMs to define the maximum applied bearing pressure, storage method, heavy components storage durations and acceptable settlement/differential settlement.

6.1.4.3. Site Stabilization (Ground Improvement)

Given the applied high live loads on the upland area, site stabilization will be required. Preloading is the preferred option to reduce the long term settlement for most of the upland area. The use of wick drains will be examined after discussing its impact on the construction schedule and the rate of settlement at the early stages of port operation. Ground improvement for the area directly behind the wharf structure and along the shoreline will be assessed in future phases of this project.

6.2. Hydrographic Surveys

Hydrographic survey was performed by eTrac. The bathymetric data will be included in the next revision of this document.

6.3. Topographic and Boundary Surveys

Topographic survey based on Lidar was performed by SHN, Sea Attachment 1.

6.4. Humboldt Bay Navigation Channel

Humboldt Bay navigation channel provides marine access up to the vicinity of the project site with the following minimum dimensions:

- Width = 400 feet (Samoa Channel)
  = 400 to 600 feet (North Bay Channel)
- Depth = -38 feet MLLW (Samoa Channel) or -48 feet MLLW (Outer/Entrance Channel)

The channel is currently maintained by USACE.

7. Navigation, Dredging, Mooring and Berthing Criteria

7.1. Design Vessels

The vessels expected to call on the proposed port facility will consist of delivery vessels and semi-submersible barges. Delivery vessels will consist of bulk carriers and/or barges bringing both the foundation raw materials and WTG components to the site. The semi-submersible barges are assumed to be purpose built smart ballasting barges.

7.1.1. Delivery Vessel

The design delivery vessel is the S2L-type heavy cargo vessel with the characteristics shown in Table 7-1.

TABLE 7-1: DELIVERY BERTH DESIGN VESSEL

Vessel Characteristic	S2L-TYPE
Length Overall	608.3 ft
Summer Draft	34.8 ft
Beam	83.0 ft

7.1.2. RORO Vessels

The design RORO vessel is the ST-Class RORO vessel and the design delivery barge is the 455 Series Barge with the characteristics shown in Table 7-2.

TABLE 7-2: RORO DESIGN VESSELS AT DELIVERY BERTH

Vessel Characteristic	ST-CLASS RO-RO	455 SERIES BARGE
Length Overall	496.9 ft	400.0 ft
Summer Draft	18.6 ft	19.0 ft
Beam	83.3 ft	105.0 ft

7.1.3. Semi-Submersible Barge

The semi-submersible barge will be a purpose-built semi-submersible barge with the characteristics shown in Table 7-3.

TABLE 7-3: PURPOSE-BUILT SEMI-SUB VESSEL

Name	Purpose Built Semi-Sub
Length Overall	350.0 ft
Summer Draft	19.1 ft
Beam	350.0 ft

7.1.4. Wind Turbine Device – Base Only

The wind turbine device base is expected to be a semi-submersible, floating steel structure. Delivery of wind turbine base could be relative to the following scenarios:

- Fully Assembled on a semi-submersible vessel. A fully assembled device base manufactured outside of and transported to Humboldt Harbor. This scenario requires either an in-harbor sinking basin or out of harbor (in-ocean) sinking and dead ship tow to the marine terminal or wet storage location. A sinking basin will be provided at the RMT 1 location for in-harbor use. If size is not sufficient for ocean transport vessels, alternative sinking basin locations will need to be proposed by the terminal operator or will require use of sinking out of harbor in the ocean.

- Partially Assembled on RORO Vessel. Subcomponents are manufactured at locations outside of Humboldt Harbor and delivered to the marine terminal for transfer to the marine terminal yard. Subcomponents are assembled into an entire device base that is transferred across the wharf using SPMTs to a semi-submersible barge (Figure 4-1) that would utilize the in harbor sinking basin located in the berth pocket of marine terminal 1.
- Device Base Fully Manufactured in Humboldt. Steel materials would be delivered by combination of vessel and truck to fully fabricate the device base onsite. Completed base would be transferred to the wharf using SPMTs to a semi-submersible barge (Figure 4-1) that would utilize the in harbor sinking basin located in the berth pocket of marine terminal 1.

Based on discussion with wind industry developers, the following geometric parameters were developed for the design of the new wind terminal facility.

- Near Term Size (Estimated 12 MW Turbine Size)
  - Beam: 325 ft x 325 ft
  - Draft: 19 ft Min, 23 ft Max
- Future Size (Estimated 20 MW Turbine Size)
  - Beam: 400 ft x 400 ft
  - Draft: 20 ft Min, 25 ft Max

7.1.5. Wind Turbine Device – Fully Integrated

Outreach with Wind Industry Developers, the following geometric parameters were developed for the design of the new wind terminal facility for fully integrated devices.

- Near Term Size (Estimated 12 MW Turbine Size)
  - Beam: 325 ft x 325 ft
  - Draft: 32 ft Min, 38 ft Max
- Future Size (Estimated 20 MW Turbine Size)
  - Beam: 400 ft x 400 ft
  - Draft: 32 ft Min, 45 ft Max

It should be noted the draft stated is assumed for safe navigation through the navigation channels to open ocean conditions. The draft required for mooring stability will likely be greater once installed at the wind farm. There could be device base technologies that are stable during transport under lower ballasted condition or that utilize supplemental flotation to navigate through the confined navigation channels to the open ocean and then adjusted in deeper water. The actual navigation channel parameters needed to support a specific technology type is specific to each type of technology and dependent on the results of detailed maneuvering analysis and bridge simulation work for the tow out environmental conditions and operational plan. A navigation risk assessment will be required for each type of technology that will be subject to review and approval by the US Coast Guard. The US Coast Guard may require a moving channel closure when transporting fully integrated wind turbine devices.

7.2. Channel and Berth Pocket Requirements

7.2.1. Berth Pocket & Sinking Basin

A berth pocket and sinking basin are required at the RMT1 location with the following criteria.

- Moored Device Location Relative to Navigation Channel: 50 ft offset for maximum turbine dimension.
- Mooring & Maneuvering Area Depth. El -40 ft MLLW with 2 ft over dredge allowance to account for extreme low tides.
- Sinking Basin Area Depth is 450 ft by 450 ft, dredged to elevation El -60 ft MLLW.
- Side Slopes: Estimated to be 2H:1V with rock armoring and 2.5H:1V without armoring. To be verified after completion of marine geotechnical investigation.

7.3. Navigation and Dredging

Navigation. Vessel maneuvering and simulations for fully integrated devices will be needed to better refine the navigation procedures, tug assist, ballasting plans and other elements for a deployment of the device to the wind farm. Additional information on the characteristics of the fully integrated device will be needed to conduct a first step desktop analysis to evaluate the navigation and maneuvering to determine the need for any localized out of USACE navigation channel dredging needs.

Dredging. Dredging will be required for the berth and approach areas for the proposed RMT1 and RMT2 wharf structures. Dredging may be needed for the wet storage areas depending on location and device technology type and whether it is a fully integrated or a device foundation base. A dredged material management plan will need to be developed based on the results of sediment characterization, types and location of material by volume and relative to a range of disposal and beneficial reuse options (offshore at HOODS, onsite for fill to raise grades to mitigate SLR, and other disposal and reuse options).

7.4. Device Wet Storage

The following criteria were developed to assist in planning for the harbor-wide improvements that are needed to meet the needs of offshore wind developers and to meet the long terms needs for California to implement the goals for offshore wind power (2-5 GW by 2030 and 25 GW by 2045). The following criteria were developed based on outreach with a range of offshore wind developers, terminal operators, and device technology developers.

- Wet Storage.
  - Industry Needs Assumptions. The number of units required in wet storage is dependent on the developer, their supply chain strategy, size of the offshore wind project (GW and # of units), and required timeline to install the units offshore. However, for the purpose of developing a basis for size and quantity of wet storage required in Humboldt for the RMT project, the following assumptions were made to identify a conservative wet storage case.
    - Assumptions: Each unit is 15 MW, project size is 1.3 GW
      - Number of units = 1300 MW / 15 MW = ~90 units
    - Construction Time Period: Wind farm must be constructed in 1 year
    - Production Rate: Developer needs to deliver approximately 2 units / week to deliver 1.3 GW in 1 year

- Number of Devices for Wet Storage. Due to the distance from the port, transit times, and weather risk, developers will need more units in wet storage to serve the Morro Bay call area. Based on the assumptions above, the following quantity of units is conceivable:
  - Humboldt Call Area only (1.3 GW project, 90 units, 1 year installation window)
    - 4 floating foundations in wet storage (waiting for integration)
    - Minimum of 4 additional floating foundations in dry storage (e.g., on uplands) or in wet storage (waiting for integration)
    - Up to 8 fully integrated (waiting for good weather window to tow)
  - Morro Bay Call Area (1.3 GW project, 90 units, 1 year installation window)
    - 8 floating foundations in wet storage (waiting for integration)
    - Minimum of 7 additional floating foundations in dry storage (e.g., on uplands) or in wet storage (waiting for integration).
    - Up to 15 fully integrated (waiting for good weather window to tow)
  - Marine Vessel Operations. For these scenarios, the following tug fleet is envisioned:
    - Port tugs = 5 total
      - 2 tugs for semi-sub moves
      - 3 tugs for foundation moves and delivery vessel moves
    - Transit tugs
      - Humboldt Call Area = 3 tugs (2 for the move and 1 on stand-by at the call area)
      - Morro Bay Call Area = 7 or 9 tugs (need 2 + 2 for moves and 1 on stand-by at the call area, but will likely need an additional set of tugs to hit weather windows)
  - Device Water Depth Requirements (for wet storage).
    - Device Foundation for Wet Storage. Draft requirements.
    - El -28 ft MLLW with additional 2-ft over dredge allowance.
    - Device Fully Integrated for Wet Storage. Deeper draft requirements than the device foundation by itself.
    - El -38 ft MLLW with additional 2 ft over dredge allowance.

8. Marine Structures Design Criteria

8.1. Risk Category

The marine facilities shall be designed to Risk Category II per ASCE 7-10 Table 1.5-1.

8.2. Design Life

The design life of the marine facilities shall be 50 years. Consumable components such as fenders and cathodic protection anodes shall be replaced per the manufacturer's recommendations. Design life represents the physical condition of the marine facility and its ability to perform its function as originally designed assuming regular inspection and maintenance activities are carried out.

8.3. Deck Elevation

Top deck elevation for the marine structures is assumed to be +17.1 ft NAVD88. The deck top elevation will be refined in the next design phases based on further refinement of SLR prediction and sea wave analyses.

8.4. Design Loads

Dead Load (D)

Dead load shall include the self-weight of the structure including any permanent attachments.

- Steel: 490 pcf
- Concrete: 150 pcf
- Dense Graded Aggregate: 145 pcf

Buoyancy Load (B)

Buoyancy load shall be considered using a seawater unit weight of 64.1 pcf. All new structures shall be designed to be submerged in an extreme event.

Live Load (L)

The following live loads shall be considered:

- Uplands Storage and Staging Area: 3,000 psf
- Marine Structure (Heavy Lift Wharf): 6,000 psf
- Dolphins and Walkways: 100 psf

Vehicular loads include an AASHTO HS-20 truck with a 15% impact factor applied to design and a lateral load equal to 10% of the vertical load.

Wind Load (W)

Wind loads, on structural components when berth is vacant, shall comply with ASCE 7-16 requirements. Design wind speed shall be 92 mph (3 second gust at 33 feet above ground).

Current Load (C)

Current forces on structural pipe members shall be determined in accordance with API RP 2A. Lift, drag and mass coefficients shall be determined for each member taking into account its cross-section and inclination as well as marine growth. Current forces on vessels shall be determined in accordance with the OCIMF Mooring Equipment Guidelines (MEG4) for static mooring analyses. Design current speed and direction to be confirmed.

Berthing Load (Be)

PIANC Guidelines for the Design of Fenders Systems (2002) shall be used to determine the required berthing energy for the design vessels, size of the fender system, and the berthing load. The structure shall be designed for the maximum fender load, including a +/- 10% tolerance in fender performance. The fender panel shall include ultra-high molecular weight (UHMW) facing to provide a maximum coefficient of friction of 0.2. Horizontal and vertical forces on fender system shall be considered based on friction between the vessel and fender panel.

Mooring Load (M)

The vessel with the strongest mooring line minimum breaking load (MBL) should be used to determine the bollard capacity safe working load (SWL). The mooring load shall be applied 180 degrees horizontally and at an angle of +25, 0, and -25 degrees to the horizontal plane. The bollards shall be designed for one mooring line per bollard. Structures shall be designed to accommodate 100% SWL on a single bollard and 60% SWL on an adjacent bollard(s), simultaneously. Application of the 60% SWL on adjacent bollards shall be based on designer judgement with consideration of mooring line arrangements. In addition, actual mooring forces from the mooring analysis shall be checked.

Earthquake Load (E)

Earthquake loads will be determined per CBC 2019 based on the site classification. The seismic performance criteria for the project, under Level 2 ground motion, is collapse prevention. Under Level 1 ground motion, post-event inspection and repair may be required (to be confirmed in future phases).

Load Combinations

All structures shall be designed using load combinations per UFC 4-152-01. Wind and current loads shall be operating loads when combined with operating loads (live, mooring and/or berthing). Wind and current loads shall be extreme loads during vacant / non-operating conditions (no mooring and/or berthing). Seismic loads shall coincide only with operating environmental conditions.

TABLE 8-1: LOAD COMBINATIONS – LOAD AND RESISTANCE FACTOR DESIGN (LRFD)

Load Case	U0	U1	U2	U3	U4	U5	U6	U7	U8	U9
D[a]	1.4	1.2	1.2	1.2	1.2	1.2	1.0+k	1.0-k	1.2	1.2
L	-	1.6[b]	-	1.6[b]	-	1.6[b]	0.1	-	1.6[b]	1.0
B	1.4	1.2	1.2	1.2	1.2	1.2	1.2	0.9	1.2	1.2
Be	-	-	1.6[c]	-	-	-	-	-	-	-
C	-	-	1.2	1.2	1.2	1.2	-	-	-	1.2
H[d]	-	1.6	1.6	1.6	1.6	1.6	1.0	1.0	1.6	1.6
Eq	-	-	-	-	-	-	1.0	1.0	-	-
W	-	-	-	-	1.0	-	-	-	-	1.0
M	-	-	-	-	-	1.6[e]	-	-	-	-
R+S+T	-	-	-	1.2	-	-	-	-	-	-
Ice	-	-	-	0.5	-	-	-	-	1.0	1.0

TABLE 8-2: LOAD COMBINATIONS – ALLOWABLE STRESS DESIGN (ASD)

Load Case	S0	S1	S2	S3	S4	S5	S6	S7	S8	S9
D[a]	1.0	1.0	1.0	1.0	1.0	1.0	1.0+k	1.0-k	1.0	1.0
L	-	1.0	-	1.0	-	1.0	0.1	-	1.0	0.75
B	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.6	1.0	1.0
Be	-	-	1.0	-	-	-	-	-	-	-
C	-	-	1.0	1.0	1.0	1.0	-	-	1.0	1.0
H[d]	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Eq	-	-	-	-	-	-	0.7	0.7	-	-
W	-	-	-	-	0.6	-	-	-	-	0.6
M	-	-	-	-	-	1.0	-	-	-	-
R+S+T	-	-	-	1.0	-	-	-	-	-	-
Ice	-	-	-	0.2	-	-	-	-	0.7	0.7

Notes:

a. *0.9 (0.6 ASD) for checking members for minimum axial load and maximum moment.*
b. *1.3 for the maximum outrigger float load from a truck crane.*
c. *Accidental Berthing: 1.2 support structure, 1.0 fender system components.*
d. *Where the effect of H resists the primary variable effect, a load factor of 0.9 (0.6 ASD) shall be included with H where H is permanent and H shall be set to zero for all other conditions.*
e. *1.6 for the mooring loads from the mooring analysis and 1.0 for the SWL of bollards.*
f. *k = 0.5 (PGA)*

8.4.1. Durability

Calculation of concrete crack width shall comply with ACI 224R. Maximum design crack width under service loads shall comply with the following:

- Concrete exposed to seawater or seawater spray = 0.01 inch
- Buried structures = 0.012 inch

8.4.2. Corrosion

Steel piles exposed to salt water shall be protected using a minimum of two of the following strategies. Regardless of approach selected, steel piles shall be regularly inspected, maintained, and repaired as required to prevent section loss.

- Marine grade coating applied with strict conformance to specifications including inspection and repair of all coating defects and damages
- Cathodic protection anodes
- Pile wrap or jacket
- Additional “sacrificial” wall thickness

Corrosion rates for steel elements were obtained from the Waterfront Facilities Inspection and Assessment, ASCE Manuals and Reports on Engineering Practice No. 130, 2015; Section 4.6.2:

- Soil embedded zone (mudline down): 0.001 in./year;
- Immersed zone (between LAT and mudline): 0.004 in./year; and
- Splash and tidal zone (LAT up): 0.005 in./year.
- Steel elements located away from the water shall be designed for an atmospheric zone rate of 0.0004 in./year.

8.4.3. Serviceability

High Mast Light Pole: Maximum lateral deflection of foundation during service loading is 1/2 inch.

8.4.4. Material Properties

All materials shall comply with latest applicable ASTM specifications.

Concrete shall be normal-weight concrete with a minimum 28-day compressive strength of 5,000 psi, maximum water-to-cementitious ratio of 0.4 and a minimum clear cover to the reinforcing steel of 3-inches.

9. Civil Design Criteria

9.1. Heavy Lift Area and Uplands

9.1.1. Site Preparation

Demolition of existing at grade and below grade concrete structures, cultural protection considerations (minimize cut in areas of original upland areas) and consideration of other site preparation requirements will need to be considered in the site grading design and prior to conducting any grading work.

9.1.2. Stormwater Design

Stormwater systems will be designed to:

- Use the Rational Method for calculating runoff (Q)
- Convey the 10-yr, 24-hr storm event (Q10)
- Use NOAA14 or other local source of rain data
- A 10-minute time of concentration (Tc) minimum
- Provide 1 ft of freeboard to building pads for the (Q100)

9.1.2.1. Stormwater Compliance

The project site lies within the County of Humboldt's jurisdiction, but it is outside the regulated Municipal Separate Storm Sewer System (MS4) permit boundaries. Therefore, MS4 stormwater mitigation requirements do not apply to this project. However, this project will disturb over an acre of ground and will be required to meet the post-construction stormwater requirements for the State Water Resources Control Board's (SWRCB) Construction General Permit (CGP). The CGP specifies post-construction runoff reduction requirements for all sites not covered by a Phase I or Phase II MS4 NPDES permit. The CGP post-construction standards require that the project replicate the pre-project water balance (runoff) for the smallest storms up to the 85th percentile storm event.

Those activities that are considered industrial and have a Standard industrial Classification (SIC) code will be required to obtain coverage under the Statewide General Permit for Stormwater Discharges Associated with Industrial Activities, Order 2014-0057-DWQ (Industrial General Permit) implements the federally required stormwater regulations in California for stormwater associated with industrial activities discharging to waters of the US.

9.1.3. Parking

Project will provide on-site parking for all employees, contractors, visitors, etc. No off-site parking will be allowed.

9.1.4. Access Roads

Access roads include both access points to the site from the county New Navy Base Road and Cookhouse Road. The railroad right of way (ROW) will need to be retained and the west access road will be located adjacent to and not within the rail ROW corridor. Additional right of way or easements may be needed within the west access road corridor to provide access and utilities through the Phase 3 area and into the Phase 2 area.

Access roads connecting to the site will have a minimum surface elevation of 16.00 ft. The maximum longitudinal slope of the access roads will be 5%. Access roads will have 12-ft paved lanes, 8-ft paved shoulders, 2-ft gravel shoulders, and 4:1 max side slopes for fill prisms.

Roadway access to the project site outside of Harbor District property shall meet AASHTO and Humboldt County Public Works standards.

North Site Access - The north access road will need to be routed within the available property parcel boundaries and easements, raised to mitigate flooding from SLR, and an alignment that considers wetland impacts and stormwater management. Peak stormwater flood routing will need to consider utilizing the existing low level outlet culvert, tide gate and discharge to the bay.

Intersection Site Access - Based on preliminary transportation analysis, signaling of intersections for the connection to Navy Base Road (both north and west access road) and to Vance Avenue will not be needed. A 3- or 4-way stop at the north road intersection with Vance Avenue will be the needed improvement.

Access roads within the site will follow the criteria in Site Grading Design.

9.1.5. Site Grading Design

Redevelopment of the site will require consideration for future SLR and flood protection. SLR criteria is outlined in Section 5.1.3. Site Conditions that will be the basis for minimum finished elevations on the marine terminal site are:

- The minimum elevation within the yard will be 17.00 ft, and the minimum finish floor elevations (FFE) for the buildings will be 18.00 ft. The minimum elevations for storm drain inverts and the bottom of bioretention basins (bottom of gravel layer) will be 13.00 ft.
- The minimum slope for the finish grade surface will be between 0.5% - 1%. Due to the large scale of the site, a flatter grade will help to minimize the amount of fill needed to construct the site, but drainage of the site needs to be considered.
- All paved driving surfaces shall have a 0.5% minimum cross slope.

9.1.6. Design of Erosion, Sedimentation, and Pollution Control

The project shall develop a Stormwater Pollution Prevention Plan (SWPPP) to satisfy the CGP.

The project shall develop a post-construction stormwater plan to satisfy the local Low Impact Development (LID) standards and/or Industrial General Permit (IGP).

Also see Stormwater Design.

9.1.7. Fire Protection Water

Fire water will be needed to provide fire suppression for the various buildings to be constructed on the site. Fire water will also need to serve all fire hydrants throughout the site. The northern end of the site (early phase construction) will likely receive fire water from the Town of Samoa's water main. The southern end of the site (late phase construction) will receive fire water from Humboldt Bay Municipal Water District's industrial water main. A new fire water storage tank will be needed on site to replace the existing red tank.

9.1.8. Potable Water

Potable water will be needed for the various buildings to be constructed on the site. Potable water will be needed for general office use (restrooms, kitchens, etc.). Depending on the activities within each building, there may be additional potable water demands. The northern end of the site (early phase construction) will likely receive potable water from the Town of Samoa's water main. The southern end of the site (late phase construction) will receive potable water from Humboldt Bay Municipal Water District's potable water main.

9.1.9. Seawater Withdrawals

Seawater withdrawals for the offshore wind port are not needed for the intended operations. Other future terminal uses (aquaculture) for the site may require a salt water withdrawal. Additionally, the proposed Nordic Aquafarm development (immediately south of the project site) has a sea water withdrawal at red tank dock and a supply line running through the nearshore marine terminal shoreline. The Nordic seawater supply line will need to be re-routed into a utility corridor as part of the marine terminal redevelopment project. Consideration for sizing the pipeline and points of connection for potential future Phase 4 area aquaculture operations should be considered in the design of the new seawater withdrawal and pipeline. Red tank dock may be replaced as part of the marine terminal redevelopment. If a new pier or dock is proposed, the seawater withdrawal will need to be accommodated on that new pier.

9.1.10. Sanitary Sewer

Sanitary sewer service will be needed for the various buildings to be constructed on the site. Sanitary sewer service will be limited to demands from general office use (restrooms, kitchens, etc.). If there are industrial processes on the site that generate wastewater, they will need to be evaluated individually to determine if the wastewater generated by these processes can be sent directly to the sanitary sewer system, or if on-site pre-treatment is needed. On-site treatment and disposal of domestic wastewater is not expected for this site. It is expected that wastewater will be treated at the Samoa Wastewater Treatment Plant (WWTP), which discharges treated wastewater to the existing ocean outfall pipe. Wastewater from the site will need to be pumped to tie-in to the Town of Samoa's sewer main or directly to the Samoa WWTP.

9.1.11. Finished Surface Materials

The site surfacing material will be crushed aggregate with a total thickness of approximately 3 ft. Due to concerns with the potential for mobilizing fines in stormwater runoff, a two layer, 3-ft finished surface will likely be required. The upper finished surface should be a cleaner crushed aggregate product that has been screened to minimize the amount of fines. Pavements are not planned nor desired for the finished surface of the site. The heavy loads anticipated on the site make paving the entire site impracticable. Additionally, the crushed aggregate surface allows ease of maintenance for re-grading the finished surface when settlement from the heavy loads occurs. If localized areas of pavement are needed to meet industrial area runoff collection and treatment, that area should be minimized, and additional subsurface soil improvements will likely be needed in order to provide adequate support for pavements

9.1.12. Signage

The project shall be designed to meet the Federal Highway Administration Manual on Uniform Transportation Control Device standards.

10. Electrical Design Criteria

10.1. Port Operations Electrical Demands

Operations at the RMT port facility will be continuous and varied for all phases of the build-out, and will require significant power. Conceptualized as an all-electric facility (without diesel/gas engine driven equipment), reliable power will be essential to the success of the terminal. The expected operations and equipment requiring power include manufacturing buildings, warehouse buildings, assembly buildings, office space, on-site material heavy transport, on-site light material transport, manufacturing/construction equipment and tools, cranes, site lighting, vessel shore power and battery charging, along with a number of miscellaneous electrical loads.

Power will be distributed to the site at medium voltage (12,000 volts) and transformed down to utilization voltages of 480V, 208V and 120V, all at 60 Hz.

10.2. Estimated Electrical Loads

The terminal build-out will be completed in phases, with four phases currently being considered. The estimated loads are detailed in the Electrical Load Estimate, which indicates a total power requirement of 9.7 MVA at full build-out. The estimate relies on information that may change, including, for example, the size and number of buildings, the number of cranes, the number of battery chargers, etc. Because of this uncertainty, a conservative contingency of 50% has been included in the Electrical Load Estimate for power supply planning purposes.

10.3. Power Supply Sources and Distribution

The Samoa peninsula is currently fed by two PG&E 60kV circuits, the Humboldt #1 circuit and the Essex Junction-Fairhaven circuit, both of which terminate 1/2-mile south of the site at PG&E's Fairhaven Substation.

The proposed supply to the facility will be from two sources, the Harbor District's substation and directly from the Fairhaven substation. The Harbor District substation will supply Phases 1 and 2 of the project, and the Fairhaven substation will supply power for Phases 3 and 4. Further details on these two supply sources are located in the *Electrical Infrastructure and Green Port Conceptual Engineering Assessment Memorandum.*

Power will be distributed to the site at 12KV, on overhead lines, with some locations brought below grade in ductbanks. The lines would be routed along the western side of the facility within an established utility corridor. Further details of the incoming distribution lines are in the *Electrical Infrastructure and Green Port Conceptual Engineering Assessment Memorandum.*

10.4. Green Port Development

The goal for the terminal redevelopment is to provide a focus on electrification and zero-emissions equipment through the use of renewable energy supplies. The intent is for the facility to operate with reduced net carbon emissions for ongoing normal terminal operations.

A potential strategy for providing power from renewable sources is the development of a photo-voltaic (PV) system to generate and store power, to be used by the facility. This solar panel concept and options of a PV system are discussed in depth in the *Electrical Infrastructure and Green Port Conceptual Engineering Assessment Memorandum.*

10.5. Backup Power

The RMT facility will require some level of backup emergency power, which will likely include the installation of at least one standby generator. Although diesel generation is an option, natural gas fired backup generator(s) are preferred and will provide backup power for critical systems. At a minimum, the backup generator system will provide power to life safety systems, emergency lighting, and other equipment and systems considered critical. The extent of equipment, lightings, systems, and building components that would be included as critical will be determined once details of the facility installation are finalized.

Backup generators, or other emergency power supply systems such as battery storage may also be required for continuity of operations during a loss of utility power. This might include orderly shutdown of systems, or perhaps some level of ongoing production or other operations during loss of power. The extent of backup power for operational continuity will be determined once details of facility equipment is finalized.

11. Security

11.1. Background

The RMT facility will require certain security measures in order to comply with federal law. The following table illustrates the applicable federal codes to be used for terminal security for US ports.

TABLE 11-1: RELATIVE SECURITY CODES

Codes and Standards	Description/Use
33 CFR 101	Maritime Security - General
33 CFR 105	Maritime Security - Facilities
33 CFR 101.514 33 CFR 105.255	TWIC Requirements

12. Aids to Navigation & Lighting

12.1. Background

Aids to navigation and lighting requirements will apply to aspects of the project as follows in accordance with requirements outlined by the US Coast Guard and Federal Aviation Administration (FAA).

- Lighting. Navigation lighting for cranes and fully integrated wind turbine devices will be required. Lighting requirements will be outlined in consultation with the appropriate federal and state agencies.
- Aids to Navigation. Federal navigation aid structures and buoys may require relocation in localized areas such as the proposed marine terminal berth and wet storage locations. Relocation of aids to navigation will require coordination with the US Coast Guard. Additional private aids to navigation may be needed to mark wind turbine device wet storage area. The need for and type, size of private aids to navigation will be determined in coordination with the US Coast Guard.

13. Green Port Development

13.1. Background

The redevelopment of the RMT presents an opportunity to develop the new facility and operation following a goal to create a Green Port Development. The focus of the Green Port Development emphasizes minimizing impacts on the environment as part of the construction and long-term operations of the facility. The Green Port Development has goals and criteria relative to resource consumption and environmental quality as outlined in the subsequent sections.

13.2. Resource Consumption

- Construction Materials Selection – Building type, use of beneficially reused materials (dredged material), durable construction materials for longevity, and reduced GHG reduction measures as part of the materials sourcing and construction.
- Waste Management – Onsite recycling of materials for re-use on project site (such as concrete foundations crushed for fill needs), WWT treatment utilizing existing waste treatment systems and minimizing load demands, and minimizing waste generated as part of the development and site operations.
- Energy Use, Efficiency, Resiliency – Consider and develop the use of alternative fuels, renewable power, on-site solar, on-site microgrid, and backup power systems to reduce carbon footprint and improve resiliency of the facility operations.
- Transportation – Consider a range of modes of transportation for workers (walk, bus access, electric car, worker parking), and marine transportation alternative fuels or electrification, and shore power for vessels.

13.3. Environmental Quality

- SLR/Climate Change – Accommodate future water levels in accordance with California State Lands Commission guidance and to plan and build a facility that is resilient and adaptable to a changing environment.
- Air Quality – Site operation emissions reductions, near zero carbon goals, shore power for vessels, electrification or alternative fuel equipment operations will be pursed.
- Water Quality – Stormwater management for compliance with water quality discharge for the range and type of proposed uses.
- Ecosystem Restoration & Mitigation – Minimize impacts (to wetlands, eelgrass, habitat, and species of concern) through strategic, informed planning and design of the proposed improvements.
- Light & Noise – Development of site layouts and operations will be considerate of outdoor light and need for noise abatement needs for the project area.

Attachment 1 -Topographic and Boundary Surveys

EXPLANATION

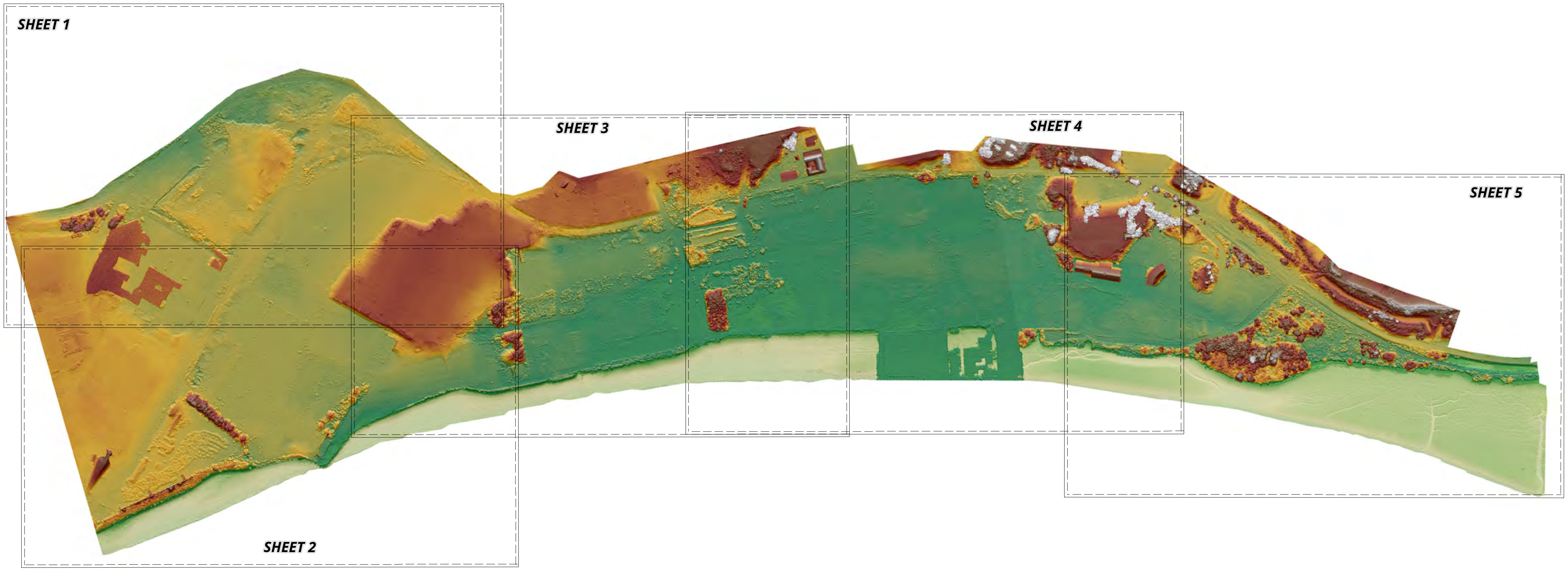
SHEET INDEX

DIGITAL ELEVATION MODEL

ELEVATION (FEET, NAVD88)

60'

-10'



0 600

1" = 600'±

Humboldt Bay Harbor, Res. & Cons. District
Redwood Marine Multipurpose Terminal
Samoa, California

Preliminary Digital Elevation Model
Key Sheet Index
May 2022 - 022054.400

Figure 1

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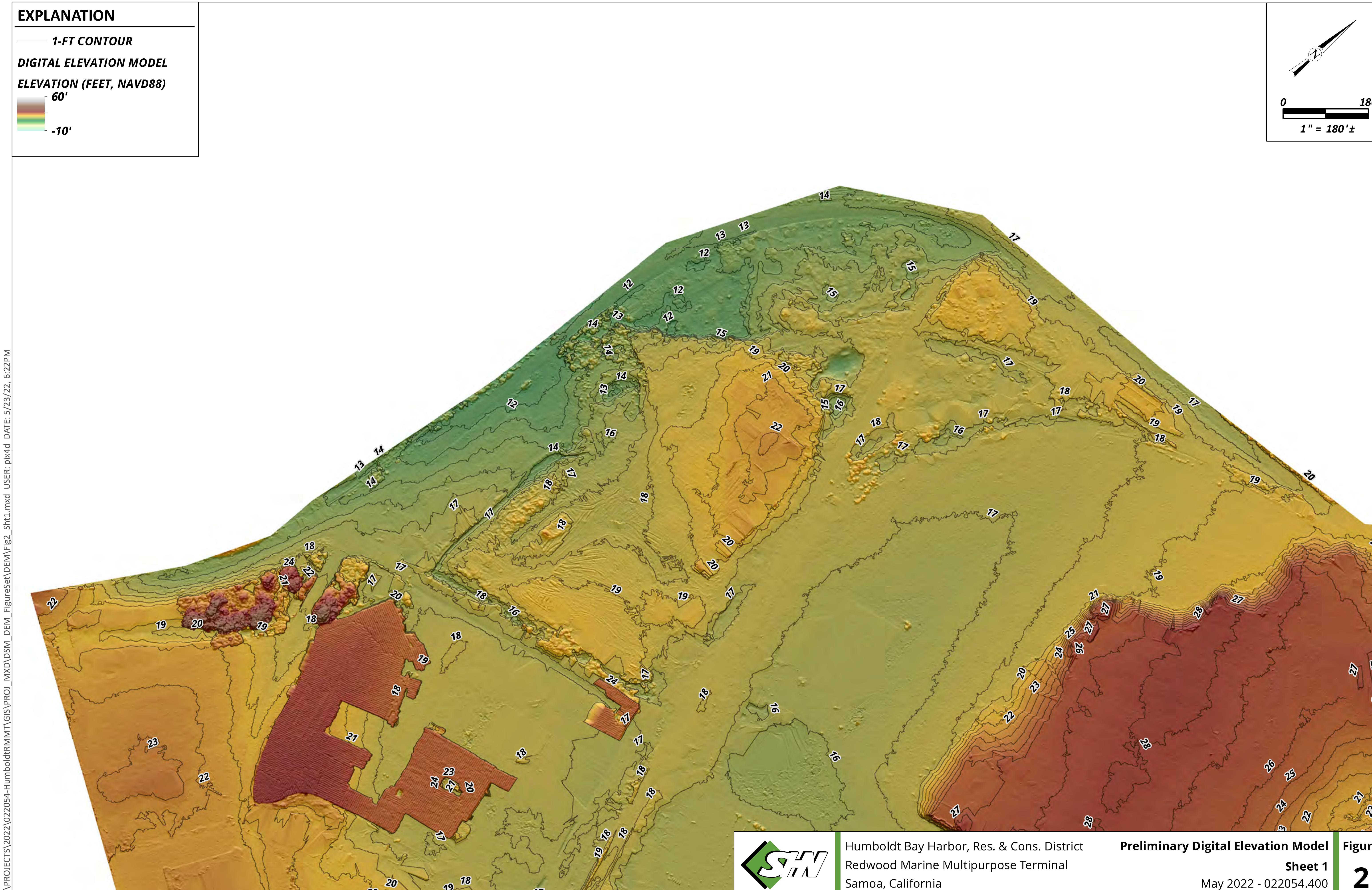

SHN

Humboldt Bay Harbor, Res. & Cons. District
Redwood Marine Multipurpose Terminal
Samoa, California

Preliminary Digital Elevation Model

Sheet 1

May 2022 - 022054.400

Figure

2

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1" = 180'±

EXPLANATION

1-FT CONTOUR

DIGITAL ELEVATION MODEL

ELEVATION (FEET, NAVD88)

60'

-10'

SHN

Humboldt Bay Harbor, Res. & Cons. District
Redwood Marine Multipurpose Terminal
Samoa, California

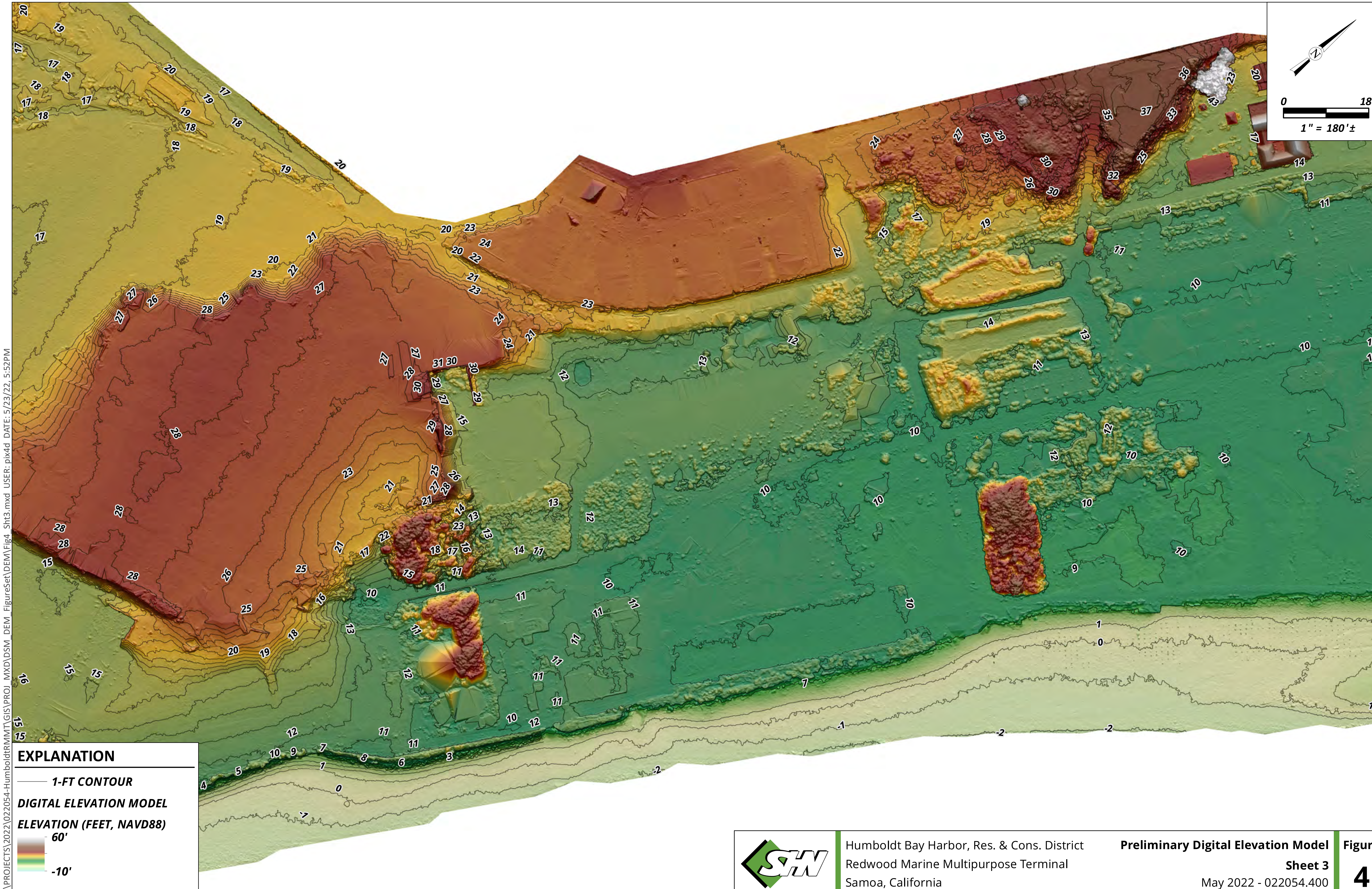
Preliminary Digital Elevation Model

Sheet 2

May 2022 - 022054.400

Figure

3



Humboldt Bay Harbor, Res. & Cons. District
Redwood Marine Multipurpose Terminal
Samoa, California

Preliminary Digital Elevation Model

Sheet 3

May 2022 - 022054.400

Figure 4

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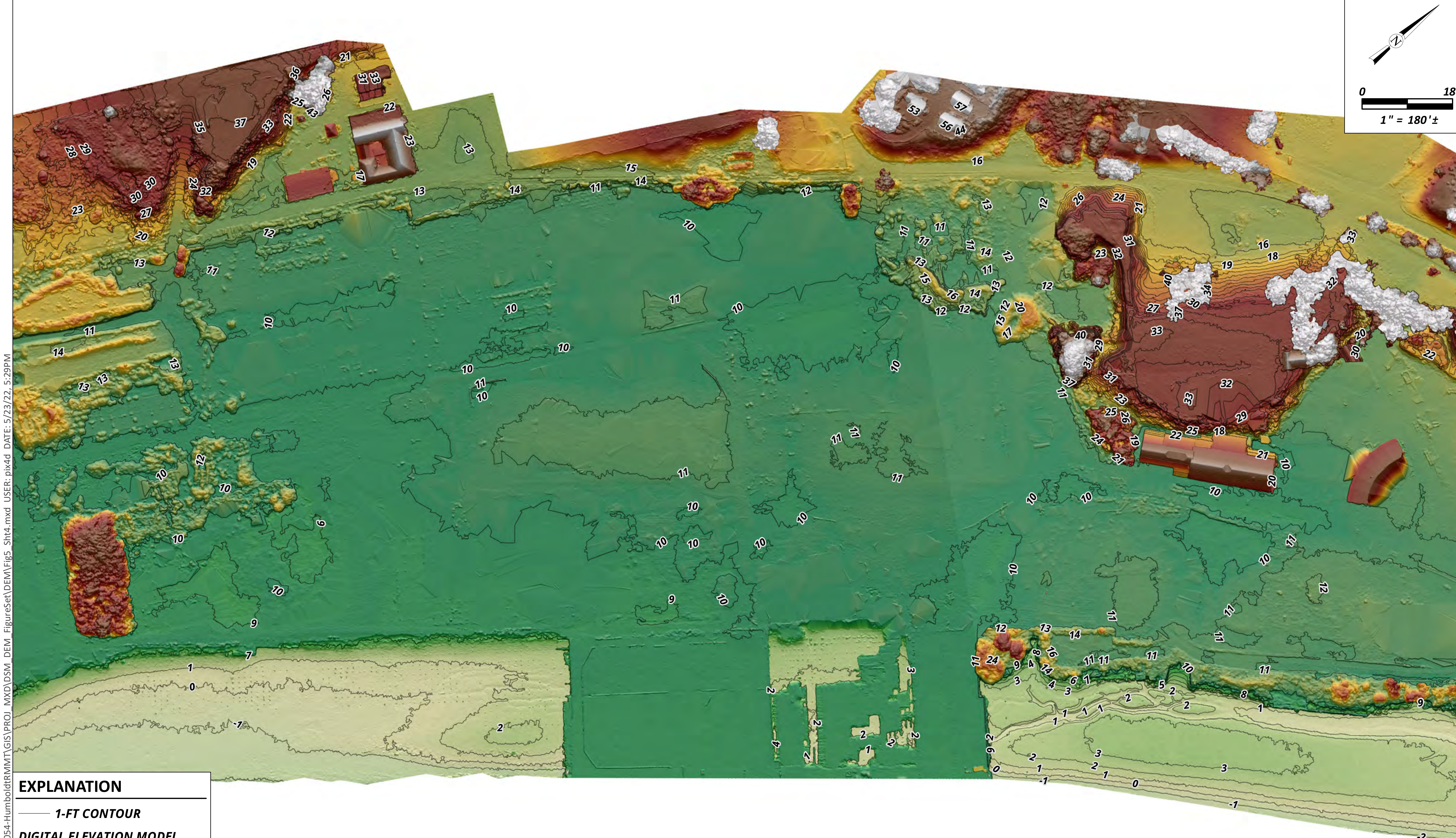

EXPLANATION

1-FT CONTOUR

DIGITAL ELEVATION MODEL ELEVATION (FEET, NAVD88)

60'

-10'

SHN

Humboldt Bay Harbor, Res. & Cons. District
Redwood Marine Multipurpose Terminal
Samoa, California

Preliminary Digital Elevation Model
Sheet 4
May 2022 - 022054.400

Figure
5

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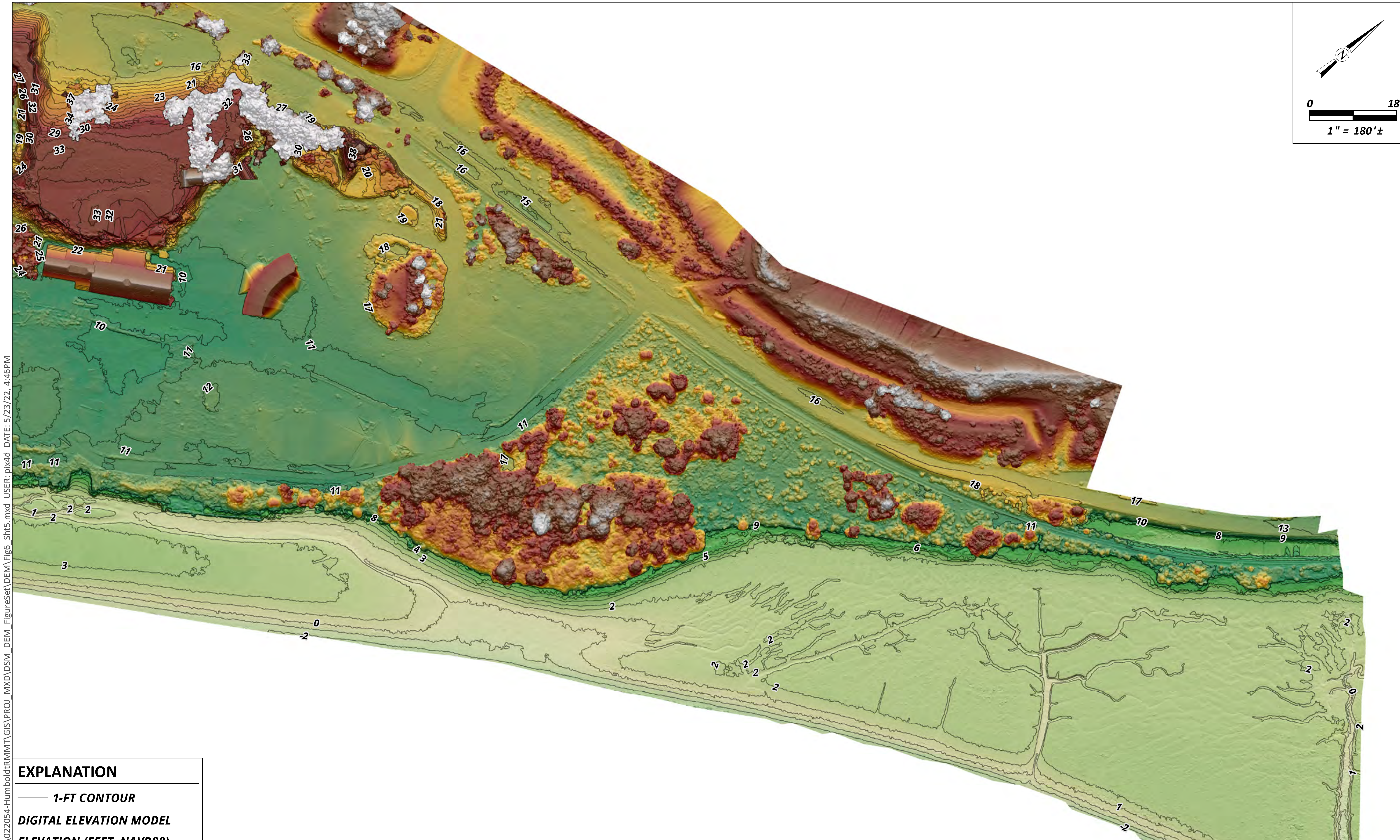

EXPLANATION

1-FT CONTOUR

DIGITAL ELEVATION MODEL

ELEVATION (FEET, NAVD88)

60'

-10'

Humboldt Bay Harbor, Res. & Cons. District
Redwood Marine Multipurpose Terminal
Samoa, California

Preliminary Digital Elevation Model
Sheet 5
May 2022 - 022054.400

Figure
6

Electrical Infrastructure and Green Port Conceptual Engineering Assessment Memorandum

Project:	Redwood Marine Multipurpose Terminal Replacement Project
Date of Report:	August 13, 2022
Recipient Organization:	Moffatt & Nichol
Technical Contact:	Shane Phillips, Moffatt & Nichol
Submitted by:	Schatz Energy Research Center

Introduction

This technical memorandum presents the results of the conceptual engineering assessment of the Electrical Infrastructure and Green Port Options for the Redwood Marine Multipurpose Terminal Replacement Project. The topic areas addressed in the assessment include a:

- description of the existing utility infrastructure,
- summary of the estimated energy use for all project phases,
- proposed electrical infrastructure for Phase 1 and 2,
- proposed electrical infrastructure for Phase 3 and 4,
- procurement and generation renewable energy options,
- backup power and grid reliability,
- proposed conceptual microgrid designs, and a
- summary of the proposed design concepts, key findings, and next steps.

For supporting documentation and detailed information refer to the following appendices:

A. *Integrated Capacity Analysis*
B. *RMT -Electrical Load Estimates*
C. *Conceptual Phasing Plan*
D. *Conceptual Master Plan*
E. *Overhead Line and Utility Re-routing Specifications*
F. *HelioScope Rooftop Annual Production Report*
G. *HelioScope Landfill Annual Production Report*

The Schatz Energy Research Center at Humboldt State University
1 Harpst Street, Arcata, CA 95521 707-826-4345 | info@schatzcenter.org
schatzcenter.org

Electrical Infrastructure

A concept has been developed for the required infrastructure to serve the electrical loads for the various facilities presented in the May 7, 2022 Conceptual Master Plan. Site development will be conducted in phases. This approach was adhered to in developing the electrical infrastructure concepts.

Existing Utility Infrastructure on Samoa Peninsula

The Samoa peninsula is currently fed by two PG&E 60kV circuits, the Humboldt #1 and Essex Junction-Fairhaven circuits, both of which terminate in PG&E's Fairhaven Substation located approximately 1/2 mile south of the project site. As of the end of 2021, the 60kV Humboldt #1 and Essex Junction- Arcata- Fairhaven circuits feeding the Fairhaven substation had a capacity of 38MVA with a pre-project loading of < 90%[1].

An assessment of PG&E's Integrated Capacity Analysis (ICA) maps was conducted to evaluate the available capacity on the local utility distribution system to accept additional photovoltaic generation.[2] The total load hosting capacity on 12kV lines leaving the Fairhaven substation is 13.39 MW, 7.59 MW to the south and 5.80 MW to the north[3]. The property located directly south of the project site, the former Samoa pulp mill site, also owned by the Humboldt Harbor District, has a currently unused 20MW, 60kV substation located in the north-west corner of that site, which initially supplied power for pulp mill operations. This substation has a dedicated 12 kV feeder from the Fairhaven substation to the town of Samoa which is proposed for development for this project.

The project site is currently fed from PG&E 1103 circuit, a 12kV distribution line on wood poles, which currently transverses the project site from the Fairhaven substation 12kV switchyard in-route to feeding the town of Samoa. At this time, the load hosting capacity of the Fairhaven 1103 circuit is 5.8MW, which can reasonably be assumed to be available in part for Wind Port use; however, with the planned buildout of the Town of Samoa, a Large Load Application will be necessary to confirm that assumption and secure capacity. See the *Integrated Capacity Analysis* (Appendix A) for detailed information regarding existing electrical infrastructure.

Electrical Load Estimate

Estimates of the electrical loads for the onsite assembly and manufacturing facilities and operation of the major electrical equipment throughout the laydown areas and wharfs are presented in Table 1. Given that the project is in the early stages and the future facilities and their associated electrical loads are not known, a 50% contingency has been factored into the estimates. The combined Phase 1 and 2 estimate of 4 MW and 10.5 MW for Phase 3 and 4 will

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[1] CA North Coast OSW Study: Transmission Analysis, Quanta Technology, December 9, 2021

[2] Customers are encouraged to use the Pre-Application process to get a general engineering review of a specific site without committing to a project application or queue. The ICA maps are designed to help contractors and developers find information on potential project sites for distributed energy resources. The maps show hosting capacity, grid needs, and other information about PG&E's electric distribution grid. The information on these maps is illustrative and is may not be representative of the current grid conditions.

[3] Integrated Capacity Analysis Map, PG&E, https://www.pge.com/en_US/for-our-business-partners/distribution-resource-planning/distribution-resource-planning-data-portal.page?ctx=large-business?ctx=business

be used for planning and preliminary design phase of the project. A breakdown of the equipment and facilities in operation for each phase and their estimated loads can be found in Appendix B.

Table 1: Electrical Load Estimates by Project Development Phases. Source: Moffatt & Nichol.

Phase	*Description*	*Estimated Load (MW)*	*Planning Load (MW) 50% Contingency*
1	Entry and Fabrication/Assembly Building	0.9	1.3
2	Wind Turbine Laydown Area and Wharf	1.8	2.7
3	Blade Manufacturing and Blade Laydown Area, Wharf	4.3	6.4
4	Tower Manufacturing and Tower Laydown Area	2.7	4.1

Proposed Electrical Infrastructure

The electrical infrastructure required to serve the future project loads is based on the project buildout as shown in the *Conceptual Phasing Plan* (Appendix C). The approach taken was to develop a conceptual design for the electrical infrastructure necessary to meet the combined electrical demand for the Phases 1 and 2 loads and a separate electrical infrastructure design to serve the future loads at the Phases 3 and 4 facilities. The location and routing of the proposed designs are shown in the *Conceptual Master Plan* (Appendix D). For line specification details, refer to the *Overhead Line and Utility Re-routing Specifications*[4][5][6] in Appendix E.

Proposed Electrical Infrastructure - Phase 1 and 2

The combined electrical load for Phase 1 and 2 of the project development is estimated to be between 2.7 and 4 MW. As part of the Nordic Aquafarms Samoa Peninsula Land-based Aquaculture Project, the Harbor District's 20 MW electric substation (here-in referred to as the District Substation) shall be increased by at least 5 megawatts to a total of 25 MW. The additional 5 MW of capacity is proposed to serve the combined estimated Phase 1 and Phase 2 electric loads via a new line from the upgraded switchyard to a new proposed 75' x 50', 12 kV switchyard to be located adjacent to the new Fabrication and Assembly building at the north end of the project site. Any remaining capacity of this line after the Phase 1 and 2 buildout is in operation may also be used for a portion of the Phase 3 and 4 electric loads. Revenue metering of this line will need to be installed during the upgrade of the existing pump mill switchyard.

This new line is proposed to be a new single circuit overhead 12kV distribution line routed on wood poles along the west-northwestern boundary of the project site and is to be located within the existing or expanded 50-foot wide Vance Ave. ingress/egress right of way and within the project boundary to the north end of the project site where it will eventually follow the north-boundary of the project to the proposed switchyard at the Fabrication and Assembly building. This new circuit will require approximately 18' of utility right-of-way or 30' of right of way where the relocation of the existing utilities currently traversing the site is likely.[7]

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[4] Specifications and Drawings for 12.47_7.2kV Line Construction, UEP_Bulletin_1728F-804, US Department of Agriculture Rural Utilities Service, 2018

[5] Overhead Electric Line Construction, GO-95, California Public Utilities Commission, 2015

[6] 2022-2023 Greenbook Manual, PG&E, https://www.pge.com/en_US/large-business/services/building-and-renovation/greenbook-manual-online/greenbook-manual-online.page

[7] Appendix E: Overhead Line and Utility Re-routing Specifications

Proposed Electrical Infrastructure - Phase 3 and 4

The combined electrical load for Phase 3 and 4 of the project development is estimated to be between 7 and 10.5 MW. The loads at the blade, tower, and wharf facilities are proposed to be fed from a new 75' x 50', 12 kV switchyard located at the south end of the project site. This switchyard is proposed to be fed via a new overhead line tap of the existing PG&E Fairhaven 1103 circuit at the southeast boundary of the project site and/or from a new overhead line from the existing District Substation. As of today, there is approximately 5.8MW of capacity on circuit 1103. With the remaining approximately 1-2.3 MW of capacity on the new circuit feeding Phases 1 and Phase 2, there would be 6.8-8.1 MW of capacity on the existing infrastructure at the time of construction of Phase 3 and Phase 4. Therefore, system upgrades will be required to feed the full Phase 3 and Phase 4 load. The customer is advised to apply for Large Load Service as early as possible. A large Load Service Application is anticipated to cost $30k and require a 90 days turnaround time.

New single-circuit overhead line(s) would be constructed from the tap(s) to the new switchyard along the improved southern site access roadway just south of the project site. This circuit(s) will require approximately 18' of utility right-of-way. PG&E circuit 1103, which currently traverses the Phase 3 and Phase 4 project site, is proposed to be rerouted around or underground as part of Phase 3 and 4 of the project.

Green Port - Renewable Energy

An important aspect for operating as a green port is the use of renewable energy to meet the demand of the all-electric terminal. The use of energy from onsite renewable energy generation and/or the procurement of carbon-free energy from electric service providers will eliminate harmful air emissions and greenhouse gases that would be emitted from traditional fossil-fuel electrical generation. This section presents the renewable energy procurement options, types renewable energy systems and their associated benefits, and an overview of backup power and grid reliability.

Renewable Energy Procurement

The electrical load for marine terminal operations is expected to be much greater than the amount of energy that could be generated on site from renewable resources for all phases of the project. In addition, the generation hosting capacity is limited without infrastructure upgrades or microgrids integration. Generation customers must submit an interconnection application to determine requirements and costs based on the project's location, size, and application date compared with other projects in the same area. The customer is advised to use the Pre-Application process to get a general engineering review of [the] site without committing to a project application or queue. Therefore, the majority of the energy may be purchased from either the local utility Pacific Gas & Electric (PG&E), the local Redwood Coast Energy Authority (RCEA) or through a power purchasing agreement with an offshore wind developer.

PG&E has two programs for customers to buy more renewable energy than is provided in their standard power mix, *Solar Choice* and *Regional Renewable Choice*. The *Solar Choice* program allows customers to purchase 50% or 100% of their energy use from solar energy projects. In the *Regional Renewable Choice* program customers can elect to purchase renewable energy from specific projects within PG&E's territory. At the time of this memorandum, both programs are closed to new enrollment.[8]

RCEA is a local joint powers agency that administers Humboldt County's Community Choice Energy program. Through this program, RCEA buys and provides a basic power mix higher in renewables to their customers at a lower cost than Pacific Gas & Electric (PG&E)[9]. Most customers in the region purchase electricity from RCEA, but, PG&E is responsible for delivering the electricity and maintaining the infrastructure. Currently, RCEA offers standard and premium electricity service options. The standard option, *REpower*, is lower in cost and higher in renewables than PG&E while the premium option, *REpower*$^{+}$, is 100% carbon free for $0.01 per kWh more than the standard option. RCEA energy rates replace PG&E rates and they also have a net metering (NEM) schedule for customers who use an eligible renewable electrical generation facility as defined in PG&E's Electrical Schedule NEM[10]. RCEA has procurement goals of 100% carbon-free electricity by 2025, and 100% local carbon-free electricity by 2030. Procurement of 100% carbon-free energy from RCEA for energy demands required beyond what may be produced from onsite renewable energy generators is the proposed approach for this project.

Onsite Renewable Energy Systems

Solar photovoltaic (PV) systems are the main resource for generating on-site renewable energy. Grid-connected, net-metered PV systems provide cost savings by reducing the amount of energy purchased from the utility to meet the site's electrical needs. However, their use may be limited by the generation hosting capacity of the grid in this location. When coupled with battery energy storage, a PV- battery system can provide additional cost savings benefits through time of use savings and demand charge reductions. If the additional benefit of backup power (i.e. green resiliency) is desired, microgrid (MG) electrical switchgear can be installed that will allow for grid-islanding capability of the PV-battery system in the event of a utility grid outage and can also free up generation hosting capacity. For extended outages, a backup generator can be implemented to serve site loads beyond what the PV-battery system can provide. The benefits for each type of system are summarized in Table 2 below.

Table 2: Benefits of Various Types of Renewable Energy Systems

System Types	*Energy Use Savings*	*Time of Use Savings*	*Demand Charge Reduction*	*Short-term Backup Power*	*Extended Backup Power*
PV system	X				
PV-battery system	X	X	X		
PV-battery microgrid	X	X	X	X	
PV-battery-generator MG	X	X	X	X	X

8 https://www.pge.com/en_US/small-medium-business/energy-alternatives/private-solar/solar-choice-rates.page?

9 https://redwoodenergy.org/

10 https://www.cpuc.ca.gov/General.aspx?id=3800

Photovoltaic Systems

The installation of any one of the solar PV energy systems listed above to PG&E's Distribution System must follow Rule 21's net energy metering (NEM) interconnection process. Net energy metering allows customers who generate their own energy ("customer-generators") to serve their energy needs directly onsite and to receive a financial credit on their electric bills for any surplus energy fed back to their utility.[11]" A NEM schedule is applicable to customers who take service on an applicable time of use rate schedule[12]. This tariff describes the requirements for interconnection and metering of generation facilities connected to the distribution grid.

Battery Energy Storage Systems

Battery energy storage systems can provide several value streams to reduce the payback period of the investment. Table 3 lists the services that can be provided by commercial scale systems with the value stream providing an opportunity as an avoided cost (or avoided loss)[13]. The most common value stream for battery storage is lowering the cost of utility purchases by offsetting high demand charges or shifting electricity use from high- to low-cost periods (energy arbitrage).

Table 3: Value Streams for Storage: Opportunities To Avoid Costs and Losses

Service	*Description*
Demand charge reduction	Use stored energy to level load peaks to reduce demand charges
Energy arbitrage	Stores energy when grid prices are low then sells it when grid prices are high
Time-of-use bill reduction	Use storage to shift the time self-generated electricity is used onsite to reduce grid purchases when electricity costs are high

For demand charge reduction, the specified power rating of the battery energy storage system (i.e. battery inverter) must be high enough to address the peak demand at the facility and the energy storage capacity must be optimized to provide sufficient energy storage to be cost effective. Large battery systems can also provide grid services such as demand response, frequency regulation, and reserve markets (Table 4).

Table 4: Value Streams for Storage: Opportunities for Income

Service	*Description*
Demand response	Storage used to support participation in utility programs that pay customers to lower demand during system peaks
Frequency regulation	Stabilizes frequency on moment-to-moment basis
Reserve markets	Supply spinning, non-spinning reserves

11 Source: https://www.cpuc.ca.gov/General.aspx?id=3800

12 PG&E Electric NEM2 Schedule

13 https://www.nrel.gov/state-local-tribal/blog/posts/batteries-101-series-use-cases-and-value-streams-for-energy-storage.html

Microgrids

Microgrids are defined as local grids that can disconnect from the utility grid to operate autonomously. For example, a solar PV- battery microgrid with an optional backup generator, equipped with the appropriate islanding hardware and controls, can provide renewable power to a critical facility in the event of a grid outage and can eliminate constraints on renewable energy interconnection. A simplified single line diagram of a microgrid is shown in Figure 1.

During normal operations when utility grid power is available, both the generation and islanding breakers are closed (as shown in the schematic) and the solar array will generate solar energy to meet the electrical loads, charge the battery and/or export excess power to the grid. The battery system will dispatch energy as programmed to provide utility bill savings (e.g. operate in peak shaving mode to reduce demand charges).

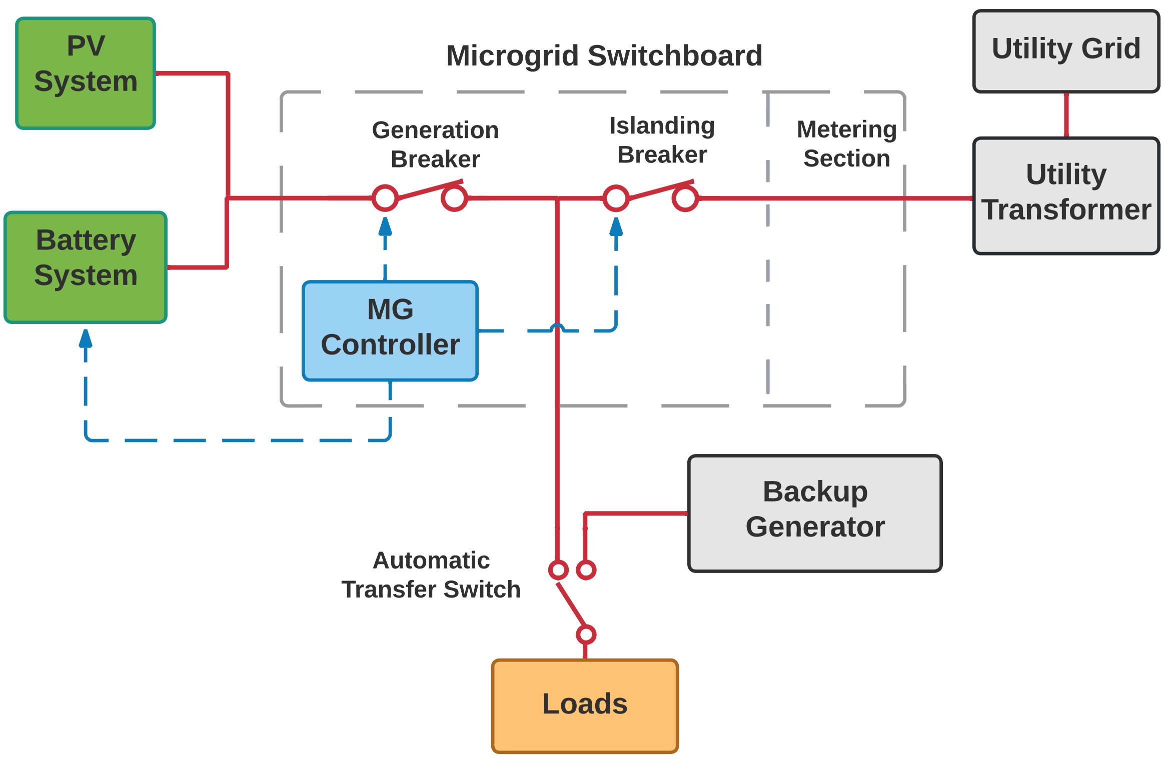

Figure 1: Simplified Single Line Diagram of a Microgrid

During a grid outage, the system enters island mode, and the islanding breaker opens and disconnects the facility from the utility grid. The facilities' loads are powered by energy from the solar array and battery. The microgrid can island and provide power for a period of time depending on the system design. The amount of time the PV-battery system can supply the load depends on the time of day the outage occurs and the state of charge of the battery system when the outage occurs. In the daytime, the PV system can directly supply the load whereas, if the outage occurred at night, the load would be supplied solely by the battery and the higher the state of charge, the longer the load can be met by the battery.

If the battery's state-of-charge drops to a specified low level and if there is either no PV generation or generation cannot keep up with demand, the microgrid controller opens the generation breaker and disconnects the facility from the solar array and battery system. The automatic transfer switch then detects the power outage and connects the facility to the backup generator.

During generator operation when the generation breaker is open, the battery system is allowed to recharge from the solar array until the state-of-charge is sufficient to resume islanding with the battery system and PV. At this point the microgrid controller closes the generation breaker, causing the automatic transfer switch to detect that power has been restored and reconnects the facility to the renewable generation and storage.

Backup Power and Grid Reliability

In the event of a utility grid outage, backup power is needed to serve critical loads. This emergency power must be available to ensure operations at the Fabrication & Assembly facility and that equipment handling activities are carried out in a safe manner wharf side during a power disruption.

PV-battery only microgrids have backup power capability and can serve the critical loads for short term grid outages. The battery system must be sized to meet design criteria to ensure the critical loads with specified energy requirements are met for a specified length of time. Critical loads can be an entire facility or a portion of a building's electrical load that affects the ability of a facility to operate and must continue to be powered during the entire grid outage or only long enough to put the terminal operations in a safe state. Preliminary critical loads include lighting, security, communication, and cranes. Major grid power disruptions such as winter storms or earthquakes that could result in prolonged power outages and would require a natural gas-powered generator to be integrated with a PV-battery microgrid to ensure critical functions are powered during extended grid outages.

In addition to identifying the critical loads, the reliability of the grid should be considered when evaluating backup power options. In October of 2019, there were two PG&E Public Safety Power Shutoff (PSPS) events due to potential fire conditions in other regions of the state that resulted in significant and unnecessary power outages within Humboldt County. In response to these events, engagement from Humboldt County leaders and customers prompted PG&E to reduce the undesirable local impact of PSPS events when severe weather is not forecasted locally.

In June 2020, PG&E announced that the Humboldt Bay Generating Station is capable of serving as a local power source during emergencies by reconfiguring the plant to island from the rest of the California grid. Figure 2 shows a map of the areas where power would be provided by the Humboldt Bay Generation Station during islanding conditions[14]. The Samoa Peninsula is included within the islanding portion of Humboldt County and should no longer experience power outages due to out of area PSPS events.

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[14] https://www.pgecurrents.com/2020/06/12/humboldt-bay-generating-station-ready-to-serve-as-a-direct-local-power-source-during-emergencies-reducing-impact-of-psps-events/

With the ability of the Humboldt Bay Generating Station to island during state-wide Public Safety Power Shutoff (PSPS) events, the number of long-term transmission-level outages due to these out of county safety issues are expected to be infrequent. Also, the likelihood of distribution-level outages is very low due to the limited overall length of the proposed distribution lines (less than 2 miles) and lack of nearby trees that could be a potential cause for local outages during winter storms.

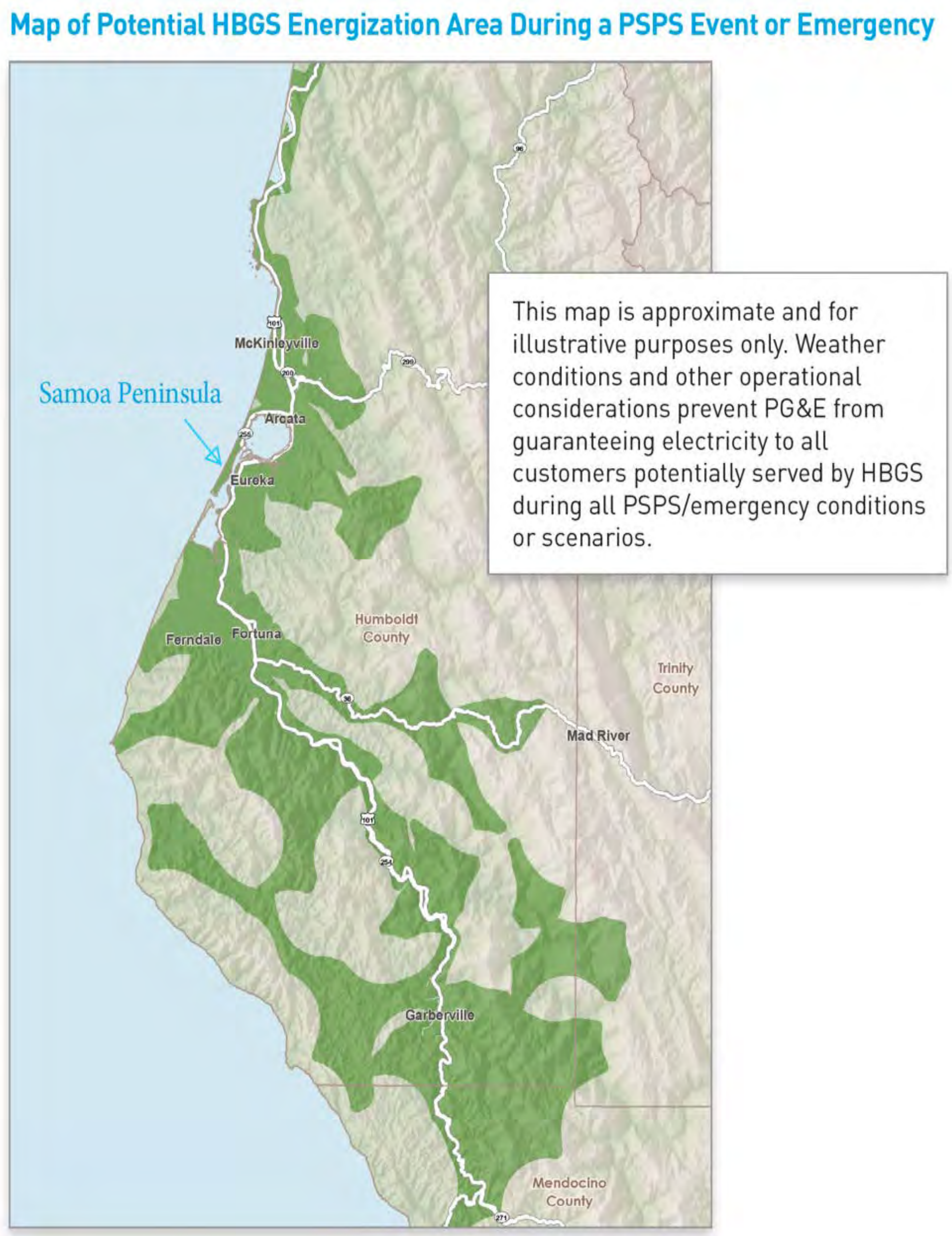


Figure 2 : Map of Areas (in green) served by PG&E during islanding conditions.

Proposed Energy Systems

Grid-connected microgrids are proposed to meet the electrical needs for the various phases of port development. Conceptualized PV-battery-generator microgrids will provide energy cost savings through onsite renewable energy generation from the photovoltaic system, short term backup power capability from the battery energy storage system and emergency power capability from a natural gas generator during extended outages. A Phase 1 and 2 12-kV microgrid electrical switchyard is proposed to be sited adjacent to the Fabrication & Assembly building and serve the facility and wharf operations associated with Phase 1 and 2. A Phase 3 and 4 microgrid switchyard is proposed to be located at the southern end of the property to serve the manufacturing facilities and southern wharf operations associated with Phase 3 and 4.

As shown in the *Integrated Capacity Analysis* map of the existing site electrical circuits (Appendix A), the existing Generation Hosting Capacity and the Generic PV Hosting Capacity of the 12kV infrastructure on the Samoa peninsula are limited. Therefore, microgrids are a way to utilize the solar generating capacity at the project site without additional infrastructure upgrades.

Phase 1 and 2 Switchyard Microgrid Conceptual Design

A 12kV switchyard is proposed for location on the north end of the project site on District-owned property for Phase 1 and 2 load service. The major equipment configuration of a 12kV switchyard microgrid is shown in Figure 3. The general concept of operation is as described in the Onsite Renewable Energy Systems section of this memo.

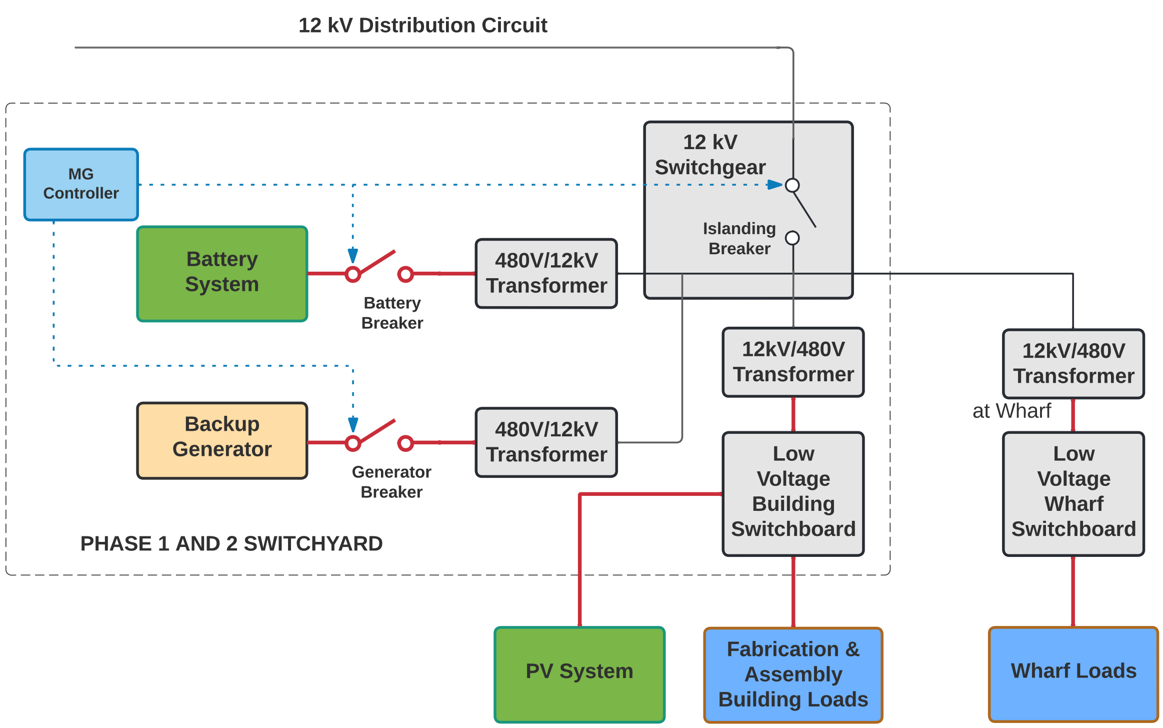


Figure 3 : Simplified Single Line Diagram of a 12kV Switchyard Microgrid

A typical arrangement of the major equipment and the estimated footprint of the substation is shown in Figure 4.

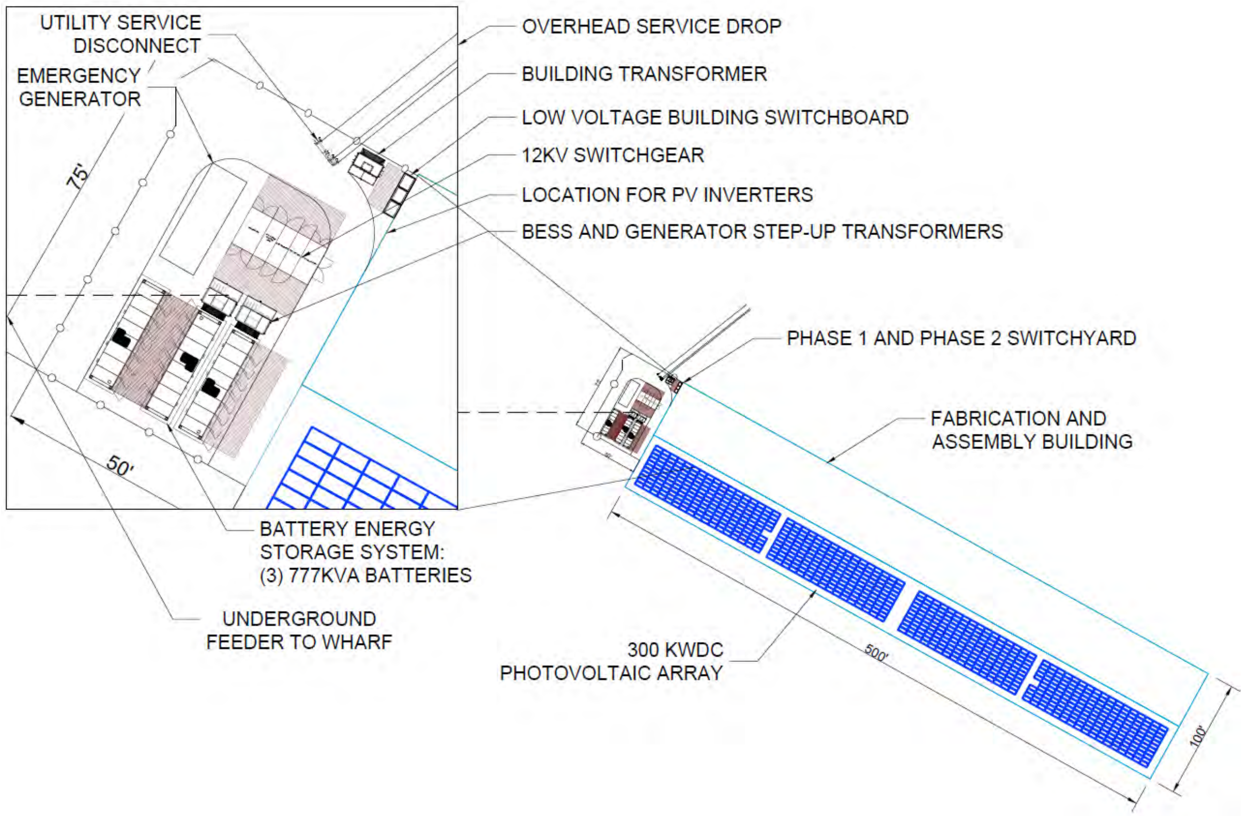


Figure 4 : Typical General Arrangement of the Phase 1 Switchyard Microgrid

<u>Photovoltaic System</u>

The conceptual PV system would be a roof-mounted photovoltaic (PV) array with an approximate system size of 300kWDC. The system was designed to utilize rows of 420W high efficiency, monocrystalline modules flush-mounted in rows in landscape orientation at a tilt of 14 degrees. The modules are designed for flush-mount attachment to a standing seam metal roof. IBC access pathways and smoke ventilation setbacks were included in the design.

Power generated by the arrays was designed for AC conversion through three 100kW, 480V inverters adjacent to the building for 480V three phase interconnection into a building's low voltage switchboard. These inverters are UL 1741-SA listed and can be frequency-controlled by the battery energy storage system to ramp PV output to balance generation with the load. The DC/AC ratio is 1.01 for minimization of equipment variation on the overall site; however, inverter capacity could be downsized to a DC/AC ratio of up to 1.25 with minimal clipping with further inverter optimization. The inverters are connected to a building's low voltage switchboard through a solar subpanel and a visible, lockable disconnect to be located next to the inverters for ease of shutdown in the case of a fire.

Battery Energy Storage System

The conceptual microgrid includes a 2-MW battery energy storage system with a 1-hour duration of energy storage. This duration assumes the load during an outage will be 50% of the peak load (4 MW). Load shedding of non-critical loads during grid outages can be implemented to extend the hours of resiliency. The optimal battery system power rating and energy storage capacity will require further analysis as the electrical load assessment is further refined and critical loads are identified. The BESS output is rated for 480V, three phase interconnection, so a 2500KVA BESS transformer is included for step-up to 12kV for interconnection at the Main Switchgear.

Main Switchgear

The conceptual switchyard includes a new 3ph, 12kV, raintight Main Switchgear lineup containing a controllable main breaker to be supervised by a Schweitzer Engineering Laboratories 700GT+ Intertie and Generation Relay Islanding Controller, which interfaces with the integrated Site Controller to provide seamless transitions to an islanded battery-powered state and retransfers back to the local utility grid. The Main Switchgear contains all the metering, control, and UPS equipment required for interconnection with the utility grid and for PV, BESS, and load control and monitoring to ensure safe stable grid-connected and microgrid operation. The switchgear feeds loop-feed, pad-mount 12kV transformers for BESS and generator step-up and for step-down to feed the building and wharf loads.

Emergency Generator

A 2-MW natural gas generator is included for emergency back-up operations. The power rating assumes that the critical loads (i.e., lighting, security, communication, and cranes) will be a maximum of 50% of the combined 4 MW peak load from the Fabrication & Assembly building and Phase 2 wharf operations. The actual load during emergency operation will be based on the critical loads required during extended outages.

The expected runtime of the emergency generator is based on the reliability of the grid serving the project site. For short term grid outages, the microgrid battery system will provide backup power. With the ability of the Humboldt Bay Generating Station to island during state-wide Public Safety Power Shutoff (PSPS) events, the number of long-term transmission-level outages due to these out of county safety issues are expected to be infrequent. Generator runtime could range from 12 hours to 500 hours per year. Generator operation of 1 hour per month is required for maintenance purposes to ensure proper lubrication of the generator and verify system functionality and load transfer capability. Generator operation may be required during future electrical infrastructure work as the project phases are implemented. These planned utility grid outages could require up to 500 hours of operation during these construction activities.

Phase 3 and 4 Switchyard Microgrid Conceptual Design

A conceptual switchyard is proposed for location on the south end of the project site on District-owned property for Phase 3 and 4 load service. The basic design for the Phase 3 and 4 microgrid would be similar to the Phase 1 and 2 design. The Phase 3 and 4 site loads are estimated to be 10.5 MW and may require a larger battery system size as well as a larger emergency generator depending on critical load identification. Upsizing the equipment would increase the footprint; however, the medium voltage infrastructure has capacity as drawn to handle up to the remaining load hosting capacity of PG&E circuit 1103 (5.8 MW).

Photovoltaic System

For this concept, there are multiple options for installing PV systems, on the rooftops of the Phase 3 and 4 manufacturing buildings and an optional ground-mounted PV system(s) at the Harbor District landfill located on District-owned property across Vance Avenue from the existing former pulp mill site.

The roof-mounted PV designs for all phases were modeled using the same assumptions as in the Phase 1 and 2 microgrid concept. The aggregate nameplate DC capacity of conceptual rooftop PV systems on buildings for all phases is approximately 6.3 MW and has an estimated annual energy production of 7.1 GWh. See the Appendix F: *HelioScope Rooftop Annual Production Report* for additional details.

An optional ballasted PV system was designed for east-west facing landfill planes of the landfill utilizing generic PV modules and string inverters for siting and production estimating purposes. The optional landfill system was modeled for a conservative system size of approximately 2.5 MW and resulted in an annual solar energy production estimate of 2.9 GWh. See the Appendix G: *HelioScope Landfill Annual Production Report* for additional details.

The combined PV power rating from these sites is on the order of 8.8 MW of power with an estimated annual production of 10 GWh of solar energy. See the optional locations for solar included in the revised *Conceptual Master Plan* attachment for more information.

Emergency Generator

A 2-MW natural gas emergency generator is included for emergency back-up operations. The power rating assumes that the critical loads (i.e., lighting, security, communication, and cranes) will be similar to the Phase 1 and 2 emergency loads.

The expected runtime for the two Phase 3 and 4 emergency generators is similar to the Phase 1 and 2 generator and would range between 12 hours to 500 hours per year.

Summary of Proposed Design Concepts and Key Findings

Electrical Infrastructure

- The peak power demand for buildings and site operations is estimated to be:
  - Between 2.7 and 4 MW for Phase 1 and 2 and between 7 and 10.5 MW for Phase 3 and 4 for a total estimated power demand between 9.7 and 14.5 MW
  - 14.5 MW (50% reserve contingency) for all project phases is recommended for planning and preliminary design phase of the project
- 5 MW of capacity is to be built into the upgraded District substation and will be made available for the terminal redevelopment in Phases 1 and 2.
- The proposed Phase 1 and 2 electrical service is a new electrical distribution line from the District switchyard to a new Phase 1 and 2 12 kV switchyard located at the Fabrication and Assembly building
- There is 5.8 MW of load serving capacity remaining on the existing PG&E 1103 circuit at the time of this report
- The proposed Phase 3 and 4 electrical service design is for a tap of the existing PG&E circuit 1103 that will feed a new Phase 3 and 4 12 kV switchyard located at the southern end of the project site and will include optional line taps of the existing rerouted PG&E 1103 circuit for building-level service.
- The total load for all phases of the project is estimated between 9.7 and 14.5 MW while the total available capacity of the existing infrastructure is currently estimated at 10.8MW. The customer is advised to apply for Large Load Service as early as possible in order to plan for infrastructure upgrades. A large Load Service Application is anticipated to cost $30k and require a 90 days turnaround time.
- Approximately 30' of utility right-of-way is recommended for the new circuit feeding Phase 1 and Phase 2 and for relocation of existing utilities currently traversing the Phase 3 and Phase 4 project site contingent upon the results of utility engagement

Green Port

- Onsite renewable energy options include rooftop solar photovoltaic systems on all buildings and an optional ground-mounted PV system at the adjacent District landfill.
- PV Generation Hosting capacity is limited on PG&E circuit 1103 and unknown at the 60kV level. Generation customers must submit an interconnection application to determine requirements and costs based on the project's location, size, and application date compared with other projects in the same area. The customer is encouraged to use the pre-application process to get a general engineering review of [the] site without committing to a project application or queue.
- The aggregate nameplate DC capacity of conceptual rooftop PV systems on buildings for all phases is approximately 6.3 MW and has an estimated annual energy production of 7.1 GWh.
- The optional landfill system was modeled for a conservative system size of 2.5 MW and resulted in an annual solar energy production estimate of 2.9 GWh.

- The combined PV power rating from all systems is on the order of 8.8 MW of power with an estimated annual production of 10 GWh of solar energy.
- 100% renewable energy from the Redwood Coast Energy Authority can be procured to meet the energy demand required beyond what may be produced by onsite renewable energy systems.
- The goal of using 100% carbon-free energy to meet site electrical loads can be met through a combination of onsite solar photovoltaic energy production and the procurement of available renewable energy from the local electrical service provider. The procurement and use of low-cost wind energy should be investigated in subsequent stages of project development.

Proposed Energy Systems

- A Phase 1 and 2 Switchyard PV-battery-generator microgrid is proposed to supply energy and backup emergency power to the Phase 1 and 2 critical loads. Preliminary critical loads include lighting, security, communication, and cranes. Further design will be required as more electrical load information becomes available from a terminal operator. The microgrid includes a 2-MW natural gas generator that will provide emergency power to meet the estimated peak critical loads and has a maximum expected annual runtime of up to 500 hours.
- A Phase 3 and 4 Switchyard microgrid of similar design is proposed, but will include a larger battery system to handle short-term grid outages. The expected annual runtime of the 2-MW gas generator is 500 hours maximum.
- The proposed designs provide multiple levels of resiliency to meet the electrical needs of the terminal during normal and emergency operations. The levels of resiliency include: 1) Humboldt County has islanding capability during state outages, 2) microgrid battery systems will provide green un-interrupted resiliency during short outages, and 3) natural-gas generators will provide deep backup emergency power for extended outages.
- The backup generators have been sized to serve critical loads during an emergency. At this conceptual stage, these critical loads are assumed to be 50% of the planned estimate load for Phase 1 and 2 and 38% for the Phase 3 and 4.

Next Steps

1. Finalize entry and egress rights of way for comprehensive site plan development.
2. Finalize Green Port and backup power criteria to meet the resiliency and regulatory guidelines, facility operations, backup power resiliency, operational needs for the proposed development.
3. Apply for Large Load Service as early as possible in order to plan for utility system upgrades. A large Load Service Application is anticipated to cost $30k and require 90 days.
4. Submit a pre-application in order to get a general engineering review of the site in order to plan for utility system upgrades.

Appendices

A. Integrated Capacity Analysis

B. RMT -Electrical Load Estimates

C. Conceptual Phasing Plan

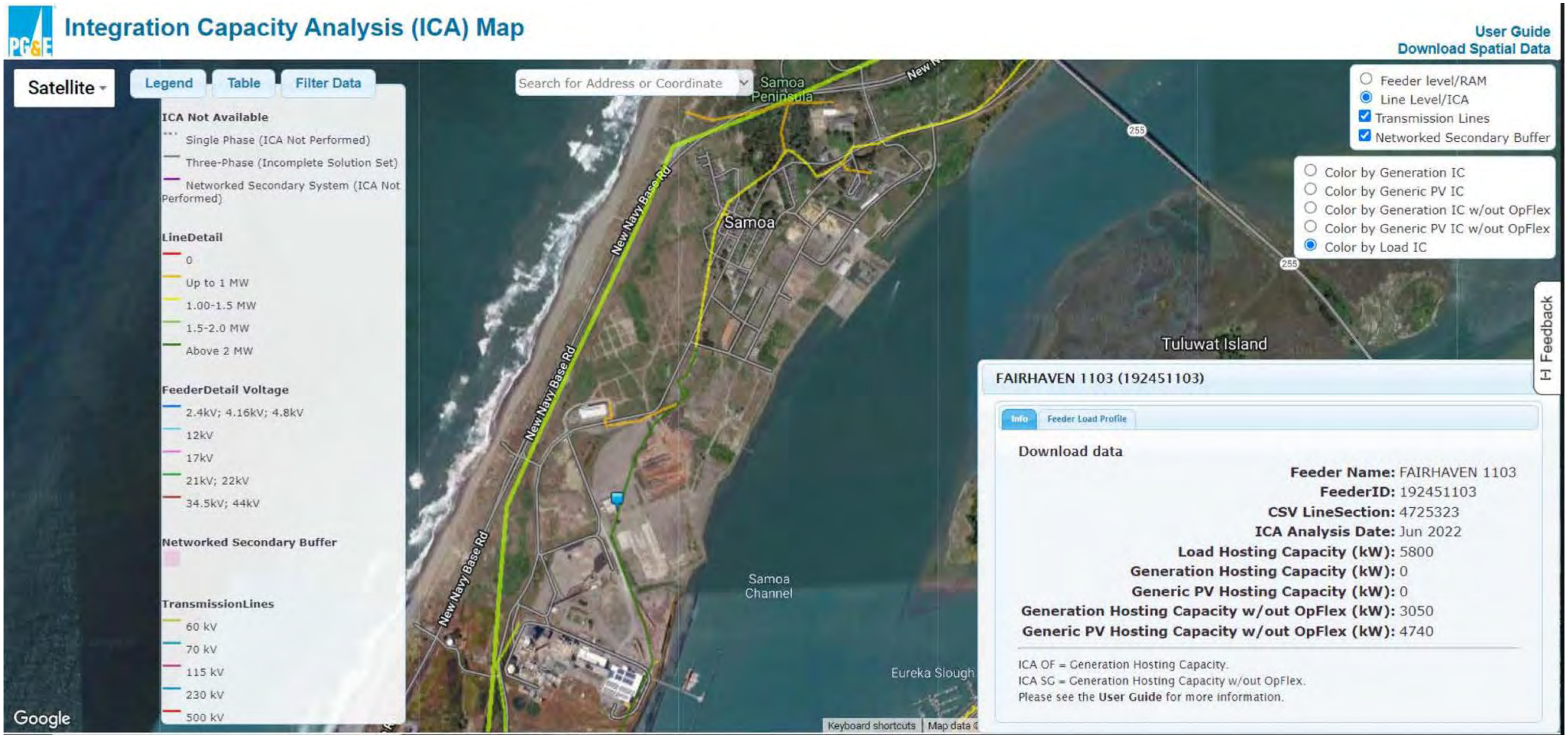
D. Conceptual Master Plan

E. Overhead Line and Utility Re-routing Specifications

F. HelioScope Rooftop Annual Production Report

G. HelioScope Landfill Annual Production Report

Appendix A: Integrated Capacity Analysis

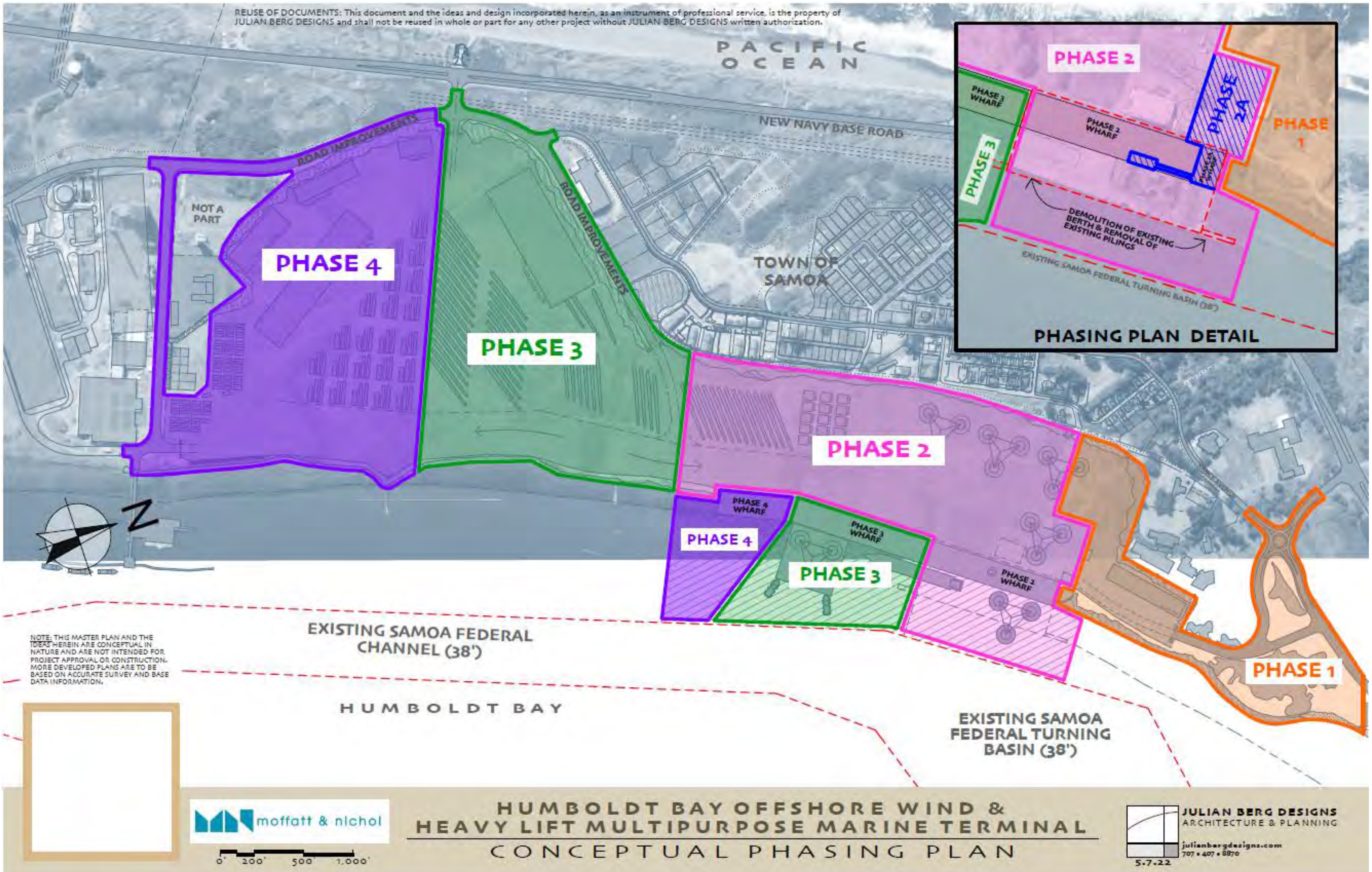


Appendix B: RMT -Electrical Load Estimates

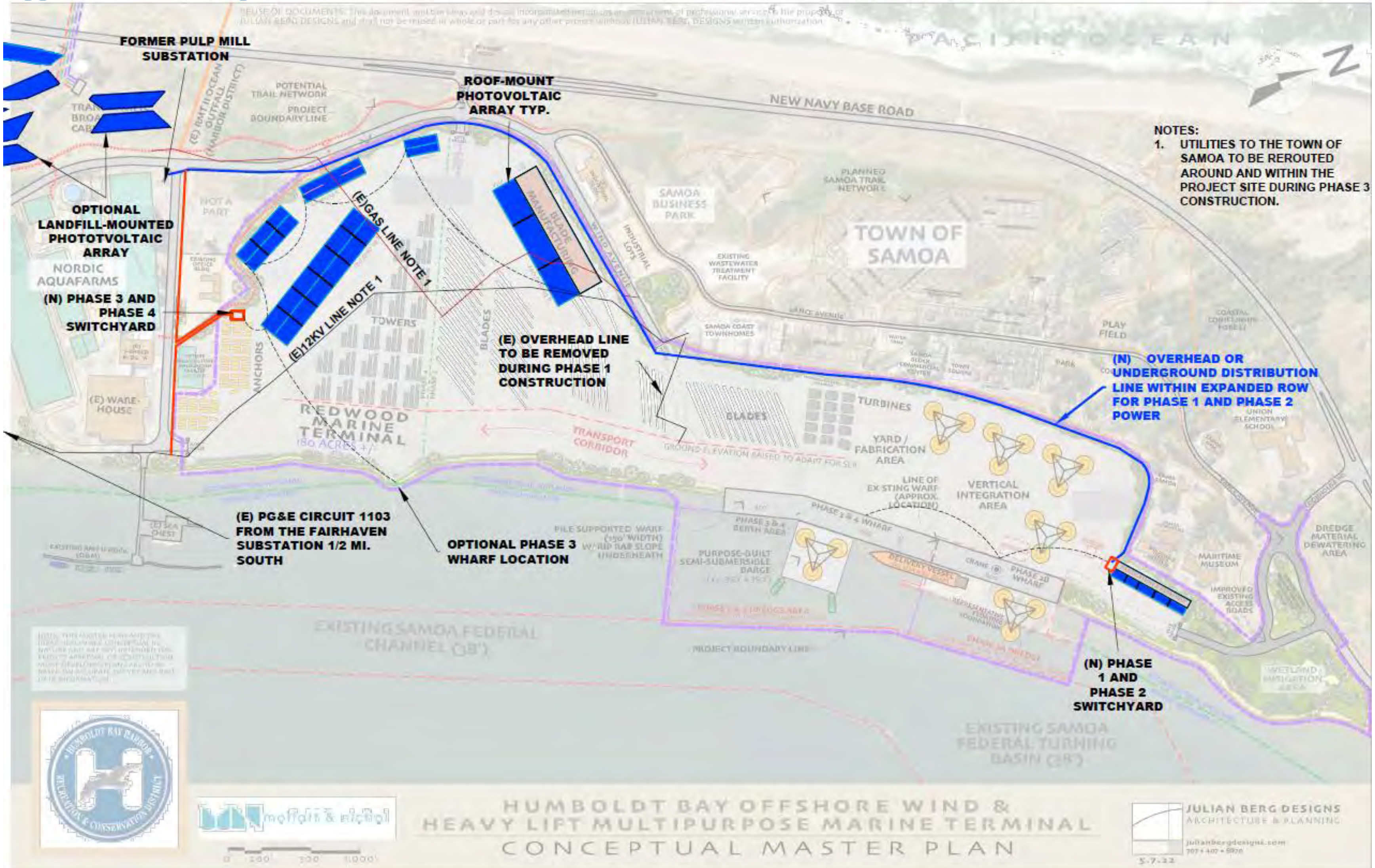
Electrical Load Estimate 2 Sept 2022

Phase	Description	Equipment	Quantity	Load KVA (each)	Connected Load (KVA)	Demand Factor	Total Load (kVA)	Notes
1	Entry and Fabrication/Assembly Building	High Mast Lighting Towers	3	9.60	28.8	1	28.8	
		Fabrication/Assembly Building (50,000 sqft)	50000	0.015	750	1	750	Phase 1
		Entry Gate / Miscellaneous	1	100.00	100	1	100	0.9 MVA
								1.3 MVA (50% Contingency)
2	Wind Turbine Laydown Area and Wharf	High Mast Lighting Towers	7	9.60	67.2	1	67.2	
		Wind Turbine Nacelle Heaters	10	10.00	100	1	100	
		Wharf Crane	1	600.00	600	0.8	480	
		Power Outlets (welding, tools, equipment)	8	15.00	120	0.5	60	
		Turbine Assembly Rack	1	200.00	200	1	200	
		Vessel Shore Power/Tug Charging	1	500.00	500	1	500	
		Battery Charging incl SPMTs	6	100.00	600	0.7	420	Phase 2
								1.8 MVA
								2.7 MVA (50% Contingency)
3	Blade Manufacturing and Blade Laydown Area, Wharf	High Mast Lighting Towers	7	9.60	67.2	1	67.2	
		Power Outlets (welding, tools, equipment)	7	15.00	105	0.5	52.5	
		Blade Manufacturing Facility (240,000 sqft)	240000	0.008	1920	1	1920	
		Turbine Assembly Rack	1	200.00	200	1	200	
		Vessel Shore Power/Tug Charging	1	500.00	500	1	500	
		Battery Charging incl SPMTs	16	100.00	1600	0.5	800	Phase 3
		Cranes	4	300.00	1200	0.6	720	4.3 MVA
								6.4 MVA (50% Contingency)
4	Tower Manufacturing and Tower Laydown Area	High Mast Lighting Towers	5	9.60	48	1	48	
		Wind Turbine Nacelle Heaters	10	10.00	100	1	100	
		Power Outlets (welding, tools, equipment)	5	15.00	75	0.5	37.5	
		Office Building (20,000 sqft)	20000	0.02	400	1	400	
		Manufacturing Building (40,000 sqft)	40000	0.01	400	0.75	300	
		Manufacturing Building (60,000 sqft)	60000	0.01	600	0.75	450	
		Tower Manufacturing Building (180,000 sqft)	180000	0.01	1440	0.75	1080	Phase 4
		Vessel Shore Power	1	300.00	300	1	300	2.7 MVA
								4.1 MVA (50% Contingency)
						Total MVA	9.7	
						Total MVA	**14.5**	50% Contingency

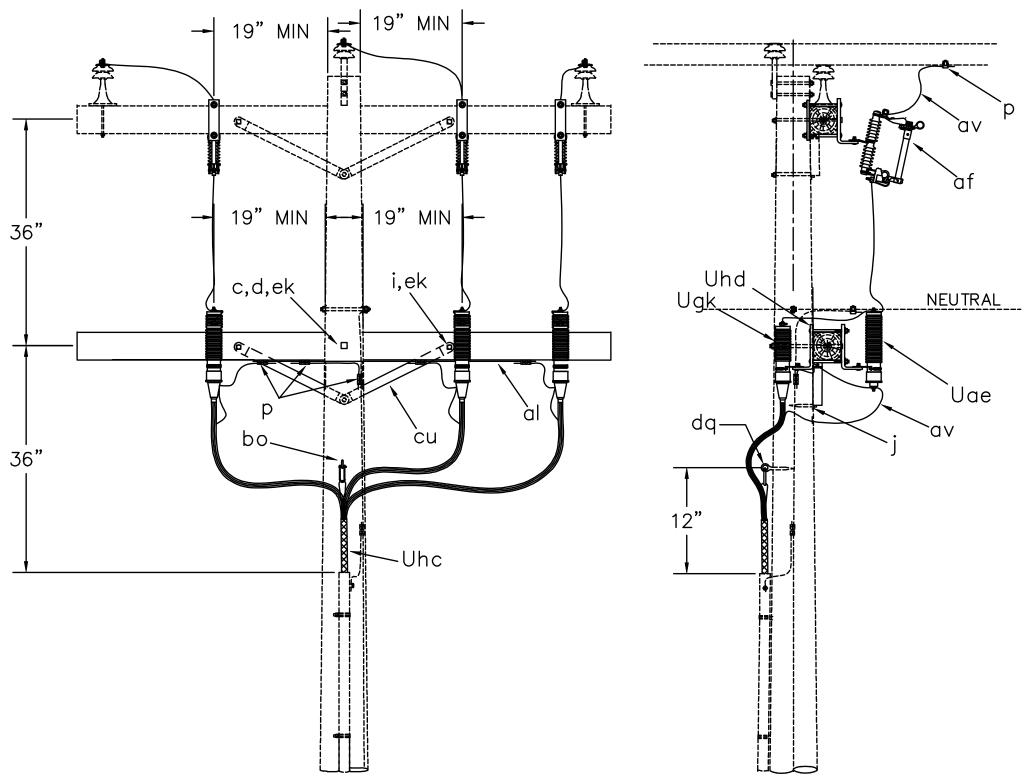
Appendix C: Conceptual Phasing Plan



Appendix D: Conceptual Master Plan



Appendix E: Overhead Line and Utility Re-routing Specifications



ITEM	QTY.	MATERIAL
c	1	Bolt, machine, 5/8" x required length.
d	2	Washer, square 2 1/4".
g	1	Crossarm, 3 5/8" x 4 5/8" x 8'–0"
i	2	Bolt, carriage, 3/8" x 4 1/2"
j	1	Screw, lag 1/2" x 4" as required.
p		Connectors, as required.
af	3	Cutout
al		Staples, as required.
av		Jumpers, as required.
bo	1	Anchor, shackle.
cu	2	Brace, wood, 28"
dq	1	Eye screw, elliptical or drive hook.
ek	3	Locknuts, as required.
Uae	3*	Surge arrester
Ugk	3	Cable termination.
Uhc	3	Cable support.
Uhd	3	Crossarm mounting bracket.

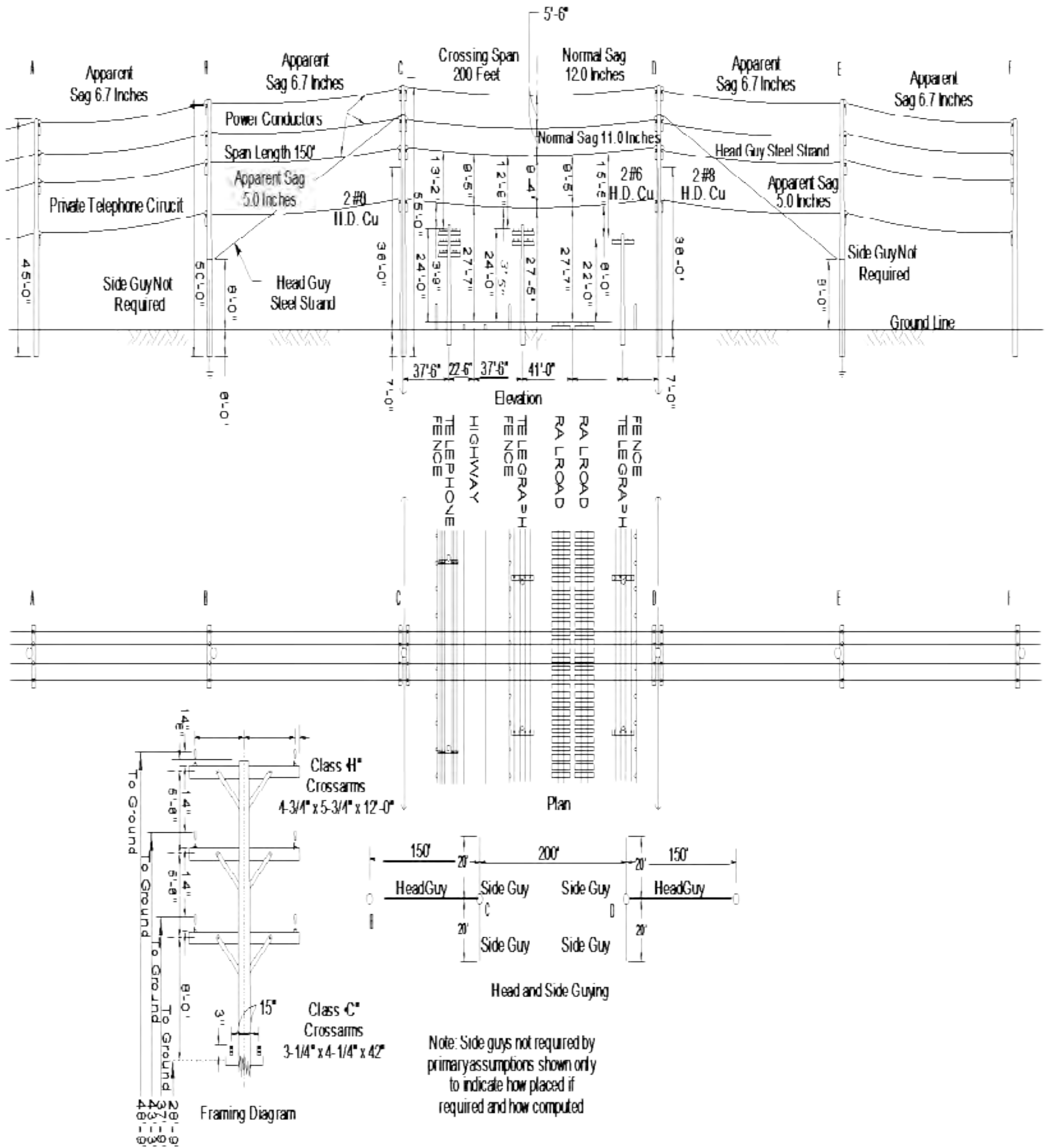
NOTES:

1. TOTAL ARRESTER LEAD LENGTH MUST BE UNDER 3'.
2. NO BENDS PERMITTED WITHIN 6" OF CABLE TERMINAL BASE.
3. MINIMUM 4" BETWEEN BOLTS.

THREE PHASE CABLE TERMINAL POLE
WITH UPPER CROSSARM MOUNTING CUTOUTS
AND CROSSARM MOUNTING ARRESTERS

AUG 2016	3 – PHASE PRIMARY	
RUS		UC5

Crossing of Class "H" Supply Line Over Major Railroad and Major Communication Lines



F-18

Table 1: Basic Minimum Allowable Vertical Clearance of Wires above Railroads, Thoroughfares, Ground or Water Surfaces; Also Clearances from Poles, Buildings, Structures or Other Objects (nn) (Letter References Denote Modifications of Minimum Clearances as Referred to in Notes Following This Table)

Case No.	Nature of Clearance	Wire or Conductor Concerned						
		A Span Wires (Other than Trolley Span Wires) Overhead Guys and Messengers	B Communication Conductors (Including Open Wire, Cables and Service Drops), Supply Service Drops of 0 - 750 Volts	C Trolley Contact, Feeder and Span Wires, 0 - 5,000 Volts	D Supply Conductors of 0 - 750 Volts and Supply Cables Treated as in Rule 57.8	E Supply Conductors and Supply Cables, 750 - 22,500 Volts	F Supply Conductors and Supply Cables, 22.5 - 300 kV	G Supply Conductors and Supply Cables, 300 - 550 kV (mm)
1	Crossing above tracks of railroads which transport or propose to transport freight cars (maximum height 15 feet, 6 inches) where not operated by overhead contact wires. (a) (b) (c) (d)	25 Feet	25 Feet	22.5 Feet	25 Feet	28 Feet	34 Feet	34 Feet (kk)
2	Crossing or paralleling above tracks of railroads operated by overhead trolleys. (b) (c) (d)	26 Feet (e)	26 Feet (e) (f) (g)	22.5 Feet (h) (i) (eee)	27 Feet (e) (g)	30 Feet (g)	34 Feet (g)	34 Feet (g) (kk)
3	Crossing or along thoroughfares in urban districts or crossing thoroughfares in rural districts. (c) (d)	18 Feet (j) (k) (ii)	18 Feet (j) (l) (m) (ii) (kkk)	19 Feet (hh) (eee)	20 Feet (ii)	25 Feet (o) (ii)	30 Feet (o) (ii)	30 Feet (o) (ii) (kk)
4	Above ground along thoroughfares in rural districts or across other areas capable of being traversed by vehicles or agricultural equipment.	15 Feet (k)	15 Feet (m) (n) (p)	19 Feet (eee)	19 Feet	25 Feet (o)	30 Feet (o) (p)	30 Feet (o) (kk)
5	Above ground in areas accessible to pedestrians only	8 Feet	10 Feet (m) (q)	19 Feet (eee)	12 Feet	17 Feet	25 Feet (o)	25 Feet (o) (kk)
6	Vertical clearance above walkable surfaces on buildings, (except generating plants or substations) bridges or other structures which do not ordinarily support conductors, whether attached or unattached.	8 Feet (r)	8 Feet (r)	8 Feet	8 Feet	12 Feet	12 Feet	20 Feet (ll)
6a	Vertical clearance above non-walkable surfaces on buildings, (except generating plants or substations) bridges or other structures, which do not ordinarily support conductors, whether attached or unattached	2 Feet	8 Feet (yy)	8 Feet	8 Feet (zz)	8 Feet	8 Feet	20 Feet
7	Horizontal clearance of conductor at rest from buildings (except generating plants and substations), bridges or other structures (upon which men may work) where such conductor is not attached thereto (s) (t)	-	3 Feet (u)	3 Feet	3 Feet (u) (v)	6 Feet (v)	6 Feet (v)	15 Feet (v)
8	Distance of conductor from center line of pole, whether attached or unattached (w) (x) (y)	-	15 inches (s) (aa)	15 inches (aa) (bb) (cc)	15 inches (o) (aa) (dd)	15 or 18 inches (o) (dd) (ee) (jj)	18 inches (dd) (ee)	Not Applicable
9	Distance of conductor from surface of pole, crossarm or other overhead line structure upon which it is supported, providing it complies with case 8 above (x)	-	3 inches (aa) (ff)	3 inches (aa) (cc) (gg)	3 inches (aa) (dd) (gg)	3 inches (dd) (gg) (jj)	1/4 Pin Spacing Shown in Table 2 Case 15 (dd)	1/2 Pin Spacing Shown in Table 2 Case 15 (dd)

Table 1 (Continued)

Case No.	Nature of Clearance	Wire or Conductor Concerned						
		A Span Wires (Other than Trolley Span Wires) Overhead Guys and Messengers	B Communication Conductors (Including Open Wire, Cables and Service Drops), Supply Service Drops of 0 - 750 Volts	C Trolley Contact, Feeder and Span Wires, 0 - 5,000 Volts	D Supply Conductors of 0 - 750 Volts and Supply Cables Treated as in Rule 57.8	E Supply Conductors and Supply Cables, 750 - 22,500 Volts	F Supply Conductors and Supply Cables, 22.5 - 300 kV	G Supply Conductors and Supply Cables, 300 - 550 kV (mm)
10	Radial centerline clearance of conductor or cable (unattached) from non-climbable street lighting or traffic signal poles or standards, including mastarms, brackets and lighting fixtures, and from antennas that are not part of the overhead line system.	-	1 Foot (u) (rr) (ss)	15 inches (bb) (cc)	3 Feet (oo)	6 Feet (pp)	10 Feet (qq)	10 Feet (ll)
11	Water areas not suitable for sailboating (tt) (uu) (ww) (xx)	15 Feet	15 Feet	-	15 Feet	17 Feet	25 Feet	25 Feet (kk)
12	Water areas suitable for sailboating, surface area of: (tt) (vv) (ww) (xx)							
	(A) Less than 20 acres	18 Feet	18 Feet	-	18 Feet	20 Feet	27 Feet	27 Feet (kk)
	(B) 20 to 200 acres	26 Feet	26 Feet	-	26 Feet	28 Feet	35 Feet	35 Feet (kk)
	(C) Over 200 to 2,000 acres	32 Feet	32 Feet	-	32 Feet	34 Feet	41 Feet	41 Feet (kk)
	(D) Over 2,000 acres	38 Feet	38 Feet		38 Feet	40 Feet	47 Feet	47 Feet (kk)
13	Radial clearance of bare line conductors from tree branches or foliage (aaa) (ddd)	-	-	18 inches (bbb)	-	18 inches (bbb)	1/4 pin spacing shown in table 2, Case 15 (bbb) (ccc)	1/2 pin spacing shown in table 2, Case 15
14	Radial clearance of bare line conductors from vegetation in Extreme and VeryHigh Fire Threat Zones in Southern California (aaa) (ddd) (hhh)(jjj)			18 inches (bbb)		48 inches (bbb) (iii)	48 inches (fff)	120 inches (ggg)

References to Rules Modifying Minimum Clearances in Table 1	Rule
(a) Shall not be reduced more than 5% because of temperature or loading	37
1 Supply lines	54.4-B1
2 Communication lines	84.4 B1
(b) Shall be increased for supply conductors on suspension insulators, under certain conditions	37
(c) Special clearances are provided for traffic signal equipment	58.4-C
(d) Special clearances are provided for street lighting equipment	58.5-B
(e) Based on trolley pole throw of 26 feet. may be reduced where suitably protected	56.4-B2
1 Supply guys	56.4-B2
2 Supply cables and messengers	57.4-B2
3 Communication guys	86.4-B2
4 Communication cables and messengers	87.4-B2
(f) May be reduced depending on height of trolley contact conductors	
1 Supply service drops	54.8-C5
2 Communication service drops	84.8-D5
(g) May be reduced and shall be increased depending on trolley throw	
1 Supply conductors (except service drops)	54.4-B2
2 Communication conductors (except service drops)	84.4-B2
(h) May be decreased where freight cars are not transported.	
1. Trolley contact and feeder conductors.	74.4-B1
2. Trolley span wires	77.4-A
(i) May be reduced for trolley contact and span wires in subways, tunnels, under bridges and in fenced areas	
1 Trolley contact conductors	74.4-E
2 Trolley span wires	77.4-B
(j) May be reduced at crossings over private thoroughfares and entrances to private property and over private property	
1 Supply service drops	54.8-B2
2 Supply guys	56.4-A
3 Communication service drops	84.8-C2
4 Communication guys	86.4-A
(k) May be reduced along thoroughfares where not normally accessible to vehicles	
1 Supply guys	56.4-A1
2 Communication guys	86.4-A1
(l) May be reduced where within 12 feet of curb line of public thoroughfares	
1 Supply service drops	54.8-B1
2 Communication service drops	84.8-C1
(m) May be reduced for railway signal cables under special conditions	84.4-A4

Table 2: Basic Minimum Allowable Clearance of Wires from Other Wires at Crossings, in Midspans and at Supports (Letter References Denote Modifications of Minimum Clearances as Referred to in Notes Following This Table) All Clearances are in Inches

Case No.	Nature of Clearance and Class and Voltage of Wire, Cable or Conductor Concerned	Other Wire, Cable or Conductor Concerned			Supply Conductors (Including Supply Cables)							
		A Span Wires, Guys and Messengers	B Trolley Contact Conductors 0 – 750 Volts	C Communication Conductors (Including Open Wire, Cables and Service Drops)	D 0 – 750 Volts (Including Service Drops) and Trolley Feeders (a)	E 750 - 7,500 Volts	F 7,500 - 20,000 Volts	G 20,000 - 35,000 Volts	H 35,000 - 75,000 Volts	I 75,000 - 150,000 Volts	J 150,000 - 300,000 Volts	K (kk) 300,000 - 550,000 Volts
	Clearance between wires, cables and conductors not supported on the same poles, vertically at crossings in spans and radially where colinear or approaching crossings											
1	Span wires, guys and messengers (b)	18 (c)	48 (d, e)	24 (e)	24 (e)	36 (f)	36	72	72	78	78 (gg)	138 (hh)
2	Trolley contact conductors, 0 - 750 volts	48 (d, e)	-	48 (d)	48 (d, h)	48	72	96	96	96	96 (gg)	156 (hh)
3	Communication conductors	24 (e)	48 (d)	24	48 (i)	48 (dd)	72	96	96	96	96 (gg)	156 (hh)
4	Supply conductors, service drops and trolley feeders, 0 - 750 volts (qq)	24 (e)	48 (d, h)	48 (i)	24	48	48	96 (oo)	96	96	96(gg)	156 (hh)
5	Supply conductors, 750 - 7,500 volts (qq)	36 (f)	48	48 (dd)	48	48 (h)	72	96 (oo)	96	96	96(gg)	156 (hh)
6	Supply conductors, 7,500 - 20,000 volts (qq)	36	72	72	48	72	72	96 (oo)	96	96	96 (gg)	156 (hh)
7	Supply conductors, more than 20,000 volts (qq)	72 (g)	96 (g)	96 (g)	96 (g, oo)	96 (g, oo)	96 (g, oo)	96 (g, oo)	96 (g)	96	96 (gg)	156 (hh)
	Vertical separation between conductors and/or cables, on separate crossarms or other supports at different levels (excepting on related line and buck arms) on the same pole and in adjoining midspans											
8	Communication Conductors and Service Drops	-	-	12 (j, rr)	48 (k, l, m, n, pp)	48 (k)	72 (m n)	72 (m)	72	78	87 (gg)	147 (hh)
9	Supply Conductors Service Drops and Trolley Feeders, 0 - 750 Volts	-	-	48 (k, l, m, n, pp)	24 (h, k, m, o)	48 (k, m, p)	48 (k, m, p)	72 (m, nn)	72	78	87 (gg)	147 (hh)

2.3.4. (continued)

Table 2-1 Minimum Separation and Clearance Requirements for Trenches[1]

		G	Duct T	DB T	C	S	P	SL
					(In Inches)			
G	Gas[2]	–	12	12	12	6	12	6
T	Telephone (Duct)	12	–	1	1	12	12	12
T	Telephone (Direct Bury)	12	1	–	1	12	12	12
C	CATV	12	1	1	–	12	12	12
S	Electric Secondary	6	12	12	12	1.5	3	1.5
P	Electric Primary	12	12	12	12	3	3	3
SL	Streetlight[3]	6	12	12	12	1.5	3	1.5
NE	Foreign Electric Sources, Non-PG&E[4]	12	12	12	12	12	12	12

1 All separation clearance distances are in inches.

2 For more information about this table, see Company Bulletin TD-5453B-002, "Updated Separation Requirements For Conduit in Joint Trench," located in Appendix B.

3 Streetlight circuits ***not owned*** by PG&E must be installed to meet the requirements in PG&E's *Joint Trench Configurations & Occupancy Guide*. Specifically, applicants must review the requirements for working with a second utility company.

4 Considered a "utility" as defined in Utility Standard S5453, "Joint Trench."

PG&E does ***not*** differentiate between the clearances for casing/conduit and pipe. The clearances and installation requirements are the same for both.

For more information on backfill-sand requirements, see Engineering Material Specification EMS-4123, "Backfill Sand," located in Appendix B.

For more information on the minimum separation and clearance requirements for service trenches, see the *Joint Trench Configurations & Occupancy Guide*.

When different service facilities (e.g., gas, electric, telecommunications) are installed in close proximity (e.g., in a joint trench), applicants must ensure that the facilities maintain a minimum horizontal separation of 36 inches from the gas riser where they transition from below ground to above ground.

Clearances between other facilities can be reduced ***only*** when the parties supplying those services or facilities reach a mutual agreement.

Note: Applicants must ensure that sufficient space is provided between facilities at all times to allow for safe maintenance and operation.

A. Applicants must ***not*** install any electrical devices or equipment including wires, cables, metering and telecommunication enclosures, bond wires, clamps, or ground rods within 36 inches of the gas service riser.

   This distance can be reduced to 18 inches for electrical devices or equipment certified for National Electric Code (NEC) Class I, Division 2 locations. See Figure 2-19, "Electric and Gas Meter Set Separation Dimensions and Clearances," on Page 2-32, and Figure 2-21, "Gas Regulator Set Clearance Requirement from Sources of Ignition," on Page 2-35.

Appendix F: HelioScope Rooftop Annual Production Report

HelioScope — Annual Production Report produced by Steve Richards

Design 1 OSW Wind Port, 936 Vance Ave, Samoa, CA 95564

Report

Project Name	OSW Wind Port
Project Address	936 Vance Ave, Samoa, CA 95564
Prepared By	Steve Richards steven.c.richards@humboldt.edu

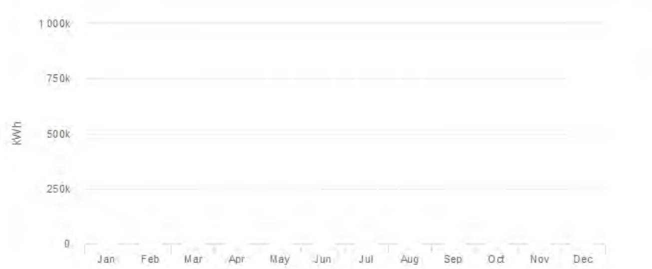
Schatz Energy Research Center

System Metrics

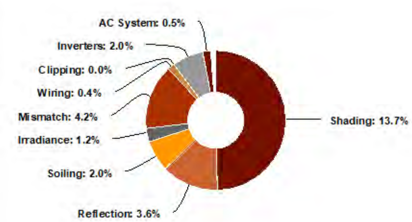
Design	Design 1
Module DC Nameplate	6.35 MW
Inverter AC Nameplate	5.10 MW Load Ratio: 1.25
Annual Production	7.097 GWh
Performance Ratio	75.2%
kWh/kWp	1,117.0
Weather Dataset	TMY, 10km Grid (40.85,-124.15), NREL (prospector)
Simulator Version	ada662d322-df0e856433-c90e500374-981fef9d56

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,450.6	
	POA Irradiance	1,485.6	2.4%
	Shaded Irradiance	1,281.6	-13.7%
	Irradiance after Reflection	1,234.9	-3.6%
	Irradiance after Soiling	1,210.2	-2.0%
	Total Collector Irradiance	**1,210.2**	**0.0%**
Energy (kWh)	Nameplate	7,693,915.2	
	Output at Irradiance Levels	7,602,838.9	-1.2%
	Output at Cell Temperature Derate	7,627,499.1	0.3%
	Output After Mismatch	7,310,069.3	-4.2%
	Optimal DC Output	7,278,645.6	-0.4%
	Constrained DC Output	7,277,946.9	0.0%
	Inverter Output	7,132,380.7	-2.0%
	Energy to Grid	**7,096,719.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		12.0 °C
	Avg. Operating Cell Temp		18.6 °C
Simulation Metrics			
		Operating Hours	4654
		Solved Hours	4654

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, 10km Grid (40.85,-124.15), NREL (prospector)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	2.81	0.0455	0°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
2	2	2	2	2	2	2	2	2	2	2	2

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations

Module	Uploaded By	Characterization
CS3W-420P (1000V) (Canadian Solar)	HelioScope	Spec Sheet Characterization, PAN

Component Characterizations

Device	Uploaded By	Characterization
CPS SCH100KTL-DO/US-480 (Chint Power Systems)	HelioScope	Spec Sheet

Components

Component	Name	Count
Inverters	CPS SCH100KTL-DO/US-480 (Chint Power Systems)	51 (5.10 MW)
Strings	10 AWG (Copper)	561 (305,313.6 ft)
Module	Canadian Solar, CS3W-420P (1000V) (420W)	15,127 (6.35 MW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	20-29	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 11	Fixed Tilt	Landscape (Horizontal)	14°	3`9°	0.0 ft	1x1	0	0	0
Field Segment 3	Fixed Tilt	Landscape (Horizontal)	14°	349°	0.0 ft	1x1	0	0	0
Field Segment 4	Fixed Tilt	Landscape (Horizontal)	14°	169°	0.0 ft	1x1	4,551	4,551	1.91 MW
Field Segment 5	Fixed Tilt	Landscape (Horizontal)	14°	289.5°	0.0 ft	1x1	286	286	120.1 kW
Field Segment 6	Fixed Tilt	Landscape (Horizontal)	14°	109.5°	0.0 ft	1x1	286	286	120.1 kW
Field Segment 7	Fixed Tilt	Landscape (Horizontal)	14°	267.4°	0.0 ft	1x1	583	579	243.2 kW
Field Segment 8	Fixed Tilt	Landscape (Horizontal)	14°	87.3°	0.0 ft	1x1	583	579	243.2 kW
Field Segment 9	Fixed Tilt	Landscape (Horizontal)	14°	247°	0.0 ft	1x1	954	950	399.0 kW
Field Segment 10	Fixed Tilt	Landscape (Horizontal)	14°	67°	0.0 ft	1x1	954	950	399.0 kW
Field Segment 11	Fixed Tilt	Landscape (Horizontal)	14°	247.9°	0.0 ft	1x1	3,172	3,152	1.32 MW
Field Segment 12	Fixed Tilt	Landscape (Horizontal)	14°	67.8°	0.0 ft	1x1	3,172	3,152	1.32 MW
Field Segment 12	Fixed Tilt	Landscape (Horizontal)	14°	138.7°	0.0 ft	1x1	650	642	269.6 kW

Detailed Layout

Appendix G: HelioScope Landfill Annual Production Report

HelioScope Annual Production Report produced by Steve Richards

Design 2 Landfill, 936 Vance Ave, Samoa, CA 95564

Report

Project Name	Landfill
Project Address	936 Vance Ave, Samoa, CA 95564
Prepared By	Steve Richards steven.c.richards@humboldt.edu

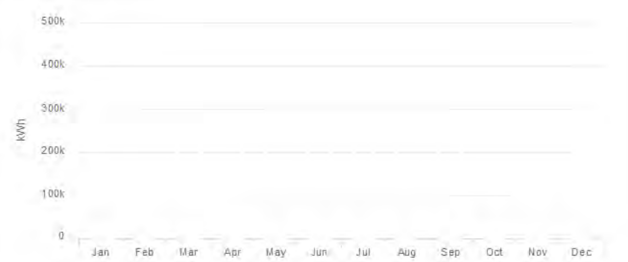
Schatz Energy Research Center

System Metrics

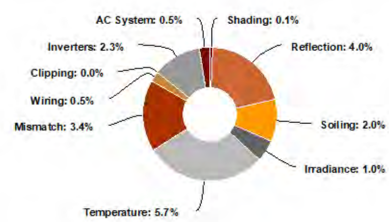
Design	Design 2
Module DC Nameplate	2.51 MW
Inverter AC Nameplate	2.02 MW Load Ratio: 1.24
Annual Production	2.920 GWh
Performance Ratio	82.0%
kWh/kWp	1,163.0
Weather Dataset	TMY, 10km Grid (40.85,-124.15), NREL (prospector)
Simulator Version	6d631a840a-5f7ded908c-38381c2dbb-6ef8d412e1

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,450.6	
	POA Irradiance	1,418.2	-2.2%
	Shaded Irradiance	1,416.3	-0.1%
	Irradiance after Reflection	1,359.0	-4.0%
	Irradiance after Soiling	1,331.8	-2.0%
	Total Collector Irradiance	**1,331.8**	**0.0%**
Energy (kWh)	Nameplate	3,346,545.0	
	Output at Irradiance Levels	3,312,837.1	-1.0%
	Output at Cell Temperature Derate	3,123,624.1	-5.7%
	Output After Mismatch	3,018,390.3	-3.4%
	Optimal DC Output	3,003,880.4	-0.5%
	Constrained DC Output	3,003,871.6	0.0%
	Inverter Output	2,935,135.7	-2.3%
	Energy to Grid	**2,920,460.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		12.0 °C
	Avg. Operating Cell Temp		26.9 °C
Simulation Metrics			
	Operating Hours		4654
	Solved Hours		4654

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, 10km Grid (40.85,-124.15), NREL (prospector)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
2	2	2	2	2	2	2	2	2	2	2	2

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations

Module	Uploaded By	Characterization
CS3W-420P (1500V) (Canadian Solar)	HelioScope	Spec Sheet Characterization, PAN

Component Characterizations

Device	Uploaded By	Characterization
Sunny Tripower 24000TL-US (SMA)	HelioScope	Modified CEC

Components

Component	Name	Count
Inverters	Sunny Tripower 24000TL-US (SMA)	84 (2.02 MW)
Strings	10 AWG (Copper)	405 (90,480.2 ft)
Module	Canadian Solar, CS3W-420P (1500V) (420W)	5,979 (2.51 MW)

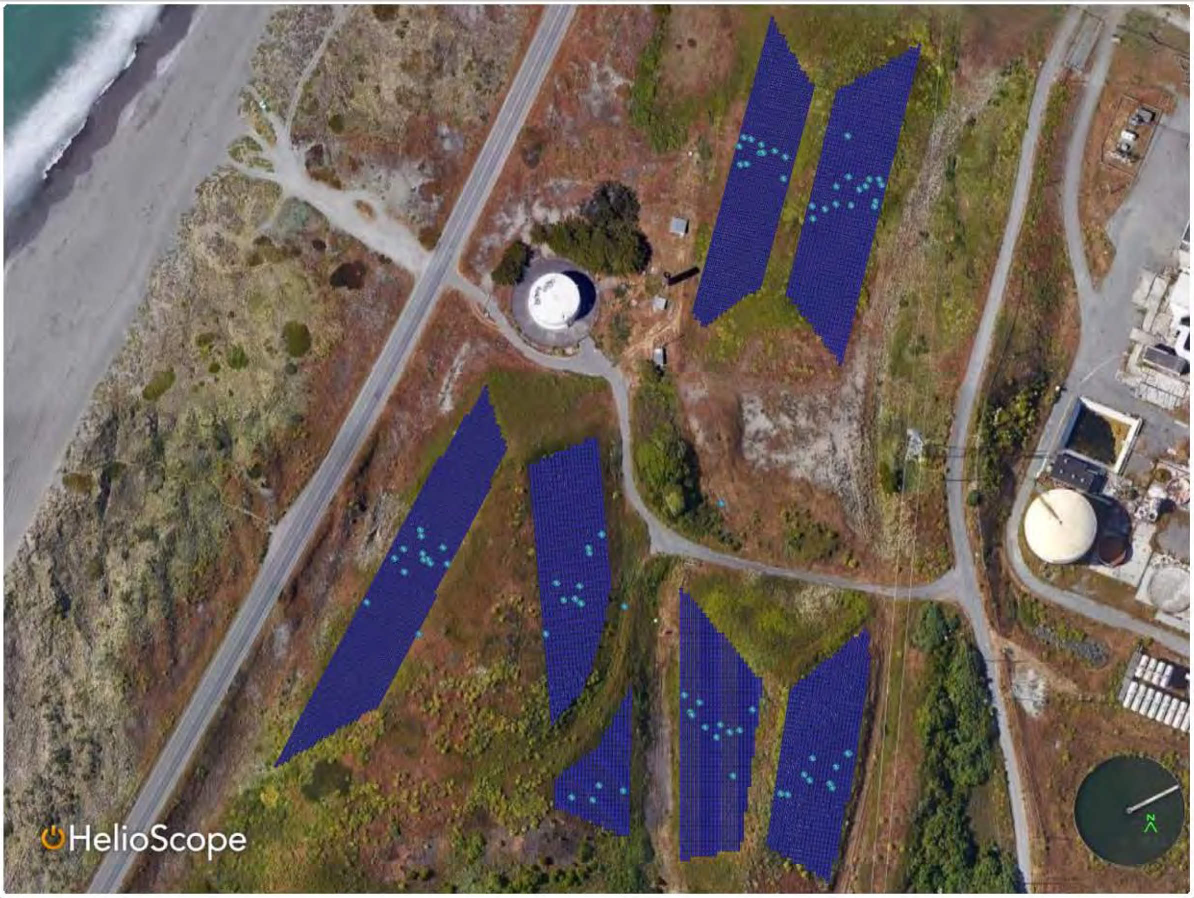
Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	4-19	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Flush Mount	Landscape (Horizontal)	15°	270°	2.0 ft	1x1	882	882	370.4 kW
Field Segment 2	Flush Mount	Landscape (Horizontal)	15°	98.5°	2.0 ft	1x1	832	832	349.4 kW
Field Segment 3	Flush Mount	Landscape (Horizontal)	15°	298°	2.0 ft	1x1	1,181	1,181	496.0 kW
Field Segment 4	Flush Mount	Landscape (Horizontal)	15°	85°	2.0 ft	1x1	863	863	362.5 kW
Field Segment 5	Flush Mount	Landscape (Horizontal)	15°	91°	2.0 ft	1x1	323	323	135.7 kW
Field Segment 6	Flush Mount	Landscape (Horizontal)	15°	104°	2.0 ft	1x1	1,037	1,037	435.5 kW
Field Segment 7	Flush Mount	Landscape (Horizontal)	15°	285°	2.0 ft	1x1	861	861	361.6 kW

Detailed Layout



Humboldt Bay: Planning for Offshore Wind, Equity, Resilience, and Economic Development

Humboldt: POWERED

Port of Humboldt, California

U.S. Department of Transportation / Maritime Administration

FY 2023 Port Infrastructure Development Program (PIDP) Grant Application

Letters of Support

Submitted by:
Humboldt Bay Harbor Recreation and Conservation District
Eureka, California

U.S. SENATOR DIANNE FEINSTEIN
CALIFORNIA

COMMITTEE ON THE JUDICIARY
- CHAIR, HUMAN RIGHTS AND THE LAW
SELECT COMMITTEE ON INTELLIGENCE
COMMITTEE ON APPROPRIATIONS
- CHAIR, ENERGY AND WATER SUBCOMMITTEE
COMMITTEE ON RULES AND ADMINISTRATION

United States Senate

April 19, 2023

The Honorable Pete Buttigieg
Secretary of the United States Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Secretary Buttigieg:

I write in support of the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application for grant funding through the United States Department of Transportation's (USDOT) Port Infrastructure Development Program (PIDP).

The District is seeking $8.5 million to begin redevelopment of the Redwood Multipurpose Marine Terminal. The terminal is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridge and channel depths, Humboldt Bay has none of these constraints.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshaling ports and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have significant employment, safety, and environmental benefits at the local level.

Thank you for your attention to this important application and request. If you have any questions, please do not hesitate to contact my San Francisco office at (415) 393-0707.

Sincerely,

Dianne Feinstein
United States Senator

DF/sy

April 6, 2023

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

On behalf of the Governor's Office of Business and Economic Development (GO-Biz), I am pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY23 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

The Project presents a new market and job creation opportunity for the District, the greater Humboldt Bay region, and the State of California. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

GO-Biz strongly endorses this planning project as an important step in advancing the State's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Dee Dee Myers
Governor's Office of Business and Economic Development

COUNTY OF HUMBOLDT
COUNTY ADMINISTRATIVE OFFICE
825 5th Street, Suite 112, Eureka, CA 95501-1153
Telephone (707) 445-7266 Fax (707) 445-7299
cao@co.humboldt.ca.us

March 12, 2023

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

The County of Humboldt is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY23 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

The County of Humboldt strongly endorses this planning project as an important step in advancing the Sate's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Elishia Hayes
Humboldt County Administrative Officer

CC: Senator Mike McGuire
Assemblymember Jim Wood

COLLEGE OF THE REDWOODS

March 11, 2023

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

College of the Redwoods is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY23 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project**.**

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region**.** Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

College of the Redwoods strongly endorses this planning project as an important step in advancing the State's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Keith Flamer, PhD
President/Superintendent
College of the Redwoods

March 13, 2023

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

The City of Eureka's pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY23 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.
The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

The City strongly endorses this planning project as an important step in advancing the Sate's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Miles Slattery
City Manager

THE CITY OF EUREKA
OFFICE OF THE CITY MANAGER

531 K Street, Eureka, CA 95501 (707) 441.4144 www.ci.eureka.ca.gov

736 F Street
Arcata CA 95521

City Manager
707-822-5953

Community Development
707-822-5955

Environmental Services
Streets/Utilities
707-822-5957

Police
707-822-2428

Finance
707-822-5951

Environmental Services
Community Services
707-822-8184

Recreation
707-822-7091

Transportation
707-822-3775

Building & Engineering
707-825-2128

March 15, 2023

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.45 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

The City of Arcata (City) is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY23 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project, which is in a Census-Designated Rural Area**.**

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, The District informs me that Humboldt Bay has none of these constraints.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

The City strongly endorses this planning project as an important step in advancing the Sate's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

David Loya

Community Development Director

The Greater Eureka Chamber of Commerce
Business HQ

April 3, 2023

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, D.C. 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

The Board of Directors of the Greater Eureka Chamber of Commerce is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY23 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. West Coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

The Greater Eureka Chamber of Commerce strongly endorses this planning project as an important step in advancing the State's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Nancy Olson
President/CEO

COREHub
Redwood Region Climate & Community Resilience (CORE) Hub

363 Indianola Road, Bayside, CA 95524
info@hafoundation.org
(707) 442-2993

April 12, 2023

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

On behalf of the Redwood Coast Climate and Community Resilience Hub ("CORE Hub"),[1] we write in support of the Port of Humboldt Bay Harbor, Recreation, and Conservation District's ("District") application to the FY23 Maritime Administration of the U.S. Department of Transportation Port Port Infrastructure Development Program (PIDP) for its Redwood Multipurpose Marine Terminal Redevelopment Project.

Offshore wind (OSW) is an emerging energy and transportation market in the U.S., with the California coast as a critical, strategic location for OSW marshalling ports for the domestic floating OSW industry. The State of California appropriated $10.5 million to initiate development of an OSW port in Humboldt Bay, to serve as a hub for the OSW industry build-out across the U.S. West Coast. The Port of Humboldt Bay requires federal assistance from the PIDP to continue progress on this critical climate and economic initiative.

The District is applying for funds to redevelop the Redwood Multipurpose Marine Terminal, a 168-acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. This Project provides an unprecedented opportunity to build a state-of-the-art, all-electric, zero-emission port from the ground up, simultaneously remediate an environmental clean-up site, and demonstrate best practices in climate-mitigating and -resilient infrastructure deployment in a region with the fastest rate of sea level rise on the Pacific Coast.The Department of Transportation's support and funding is crucial to advance the Project and the West Coast OSW industry as a whole.

The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the floating OSW industry for the entire U.S. West Coast, particularly the world-class wind resource sites in Northern California and Southern Oregon. Where other ports are constrained by entrance bridges and shallow channel depths, Humboldt Bay has no bridges and appropriate depths for OSW activities. The Project will significantly increase the competitiveness of the U.S. OSW industry by reducing travel costs between the port and OSW farms, and create employment, safety, and environmental benefits[2] at the local level.

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[1] The CORE Hub was established by regional leaders in climate resilience, mitigation, and adaptation and is based at Humboldt Area and Wild Rivers Community Foundation, serving California Counties of Humboldt, Del Norte, and Trinity, as well as Curry County in Oregon, and 27 Tribal Nations and Indigenous Territories. *The CORE Hub's goal is to become the first proven carbon sequestering rural and Tribal region in the United States.* We act toward this goal through planning and policy guidance; facilitating healthy civic dialogue; taking action for equity; promoting accurate, accessible public information; providing research, analysis and technical assistance; project acceleration; promoting traditional knowledge and multi-generational values; and conducting rigorous tracking to document progress and ensure accountability. We have convened the North Coast Offshore Wind Community Benefits Network, with participants from over 30 governments, labor, private sector, environmental, and community based organizations, since June 2022. See: www.redwoodcorehub.org

[2] California Energy Commission. "Commission Report Preliminary Assessment of Economic Benefits of Offshore Wind." *California Offshore Renewable Energy*, 24 February 2023, https://efiling.energy.ca.gov/GetDocument.aspx?tn=248972&DocumentContentId=83529

The Project is located in ancestral and current homelands of the Wiyot Peoples, including three federally recognized Wiyot-area Tribes, the Bear River Band of the Rohnerville Rancheria, the Blue Lake Rancheria, and the Wiyot Tribe, with another five federally recognized Tribal Nations with adjacencies to the District and the Port. It is also a Census-Designated Rural Area. The Project presents new market and job creation opportunities for the District and the greater Humboldt Bay region, if designed and deployed to avoid conditions that gave rise to past boom-and-bust cycles of resource and wealth extraction, and environmental and social harms that have divested this region.

The region is already in non-attainment for PM10[3]. The potential for zero-emission port construction and operations will reduce risks of air pollution, which will avoid impacts on adjacent low-income and disadvantaged, marginalized communities. Lower emissions will also help prevent water pollution, to preserve the high-health of the waters of Humboldt Bay, another stated goal of the District, local aquaculture and mariculture industries, and the CORE Hub. Many ports including the Port of Long Beach are developing pathways to zero emissions by 2030[4]. This Project provides an opportunity to design for zero emissions from the start.

A combination of federal, state, and philanthropic resources will allow this project to reach its full potential of zero-emission and electrified infrastructure, ideally with carbon lifecycle analysis in the construction and operations plans and leases. This funding will help ensure a purpose-built new port that serves clean energy will itself be utilizing clean energy and avoiding localized pollution and climate-forcing emissions. Investment in the Project will also comport with U.S. and California climate and environmental justice policies, including investment categories of the Justice 40 Initiative[5], the Earth Shots, and Floating Offshore Wind Shot[6], current and future California Air Resources Board emissions requirements[7] for ports and related heavy-transport operations which will come into effect over the next few years, as well as Governor Gavin Newsom's Zero Emissions Executive Order[8]. As the region, state, and the U.S. transition to decarbonization and carbon sequestration, it is crucial that marquee projects such as a new port serving the U.S. West Coast be developed consistent with these policies and climate justice principles.

With climate resilience and zero-emission development incorporated into the Project, the CORE Hub strongly endorses this as an important step in advancing the U.S. strategic planning for OSW development. We urge you to give full consideration to the District's application to the PIDP grant program.

Sincerely,

Katerina Oskarsson, CORE Hub Executive in Residence

Jana Ganion, CORE Hub Senior Advisor

---

[3] North Coast Unified Air Quality Management District. "Ambient Air Quality Standards." https://www.ncuaqmd.org/ambient-air-quality-standards. As accessed 12 April 2023.
[4] Long Beach Container Terminal. "Net Zero Emissions by 2030." Net Zero 2030 Climate Action Plan, February 2023, https://www.lbct.com/Resources/NetZero2030Report12.20.22.pdf. As accessed on 12 April 2023.
[5] The White House. "Justice40: A Whole of Government Initiative." https://www.whitehouse.gov/environmentaljustice/justice40/. As accessed 12 April 2023.
[6] U.S. Department of Energy. "Floating Offshore Wind Shot." Office of Energy Efficiency and Renewable Energy, Wind Energy Technologies Office, https://www.energy.gov/eere/wind/floating-offshore-wind-shot. As accessed on 12 April 2023.
[7] California Air Resources Board. "Frequently Asked Questions for the Mobile Cargo Handling Equipment (CHE) Regulation at Ports and Intermodal Rail Yards." 23 November 2020, https://ww2.arb.ca.gov/sites/default/files/2020-12/chefaq11232020.pdf. As accessed 12 April 2023.
[8] California Air Resources Control Board. "Governor Newsom's Zero-Emission by 2035 Executive Order (N-79-20)." 19 January 2021, https://ww2.arb.ca.gov/resources/fact-sheets/governor-newsoms-zero-emission-2035-executive-order-n-79-20. As accessed 12 April 2023.

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March 10, 2023

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

The Environmental Protection Information Center, the North Coast's largest environmental advocacy organization, is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY23 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channel depths, Humboldt Bay has none of these constraints.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have significant employment, safety, and environmental benefits at the local level.

The Environmental Protection Information Center strongly endorses this planning project as an important step in advancing the State's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Thomas Wheeler

Thomas Wheeler
Executive Director

HUMBOLDT: POWERED

PORT OF HUMBOLDT, CALIFORNIA

U.S. DEPARTMENT OF TRANSPORTATION / MARITIME ADMINISTRATION

FY 2023 PORT INFRASTRUCTURE DEVELOPMENT PROGRAM (PIDP) GRANT APPLICATION

FY2022 PIDP
LETTERS OF SUPPORT

Submitted by:
Humboldt Bay Harbor Recreation and Conservation District
Eureka, California

U.S. SENATOR DIANNE FEINSTEIN
CALIFORNIA

COMMITTEE ON THE JUDICIARY
- CHAIR, HUMAN RIGHTS AND THE LAW
SELECT COMMITTEE ON INTELLIGENCE
COMMITTEE ON APPROPRIATIONS
- CHAIR, ENERGY AND WATER SUBCOMMITTEE
COMMITTEE ON RULES AND ADMINISTRATION

United States Senate

May 10, 2022

The Honorable Pete Buttigieg
Secretary of Transportation
Attn: Office of Port Infrastructure Development
1200 New Jersey Avenue, SE
Washington, D.C. 20590

Dear Secretary Buttigieg:

I am writing to express my support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's application for funding under the Department of Transportation's Maritime Administration Port Infrastructure Development Grant Program (PIDP). The Port of Humboldt Bay is seeking funding for its Redwood Multipurpose Marine Terminal Redevelopment Project, which will transform a vacant industrial site adjacent to the federal navigation channel in Humboldt Bay into the hub of the California offshore wind industry.

The Port of Humboldt Bay is requesting $12 million to continue progress on this critical climate and employment initiative. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry. The project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay and the Redwood Marine Terminal have none of these constraints, making this site ideally suited to serve the nascent floating offshore wind industry for the entire coast. In addition to reduced travel and operational costs, the project will have significant employment, safety, and environmental benefits at the local level. It presents a new market and job creation opportunity for the Harbor District and the greater Humboldt Bay region, which is in a census-designated rural area.

PIDP funding would supplement the $10.5 million that the State of California has already appropriated to initiate this project. I strongly support the implementation of this vital investment as an important step in advancing California's strategic planning for offshore wind development. If you have any questions, please do not hesitate to contact my San Francisco Office at 415-393-0716.

Sincerely,

Dianne Feinstein
United States Senator

ALEX PADILLA
CALIFORNIA

(202) 224-3553
PADILLA.SENATE.GOV

United States Senate
WASHINGTON, DC 20510

COMMITTEES:
BUDGET
ENVIRONMENT AND PUBLIC WORKS
HOMELAND SECURITY AND GOVERNMENTAL AFFAIRS
JUDICIARY
RULES AND ADMINISTRATION

May 13, 2022

The Honorable Pete Buttigieg
Secretary
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

RE: Humboldt Bay Conservation and Recreation District PIDP grant application

Dear Secretary Buttigieg:

I write in support of the Port Infrastructure Development Program (PIDP) grant application submitted by the Humboldt Bay Conservation and Recreation District for their Redwood Multipurpose Marine Terminal Redevelopment Project. The District is requesting $11.25 million in PIDP funding that will be matched with state funds already secured to complete this project.

The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry. If awarded, these funds will support the Port of Humboldt Bay continue to progress on this project that is critical for climate and employment initiatives in the state of California and the entire US West Coast for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

The District will use these funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. This is a Small Port/Small Project grant request to construct onsite access, site, and resiliency improvements and to complete NEPA/CEQA documentation for the location. The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

For all the aforementioned reasons, I urge your full and fair consideration of the District's application consistent with all applicable laws, rules, and regulations. The District's Redwood Multipurpose Marine Terminal Redevelopment Project support California's renewable energy generation goals, which is essential to the future of the State of California and the nation.

ALEX PADILLA
CALIFORNIA

(202) 224-3553
PADILLA.SENATE.GOV

United States Senate

WASHINGTON, DC 20510

COMMITTEES:
BUDGET
ENVIRONMENT AND PUBLIC WORKS
HOMELAND SECURITY AND GOVERNMENTAL AFFAIRS
JUDICIARY
RULES AND ADMINISTRATION

Please keep my office informed of the status of this application, and if I can be of further assistance, do not hesitate to contact my Northern California Field Representative, Roberto Rizo, at (916) 247-8122. Thank you for your attention and consideration.

Respectfully submitted,

ALEX PADILLA
United States Senator

JARED HUFFMAN
2ND DISTRICT, CALIFORNIA

WASHINGTON OFFICE
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WASHINGTON, DC 20515
PHONE: (202) 225-5161
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WEBSITE: huffman.house.gov

Congress of the United States
House of Representatives
Washington, DC 20515–0502

COMMITTEE ON
NATURAL RESOURCES
WATER, OCEANS, AND WILDLIFE – CHAIR
NATIONAL PARKS, FORESTS, AND PUBLIC LANDS
ENERGY AND MINERAL RESOURCES

COMMITTEE ON TRANSPORTATION
AND INFRASTRUCTURE
HIGHWAYS AND TRANSIT
WATER RESOURCES AND ENVIRONMENT

SELECT COMMITTEE ON THE
CLIMATE CRISIS

May 5, 2022

Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

I am writing in support of the Humboldt Bay Harbor, Recreation, and Conservation District's application for $12 million in funding through 2022 U.S. Department of Transportation (DOT) Maritime Administration Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project. This funding is key to the development of Humboldt Bay, offshore wind power, and related infrastructure in the rural north of my congressional district.

The DOT funds would begin redevelopment of the Redwood Multipurpose Marine Terminal, a 168-acre vacant industrial site adjacent to Humboldt Bay's federal navigation channel. The deep-water port and marine terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. While other ports are constrained by bridges and channel depths, Humboldt Bay has none of these constraints. The State of California recently appropriated $10.5 million to help develop Humboldt Bay as a hub for offshore wind, which would provide both climate and economic benefits for the Humboldt region and the West Coast.

Please give the Humboldt Bay Harbor, Recreation, and Conservation District's application for DOT Port PIDP funds your full and fair consideration. If you have any questions, please contact my staff John Driscoll at 707-407-3585.

Sincerely,

JARED HUFFMAN
Member of Congress

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999 FIFTH AVENUE, SUITE 290
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PHONE: (415) 258-9657
FAX: (415) 258-9913

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UKIAH
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FORT BRAGG
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FORT BRAGG, CA 95437
PHONE: (707) 962-0933
FAX: (707) 962-0905

EUREKA
317 THIRD STREET, SUITE 1
EUREKA, CA 95501
PHONE: (707) 407-3585
FAX: (707) 407-3559

May 3, 2022

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

The Governor's Office of Business and Economic Development is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY22 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project**.**

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

This is a Small Port/Small Project grant request to construct onsite access, site, and resiliency improvements and to complete NEPA/CEQA documentation for the entire site.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

The Governor's Office of Business and Economic Development strongly endorses this planning project as an important step in advancing **the Sate's** strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Dee Dee Myers
Director of the Office of Business and Economic Development

California Department of Transportation

OFFICE OF THE DIRECTOR
P.O. BOX 942873, MS–49 | SACRAMENTO, CA 94273–0001
(916) 654-6130 | FAX (916) 653-5776 TTY 711
www.dot.ca.gov

May 16, 2022

The Honorable Pete Buttigieg
Secretary of the United States Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The California Department of Transportation (Caltrans) supports the application of the Humboldt Bay Harbor, Recreation and Conservation District to the United States Department of Transportation's (USDOT) Port Infrastructure Development Program (PIDP) competitive grant program for the Redwood Multipurpose Marine Terminal Redevelopment Project at the Humboldt Bay Wind Port (Project).

The District is requesting $12 million from the PIDP program. The District has already received a grant from the California Energy Commission for $10.45 million for this Project. Thanks to that grant, permitting and design for the project are already underway. Permitting is scheduled to be completed in early 2024. Construction is scheduled to begin in early 2025. The Project includes the comprehensive redevelopment of a 168+ acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. The Project is critical to the development of offshore wind infrastructure and will be integral to US efforts to reduce greenhouse gas emissions. The Project site itself is also envisioned to be carbon neutral, with zero-emission infrastructure for vehicles and ships that service the port. The Project also advances environmental justice and racial equity.

There is an urgent need to invest in American ports to strengthen our supply chains, improve resilience, effectively support the U.S. economy, and help ensure environmental justice and community vitality. Caltrans supports this Project for its contributions toward advancing the Department's vision to reduce greenhouse gas emissions and minimize impacts on the environment and communities surrounding port operations.

Caltrans would like to thank USDOT for its consideration of this Project.

Sincerely,

STEVEN KECK
Acting Director

California State Senate

SENATOR MIKE McGUIRE
NORTHERN CALIFORNIA'S SECOND SENATE DISTRICT

May 4, 2022

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

I am writing in support of the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) grant application to the U.S. Department of Transportation Port Infrastructure Development Program (PIDP) for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The State of California has supported this project by appropriating $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California, a census-designated rural area, as the hub of the California's offshore wind industry. The Port of Humboldt Bay requires federal assistance from PIDP in order to continue progress on this critical climate and workforce initiative.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the emerging offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay is not. This is a Small Port/Small Project grant request to construct onsite access, site, and resiliency improvements and to complete NEPA/CEQA documentation for the entire site.

The Project presents new market and job creation opportunities for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with California poised as the next critical location for offshore wind marshalling ports for the domestic wind industry. In addition to reducing travel and operational costs for offshore wind development on the West Coast, the Project will have a significant workforce and environmental benefits at the local level.

I strongly endorse this project to advance California's strategic planning for offshore wind development and urge you to give this grant application your full consideration.

Warmest regards,

MIKE McGUIRE
Senator

STATE CAPITOL, SACRAMENTO, CA 95814 • (916) 651-4002 • WWW.SD02.SENATE.CA.GOV

COMMITTEES
CHAIR: HEALTH
BUDGET
INSURANCE
JOINT LEGISLATIVE AUDIT
WATER, PARKS, AND WILDLIFE
BUDGET SUBCOMMITTEE NO. 1 ON HEALTH AND HUMAN SERVICES
SELECT COMMITTEES
HEALTHCARE ACCESS IN RURAL COMMUNITIES
CRAFT BREWING AND DISTILLING
SEA LEVEL RISE IN CALIFORNIA

Assembly
California Legislature

JIM WOOD
ASSEMBLYMEMBER, SECOND DISTRICT

STATE CAPITOL
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DISTRICT OFFICES
200 S SCHOOL STREET, SUITE D
UKIAH, CA 95482
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FAX (707) 463-5773

50 D STREET, SUITE 450
SANTA ROSA, CA 95404
(707) 576-2526
FAX (707) 576-2297

1036 5TH STREET, SUITE D
EUREKA, CA 95501
(707) 445-7014
FAX (707) 455-6607

April 27, 2022

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.
I am pleased to support the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY22 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

This is a Small Port/Small Project grant request to construct onsite access, site, and resiliency improvements and to complete NEPA/CEQA documentation for the entire site.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

I strongly endorse this planning project as an important step in advancing the State's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Respectfully,

Jim Wood

JIM WOOD
Assemblymember, 2nd District

COUNTY OF HUMBOLDT
COUNTY ADMINISTRATIVE OFFICE
825 5th Street, Suite 112, Eureka, CA 95501-1153
Telephone (707) 445-7266 Fax (707) 445-7299
cao@co.humboldt.ca.us

April 28, 2022

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Sacramento, CA 95814

Dear Secretary Buttigieg,

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

The County of Humboldt is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY22 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project. The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

This is a Small Port/Small Project grant request to construct onsite access, site, and resiliency improvements and to complete NEPA/CEQA documentation for the entire site. The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

The County of Humboldt supports increasing investment in critical infrastructure, including the Port of Humboldt Bay and strongly endorses this planning project as an important step in advancing the Sate's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Elishia Hayes

Elishia Hayes
Humboldt County Administrative Officer

REDWOOD COAST EnergyAuthority

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

April 29, 2022

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) to continue progress on this critical climate and employment initiative.

The Redwood Coast Energy Authority (RCEA) is pleased to provide this letter of support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY22 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project**.**

RCEA is a local-government joint powers agency of the County of Humboldt, the Cities of Eureka, Arcata, Fortuna, Rio Dell, Ferndale, Blue Lake, and Trinidad, and the Humboldt Bay Municipal Water District. Formed in 2003, RCEA's mission is to develop and implement sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient and renewable resources available in the region.

Northern California and southern Oregon have a world-class wind resource off our coastline, and since 2016 RCEA has been working actively with the local community to plan for and pursue the development offshore wind energy as a central strategy to achieving our energy, climate, and economic development goals. Offshore wind will provide an important new source of clean energy -- producing power in the evening and at night when solar isn't generating – while also supporting the state's economic recovery through the creation of a new global innovation industry and high-quality jobs. While these outcomes are of the utmost importance to our rural, economically-disadvantaged community, the benefits off a west coast offshore wind energy industry will be at a scope and scale of state and national significance.

The development of offshore-wind harbor infrastructure is a critical first step in realizing the potential of offshore wind energy—we can't start building the wind farms until there are the port facilities to support the work and the jobs that will come with that work. The climate emergency requires swift and bold

633 3rd Street, Eureka, CA 95501 (707)269-1700 info@redwoodenergy.org www.RedwoodEnergy.org

action, and the energy sector is poised to rapidly grow offshore wind into a central element of addressing this challenge while also growing the economy. The Humboldt Bay Harbor District's project will provide the foundation for bringing this opportunity to reality on the west coast.

RCEA strongly endorses this planning project as an important step in advancing the Sate's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program. Please don't hesitate to contact me if you have any questions or I can provide any additional information.

Sincerely,

Eileen Verbeck
Acting Executive Director

CAL POLY HUMBOLDT

Office of the President

May 10, 2022

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

Cal Poly Humboldt is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY22 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

This is a Small Port/Small Project grant request to construct onsite access, site, and resiliency improvements and to complete NEPA/CEQA documentation for the entire site.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

Cal Poly Humboldt strongly endorses this planning project as an important step in advancing the Sate's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Tom Jackson, Jr, Ed.D.
President, Cal Poly Humboldt

1 Harpst Street, Arcata, California 95521-8299 | 707-826-3311 | president.humboldt.edu

COLLEGE OF THE REDWOODS

April 28, 2022

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

College of the Redwoods is pleased to express strong support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY22 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

This is a Small Port/Small Project grant request to construct onsite access, site, and resiliency improvements and to complete NEPA/CEQA documentation for the entire site.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

College of the Redwoods strongly endorses this planning project as an important step in advancing the State's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Keith Flamer

Keith Flamer, PhD
President/Superintendent
College of the Redwoods

May 3, 2022

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

The City of Eureka is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY22 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

This is a Small Port/Small Project grant request to construct onsite access, site, and resiliency improvements and to complete NEPA/CEQA documentation for the entire site.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

The City of Eureka strongly endorses this planning project as an important step in advancing the Sate's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Susan Seaman
Susan Seaman
Mayor

THE CITY OF
EUREKA
OFFICE OF THE CITY MAYOR

531 K Street, Eureka, CA 95501 (707) 441.4144 www.ci.eureka.ca.gov

City of Arcata
736 F Street
Arcata CA 95521

City Manager 707-822-5953	*Environmental Services* 707-822-8184	*Police* 707-822-2428	*Recreation* 707-822-7091
Community Development 707-822-5955	*Finance* 707-822-5951	*Engineering* 707-825-2128	*Transportation* 707-822-3775

May 12, 2022

The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

RE: Letter of SUPPORT—Humboldt Bay Harbor, Recreation, and Conservation District, PIDP Grant Application

Dear Secretary Buttigieg:

The State of California has appropriated $10.5 million to initiate development of an offshore wind marshalling port in Humboldt Bay, California as the hub of the California offshore wind industry. The Port of Humboldt Bay requires federal assistance from the Port Infrastructure Development Program (PIDP) in order to continue progress on this critical climate and employment initiative.

The City of Arcata is pleased to express support for the Port of Humboldt Bay Harbor, Recreation, and Conservation District's (District) application to the FY22 Maritime Administration of the U.S. Department of Transportation Port PIDP grant program for its Redwood Multipurpose Marine Terminal Redevelopment Project.

The Project is located at the Port of Humboldt Bay, which is in a Census-Designated Rural Area.

The District is applying for funds to begin redevelopment of the Redwood Multipurpose Marine Terminal, which is a 168-plus acre vacant industrial site adjacent to the federal navigation channel in Humboldt Bay. The Humboldt Bay Port and the Redwood Marine Terminal site are ideally suited to serve the nascent floating offshore wind industry for the entire West Coast. Whereas other ports are constrained by bridges and channels depths, Humboldt Bay has none of these constraints.

This is a Small Port/Small Project grant request to construct onsite access, site, and resiliency improvements and to complete NEPA/CEQA documentation for the entire site.

The Project presents a new market and job creation opportunity for the District and the greater Humboldt Bay region. Offshore wind is an emerging energy and transportation market in the U.S., with the California coast poised as the next critical location for offshore wind marshalling ports for the domestic wind industry.

The Project will significantly increase the competitiveness of the U.S. offshore wind industry by reducing travel costs between marshalling port and offshore wind farm installations on the U.S. west coast. In addition to reduced travel and operational costs, the Project will have a significant employment, safety, and environmental benefits at the local level.

The City of Arcata strongly endorses this planning project as an important step in advancing the State's strategic planning for offshore wind development. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Stacy Atkins-Salazar, Mayor
City of Arcata

OPERATING ENGINEERS LOCAL UNION NO. 3

1330 BAYSHORE WAY, SUITE #103, EUREKA, CA 95501 • (707) 443-7328 • FAX (707) 443-9238

Jurisdiction: Northern California, Northern Nevada, Utah, Hawaii, and the Mid-Pacific Islands

May 12, 2022
The Honorable Pete Buttigieg
U.S. Secretary of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg:

The State of California has set aside $10.5 million for the development of an offshore wind marshalling port located within Northern California's Humboldt Bay. Development of this marshalling port is key to bringing much-needed jobs to this economically disadvantaged region and establishing California's offshore wind industry. However, the Port of Humboldt Bay is in need of federal assistance from the Port Infrastructure Development Program (PIDP), if it is to make progress on this critical piece of infrastructure.

As the district representative of Operating Engineers Local 3, which represents the working people who make up the region's skilled and trained workforce, I am writing to express support for the Port of Humboldt Bay Harbor, Recreation and Conservation District's Redwood Multipurpose Marine Terminal Redevelopment Project application to the FY22 Maritime Administration of the U. S. Department of Transportation PIDP grant program. If granted, PIDP funds would be used for redevelopment of the vacant, 168-acre, industrial Redwood Multipurpose Marine Terminal site, which is adjacent to the Humboldt Bay's federal navigation channel. Due to the site's location, as well as the constraints imposed by the presence of bridges and shallow channel depths at other ports, which are not present in Humboldt Bay, this project is ideally suited for the offshore wind industry's development along the entire West Coast. This Small Port/Small Project grant request is to construct onsite access, site and resiliency improvements and to complete NEPA/CEQA documentation for the site.

Operating Engineers Local 3, and the skilled workers it represents, knows that the Redwood Multipurpose Marine Terminal Redevelopment Project will bring a new market to the region, creating good-paying, stable job opportunities for local residents and boosting economic activity where it is needed most. It will also increase our nation's competitiveness in the offshore wind industry and reduce costs associated with establishing offshore wind farms.

Most importantly, it will benefit working families and the communities they live and work in, and do so with significant employment, safety and environmental benefit. As a result, we are eager to be a part of this emerging energy and transportation market.

I strongly endorse this planning project as an important step in advancing the state's development of offshore wind. I urge you to give full and fair consideration to the District's application to the PIDP grant program.

Sincerely,

Jeff Hunerlach

Jeff Hunerlach
District Rep. Eureka District 40, Operating Engineers Local 3

OCS Study
BOEM 2023-010

California Floating Offshore Wind Regional Ports Assessment

U.S. Department of the Interior
Bureau of Ocean Energy Management
Pacific OCS Region, Camarillo, CA

OCS Study
BOEM 2023-010

California Floating Offshore Wind Regional Ports Assessment

January 2023

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U.S. Department of the Interior
Bureau of Ocean Energy Management
Pacific OCS Region, Camarillo, CA

DISCLAIMER

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REPORT AVAILABILITY

To download a PDF file of this report, go to the U.S. Department of the Interior, Bureau of Ocean Energy Management Recently Completed Environmental & Technical Studies – Pacific webpage (https://www.boem.gov/Pacific-Completed-Studies/), and click on the link for 2023-010.

CITATION

Trowbridge M, Lim J, Phillips S (Moffatt & Nichol, Long Beach, CA). 2023. California Floating Offshore Wind Regional Ports Assessment. U.S. Department of the Interior, Bureau of Ocean Energy Management. 61 p. Report No.: OCS Study BOEM 2023-010. Contract No.: 140M0121D0008.

ABOUT THE COVER

Photo Description: Floating offshore wind turbines installed at sea and one turbine being towed out for installation.

Photo Credit: Moffatt & Nichol

ACKNOWLEDGMENTS

We would like to thank the following for their time and participation in completing this effort: City of Alameda, City of Morro Bay, Crescent City Harbor District, Diablo Canyon, Port of Benicia, Port of Hueneme, Port of Humboldt, Port of Long Beach, Port of Los Angeles, Port of Oakland, Port of Redwood City, Port of Richmond, Port of San Diego, Port San Luis, Port of San Francisco, Port of Stockton, Port of San Francisco, AMPORTS (Port of Benicia), BAE Systems (Port of San Diego), NASSCO (Port of San Diego), and Pasha Automotive Services (Port of San Diego).

Contents

List of Figures

List of Tables

List of Abbreviations and Acronyms

AB	Assembly Bill
ABS	American Bureau of Shipping
ACI	American Concrete Institute
AFOD	AF Offshore Decommissioning
AISC	American Institute for Steel Construction
API	American Petroleum Institute
ASCE	American Society of Civil Engineers
AWS	American Welding Society
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CARB	California Air Resources Board
CBC	California Building Code
CEC	California Energy Commission
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CSLC	California State Lands Commission
CTV	Crew transfer vessel
e.g.	*Exempli gratia* (for example)
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
etc.	et cetera
ft	feet
GBS	Gravity-based structure
GW	Gigawatts
i.e.	*id est* (that is)
IDIQ	Indefinite Delivery Indefinite Quantity
IDWG	Interagency Decommissioning Working Group
LSU	Louisiana State University
m	meter / meters
M&N	Moffatt & Nichol
MF	Manufacturing / Fabrication
MMS	Minerals Management Service
MW	Megawatt
N/A	Not applicable
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NOA	Notice of Availability
NOI	Notice of Intent
NOP	Notice of Preparation
NREL	National Renewable Energy Laboratory

O&M	Operation and Maintenance
OCIMF	Oil Companies International Marine Forum
OCS	Outer Continental Shelf
OEM	Original equipment manufacturers
OSW	Offshore wind
Pacific OCS	Outer Continental Shelf off the coasts of California, Oregon, Washington, and Hawaii
PARS	port access route study
PIANC	Permanent International Association of Navigation Congresses
PPE	Personal protection equipment
psf	pounds per square foot
ROD	Record of Decision
RORO	Roll-on / roll-off
S&I	Staging and Integration
SATV	Service accommodation transfer vessel
Schatz	Schatz Energy Research Center
SLO	San Luis Obispo
SOV	Service operations vessel
SPMTs	self-propelled modular trailers
TLP	Tension Leg Platform
U.K.	United Kingdom
UC	University of California
UFC	Unified Facilities Criteria
U.S.	United States
USACE	United States Army Corps of Engineers
USC	University of Southern California
USCG	U.S. Coast Guard
USDOE	U.S. Department of Energy
WEA	Wind Energy Area
WTG	Wind turbine generator
yr	Year

How to Read this Report

The overall goals of this California Floating Offshore Wind Energy Regional Ports Assessment are to:

1. Identify port requirements and deployment scenarios needed to support an offshore wind industry in California, concurrently with reasonably foreseeable Pacific Outer Continental Shelf (OCS) oil and gas decommissioning activities; and,
2. Assess physical, operational, and regulatory capabilities and constraints of port facilities and infrastructure.

This report has the following structure:

- **Section 1** provides an introduction and background to the study.
- **Section 2** documents the port requirements from a previous Bureau of Ocean Energy Management (BOEM) study titled *Port of Coos Bay Port Infrastructure Assessment for Offshore Wind Development* (Moffatt & Nichol 2022).
- **Section 3** identifies the five deployment scenarios for 2030 through 2050 and determines the number of required staging and integration (S&I) and manufacturing/fabrication (MF) sites needed to meet the above deployment scenarios.
- **Section 4** discusses the port outreach that was conducted as part of this study.
- **Section 5** identifies the number and type of California port sites that are potentially available for offshore wind development.
- **Section 6** identifies the port requirements for offshore oil and gas platform decommissioning and assesses which ports are ideal for this type of activity.
- **Section 7** provides a summary of the study and recommended next steps.

There are three (3) main port facilities that are required for offshore wind development: staging and integration (S&I), manufacturing/fabrication (MF), and operations and maintenance (O&M) facilities. The following describes the type of activities conducted at each. For details on the specific requirements of each site, refer to **Section 2**.

- **Staging and Integration (S&I) Site:** a site to receive, stage, and store offshore wind components and to assemble the floating turbine system for towing to the offshore wind area. This facility is likely to support the following services:
  - **Turbine Maintenance Site:** a facility to perform major maintenance on a fully assembled turbine system that cannot otherwise be performed in the offshore wind area, such as replacement of a nacelle or blade.
- **Manufacturing / Fabrication (MF) Site:** a port site located on a navigable waterway that receives raw materials via road, rail, or waterborne transport and creates larger components in the offshore wind supply chain. This site typically includes factory and/or warehouse buildings and space for storage of completed components.
- **Operations and Maintenance (O&M) Site:** a base of wind farm operations with warehouses/ offices, spare part storage, and marine facility to support vessel provisioning and refueling/ charging for the following O&M vessels during the operational period of the offshore wind farm:
  - **Crew Transfer Vessel (CTV):** transfers small crews to offshore wind turbine installations for day-trip O&M visits and inspections.
  - **Service Operating Vessel (SOV):** vessels that loiter and operate as in-field accommodations for workers and platform assist for wind turbine servicing and repair work. This vessel may remain in the vicinity of an offshore windfarm for an extended period of time with a permanent or semi-permanent personnel rotation.

- **Service Accommodation Transfer Vessel (SATV):** intermediate between SOVs and CTVs, with ability to sleep onboard for multiday trips.

Additional offshore wind port sites that are not included in this study but will be required for offshore wind industry use include:

- Other Types of Offshore Wind Port Sites:
    - **Installation Support Site:** a base of construction operations for the fleet of construction vessels necessary for construction and commissioning of the offshore wind farm.
    - **Mooring Line, Anchor, and Electrical Cable Laydown Site:** a site to receive and stage mooring lines, anchors, and electrical cables to support the installation of the offshore wind farm.
    - **Cable Landing Site:** locations for the electrical cables to transition from the offshore (e.g., subsea cables) to a grid connection location. These sites may include electrical infrastructure onshore.
    - **End of Life Decommissioning Site:** a site to decommission, disassemble, recycle, and dispose of turbine systems that are at end of life.

Executive Summary

The Bureau of Ocean Energy Management (BOEM) is interested in a study of California ports to support offshore wind development. Specifically, the infrastructure apart from the offshore energy facility itself, such as ports, navigation, transmission, and supply chain. This study will address the needs and requirements of California ports to support floating offshore wind. It will also support the California Assembly Bill (AB) 525 Strategic Plan that is due June 30, 2023 (Chiu 2021).

The objective of this study is to develop offshore wind deployment scenarios, which include size (gigawatts [GW]) and timing (e.g., years 2030 and 2045), as well as a high-level screening study to identify the required quantity and size of various port facilities needed to support the deployment scenarios. The feasibility of port upgrades and associated cost estimates are not included in this study but will be included in the following BOEM study titled *California Floating Offshore Wind Regional Ports Feasibility Analysis*. In addition to an assessment of existing ports, this study also considered port capabilities and requirements needed to accommodate current and anticipated Pacific Outer Continental Shelf (OCS) oil and gas decommissioning activities.

Based on this study, multiple port sites will need to be developed to meet the identified offshore wind deployment targets. Fortunately, **many existing port sites within California were identified** that could meet these goals. To do so, this will require significant investment into existing ports to support the offshore wind industry needs.

In a letter to the California Air Resources Board (CARB) dated July 22, 2022, Governor Gavin Newsom urged the California Energy Commission (CEC) to establish an offshore wind planning goal of at least 20 GW by 2045 (Newsom 2022). On August 1, 2022, the CEC established a preliminary offshore wind planning goal of 2 to 5 GW by 2030 and 25 GW by 2045 for California (Flint et al. 2022). Using these goals as a baseline, this study assessed a range of deployment scenarios for 2030 through 2050, which can be found in **Section 3**.

From these deployment targets, the required number of staging and integration (S&I) and manufacturing / fabrication (MF) sites were determined in **Section 3**. The determination of the number of operations and maintenance (O&M) sites is not included in this study but will be provided in the future AB 525 Strategic Plan. Refer to **Table 2** and **Section 2** for the requirements of each type of port site (e.g. acreage size, length of wharf, berth depth, etc.).

After the deployment targets and number of required port sites were identified, an inventory of potentially available port sites within California was taken. Moffatt & Nichol (M&N), BOEM, and California State Lands Commission (CSLC) conducted outreach meetings with seventeen (17) California ports/facilities and four (4) additional port tenants/operators to determine interest for offshore wind development and assess availability and suitability of potential sites without relocating existing uses (e.g., container, cargo, fishing, recreational boating, etc.). For a detailed list of the California ports and port tenants/operators that were contacted as part of this outreach, refer to **Section 5**.

Following outreach efforts with the California ports, an assessment of the ports was conducted in **Section 6**. It is important to note that currently, existing port sites on the United States (U.S.) West Coast are not ready to serve the offshore wind industry from a port infrastructure perspective (i.e., wharf, navigation channel, backlands, etc.). All potential port sites will require some level of investment to upgrade existing facilities, such as construction of a new wharf to withstand heavier loading and dredging of the navigation channel and/or berth pockets.

S&I sites require a large amount of space, deep navigation channels, and cannot have any air draft restrictions since the fully assembled turbine systems, which are 1,100 feet above water, need to be towed out to the installation site at the wind energy area (WEA). Therefore, only the ports of Humboldt, Los Angeles, and Long Beach were identified to have **good S&I candidate** sites that meet the required criteria.

MF sites can occupy less space than S&I sites and be at locations with air draft restrictions since the components (e.g., tower sections, nacelles, blades, and floating foundations) can be transported horizontally via vessel or barge. Therefore, ports located behind bridges, such as those in the Bay Area, are candidates for offshore wind development as MF sites. The following ports, ordered north to south, were identified to have **good MF candidate** sites with adequate acreage:

- Port of Humboldt
- Port of Benicia
- Port of Stockton
- Port of Richmond
- Port of San Francisco
- Port of Redwood City
- Port of Los Angeles
- Port of Long Beach
- Port of San Diego[1]

Ideally, O&M sites that transfer crew to and from the offshore wind farm shall be close to the wind farm location to minimize travel time. The following ports, ordered north to south, were identified to have **good O&M candidate** sites:

- Crescent City Harbor District
- Port of Humboldt
- City of Morro Bay
- Diablo Canyon Power Plant
- Port San Luis
- Port of Hueneme

While this study focuses on assessing the seventeen (17) existing California ports/facilities, another study for the CSLC assessed additional existing harbors between San Francisco and Long Beach to identify additional O&M sites that are closer to the Morro Bay WEA (Moffatt & Nichol 2023b).

The information gathered from this, and previous studies, will inform the next BOEM study titled *California Floating Offshore Wind Regional Ports Feasibility Analysis*, which will assess the feasibility of port upgrades and associated cost estimates and construction timelines. In addition, the AB 525 Strategic Plan, with support from the BOEM and CSLC studies, will include the following:

- Identify required port infrastructure improvements, including cost and schedule,
- Identify impacts to natural and cultural resources, including coastal resources, fisheries, and Native American and Indigenous peoples,
- Rank the recommended port sites,
- Determine workforce development needs, training, and strategy,
- Develop the seaport chapter for the AB 525 Strategic Plan due June 30, 2023.

[1] Within the Port of San Diego, manufacturing / fabrication of offshore wind floating foundations is possible at the NASSCO site and steel component fabrication and ship repair services are possible at the BAE Systems site.

As part of this study of assessing California ports, BOEM has also indicated the need to identify port requirements and capabilities to support Pacific OCS oil and gas decommissioning activities. As the twenty-three (23) Federal oil and gas platforms offshore southern California reach the end of their production lifetimes, decommissioning is the next step. As of this writing, eight Federal offshore oil and gas platforms have already ceased production, therefore requiring the platforms to undergo the decommissioning process. Identifying port requirements and capabilities to support the current and increasing Pacific OCS oil and gas decommissioning activities is an important outcome of this study. After identifying the necessary port requirements for decommissioning activities, an assessment was completed to determine whether these activities could be co-located with offshore wind port sites. Refer to Section 7 for offshore oil and gas decommissioning considerations.

There are some synergies between the offshore wind industry and the offshore oil and gas decommissioning industry. These synergies include similar business lines from a terminal equipment, operator, and vessel perspective, and the efficiency of two facilities located within the same port. However, they cannot be located at the same port site as both need designated berth and upland space for long periods of time. Of the ports in California, the **Port of Los Angeles and Port of Long Beach were identified to be the ideal locations for offshore oil and gas platform decommissioning** due to proximity to the offshore oil and gas platforms, access to steel recycling facilities, potential for large purpose-built sites, no air draft restrictions, wide entrance channels, and large navigation channels.

1 Introduction

The United States (U.S.) Department of the Interior, Bureau of Ocean Energy Management (BOEM), as mandated by the Outer Continental Shelf (OCS) Lands Act, administers exploration and development of energy and mineral resources in federal waters. This includes the responsibility of issuing a lease, easement, or right-of-way for offshore energy and mineral resources in federal waters off the coasts of California, Oregon, Washington, and Hawaii – the Pacific OCS Region.

The Pacific OCS is characterized by rapidly increasing water depths that exceed the feasible limits of traditional fixed-bottom offshore wind turbines. Thus, floating offshore wind technology is more suitable for this region. To construct floating offshore wind turbines, the turbine components will need to be fabricated, assembled, and transported from an onshore port to the offshore wind site. Existing port infrastructure on the U.S. West Coast, including the California coast, is not adequate to support these activities and significant port investment is required to develop offshore wind port facilities.

BOEM is interested in a study of California ports to support offshore wind development. Specifically, the infrastructure apart from the offshore energy facility itself, such as ports, navigation, transmission, and supply chain. This study will address the needs and requirements of California ports to support floating offshore wind. It will also support the California Assembly Bill (AB) 525 Strategic Plan that is due June 30, 2023 (Chiu 2021).

It should be noted that this study is part of an overarching BOEM Indefinite Delivery Indefinite Quantity (IDIQ) contract that includes the following three studies:

- Task Order 1: *Port of Coos Bay Port Infrastructure Assessment for Offshore Wind Development* study, published in 2022.
- Task Order 2: *California Floating Offshore Wind Regional Ports Assessment* study, to be published in 2023 (this report).
- Task Order 3: *California Floating Offshore Wind Regional Ports Feasibility Analysis* study, to be published in 2023 (next report).

Regarding port infrastructure, the AB 525 Strategic Plan shall identify available port space and the necessary investments to improve waterfront facilities for the floating offshore wind industry. In addition, the AB 525 Strategic Plan shall include identification of sea space for wind energy areas (WEAs) to accommodate the offshore wind planning goals for 2030 and 2045 (Chiu 2021). To date, BOEM has identified two offshore WEAs off the state of California, the Humboldt WEA and Morro Bay WEA**.**

The objective of this study is to develop offshore wind deployment scenarios, which include size (gigawatts [GW]) and timing (e.g., years 2030 and 2045), as well as a high-level screening study to identify the required quantity and size of various port facilities needed to support the deployment scenarios. The feasibility of port upgrades and associated cost estimates are not included in this study, but will be included in the following BOEM study titled *California Floating Offshore Wind Regional Ports Feasibility Analysis*. In addition to an assessment of existing ports, this study also considered port capabilities and requirements needed to accommodate current and anticipated OCS oil and gas decommissioning activities.

The overall goals of the California Floating Offshore Wind Regional Ports Assessment are to:

1. Identify port requirements and deployment scenarios needed to support an offshore wind industry in California, concurrently with reasonably foreseeable OCS oil and gas decommissioning activities; and,

2. Assess physical, operational, and regulatory capabilities and constraints of port facilities and infrastructure.

The key to a successful port development strategy requires coupling it with the proposed California offshore wind solicitation schedule and deployment scenarios. On December 6, 2022, BOEM held an offshore wind energy lease sale for five lease areas, two within the Humboldt WEA and three within the Morro Bay WEA (BOEM 2022). The size of each lease area ranges from 63,338 to 80,418 acres and has a potential installation capacity of 769 to 976 megawatts (MW), refer to **Figure 1**. On December 7, 2022, the lease sale ended and five provisional winners were announced – RWE Offshore Wind Holdings, LLC; California North Floating LLC; Equinor Wind US LLC; Central California Offshore Wind LLC; and Invenergy California Offshore LLC. It is imperative that the build out of port infrastructure can support this proposed schedule and offshore wind deployment scenarios. This study examines the following port development options:

- Utilize a single port (or as few as possible) to support all floating offshore wind fabrication, assembly, and operations (e.g., co-locate integration, fabrication, and operations and maintenance facilities).
- Utilize multiple port facilities to optimize development at the most ideal locations and to spread the economic impact throughout the state (e.g., separate integration, fabrication, and operations and maintenance facilities).

This study, and additional offshore wind studies, will help inform the AB 525 Strategic Plan that is intended to present findings that will help the state make decisions regarding the offshore wind industry within California. The AB 525 Strategic Plan will be informed by the following studies:

- BOEM Study (Task Order 1), *Port of Coos Bay Port Infrastructure Assessment for Offshore Wind Development* (Moffatt & Nichol 2022)
    - Extensive offshore wind developer outreach was conducted within this Port of Coos Bay, Oregon study to help inform the port facility requirements for offshore wind development on the U.S. West Coast. These port requirements are summarized within **Section 2**.
- BOEM Study (Task Order 2), *California Floating Offshore Wind Regional Ports Assessment* (this report)
    - Extensive California port outreach was conducted for the entire state within this study to assess how much space/acreage the existing California ports have available to support the offshore wind industry.
- BOEM Study (Task Order 3), *California Floating Offshore Wind Regional Ports Feasibility Analysis* (Moffatt & Nichol 2023a) (next BOEM study)
    - The feasibility of port upgrades and associated cost estimates and timelines will be determined and assessed for the sites previously identified in BOEM Task Order 2.
- California State Lands Commission (CSLC) Study, *Alternative Port Assessment to Support Offshore Wind* (Moffatt & Nichol 2023b)
    - A feasibility assessment was conducted for the region between San Francisco and Long Beach to determine the opportunities and limitations for creating new alternative port locations to support the offshore wind industry.

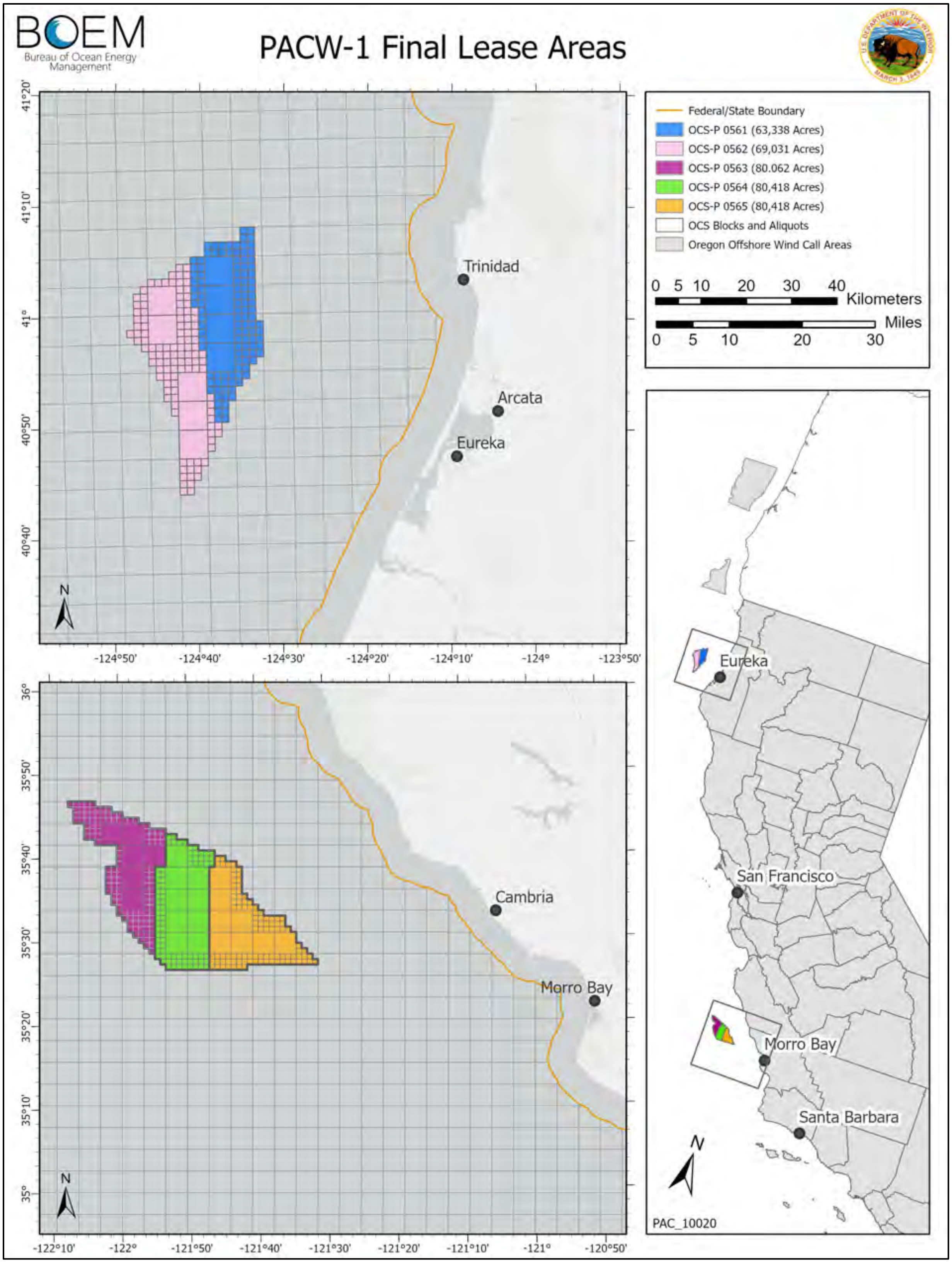

Figure 1. California final lease areas (BOEM 2022)

2 Port Requirements

The floating offshore wind industry requires port sites to stage, assemble, and provide ongoing operations and maintenance of the wind turbines. Based on the industry outreach completed for the BOEM study titled *Port of Coos Bay Port Infrastructure Assessment for Offshore Wind Development*, this section defines the requirements of this port assessment and the design criteria for the following types of offshore wind port sites (Moffatt & Nichol 2022):

- **Staging and Integration (S&I) Site:** a site to receive, stage, and store offshore wind components and to assemble the floating turbine system for towing to the offshore wind area. This facility is likely to support the following services:
    - **Turbine Maintenance Site:** a facility to perform major maintenance on a fully assembled turbine system that cannot otherwise be performed in the offshore wind area such as replacement of a nacelle or blade.
- **Manufacturing/Fabrication (MF) Site:** a port site located on a navigable waterway that receives raw materials via road, rail, or waterborne transport and creates larger components in the offshore wind supply chain. This site typically includes factory and/or warehouse buildings and space for storage of completed components.
- **Operation and Maintenance (O&M) Site:** a base of wind farm operations with warehouses/ offices, spare part storage, and marine facility to support vessel provisioning and refueling/ charging for the following O&M vessels during the operational period of the offshore wind farm:
    - **Crew Transfer Vessel (CTV):** transfers small crews to offshore wind turbine installations for day-trip O&M visits and inspections.
    - **Service Operating Vessel (SOV):** vessels that loiter and operate as in-field accommodations for workers and platform assist for wind turbine servicing and repair work. This vessel may remain in the vicinity of an offshore windfarm for an extended period of time with a permanent or semi-permanent personnel rotation.
    - **Service Accommodation Transfer Vessel (SATV):** intermediate between SOVs and CTVs, with ability to sleep onboard for multiday trips.

Additional offshore wind port sites that are not included in this study but will be required for offshore wind industry use include:

- Other Types of Offshore Wind Port Sites:
    - **Installation Support Site:** a base of construction operations for the fleet of construction vessels necessary for construction and commissioning of the offshore wind farm.
    - **Mooring Line, Anchor, and Electrical Cable Laydown Site:** a site to receive and stage mooring lines, anchors, and electrical cables to support the installation of the offshore wind farm.
    - **Cable Landing Site:** locations for the electrical cables to transition from the offshore (e.g., subsea cables) to a grid connection location. These sites may include electrical infrastructure onshore.
    - **End of Life Decommissioning Site:** a site to decommission, disassemble, recycle, and dispose of turbine systems that are at end of life.

2.1 Turbine Size

Based on the information obtained from a previous BOEM study and industry outreach, currently 12-MW offshore wind turbine systems are commercially available; however, the anticipated size of turbine systems to be installed on the U.S. West Coast may be 15 MW or larger (Moffatt & Nichol 2022). **Table 1** summarizes the anticipated dimensions for a floating turbine system with capacity of up to 20 – 25 MW. Turbine device dimensions provided are relative to the future industry needs for 15 to 25-MW size devices. Smaller size devices (beam, draft) are currently in development but are at reduced turbine capacity. The values outlined in the table are those recommended for planning a major port terminal on a 50-year time horizon to meet the anticipated needs of the continuously developing offshore wind industry. In addition, **Figure 2** shows a depiction of the turbine dimensions.

Table 1. Floating offshore wind turbine dimensions (20 – 25 MW)

Floating Offshore Wind Turbine	Approximate Dimension [ft]	Approximate Dimension [m]
Foundation Beam / Width	Up to 425 ft x 425 ft	Up to 130 m x 130 m
Draft (Before Integration)	15 – 25 ft	4.5 – 7.5 m
Draft (After integration)	20 – 50 ft	6 – 15 m
Hub/Nacelle Height (from Water Level)	Up to 600 ft	Up to 183 m
Tip Height (from Water Level)	Up to 1,100 ft	Up to 335 m
Rotor Diameter	Up to 1,000 ft	Up to 305 m

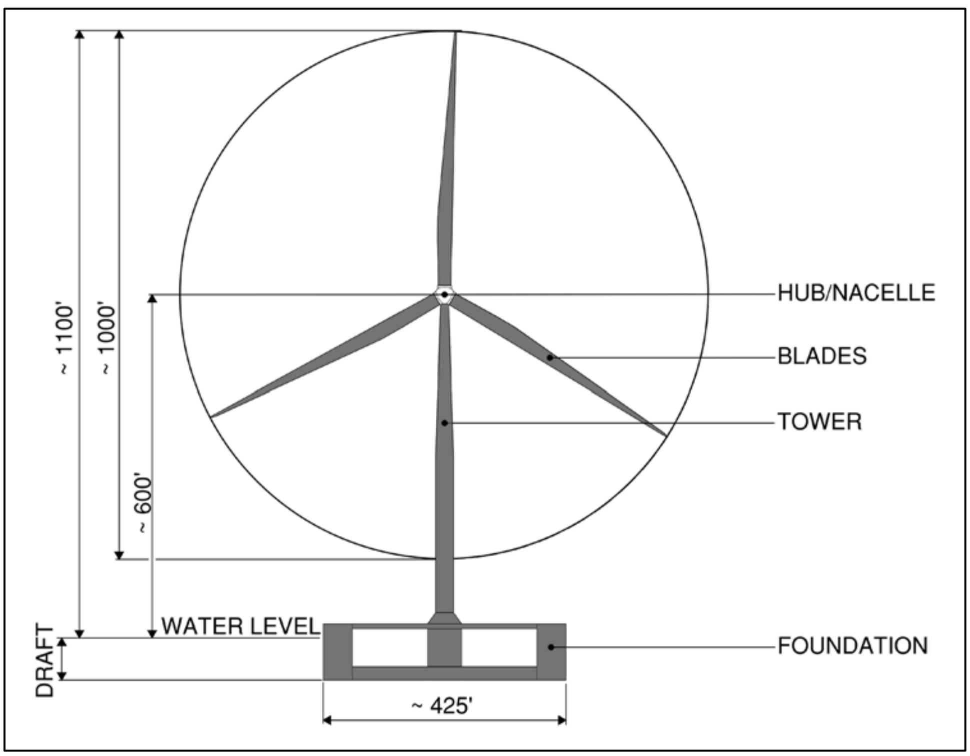

Figure 2. Floating offshore wind turbine dimensions (20 – 25 MW)

2.2 Port Requirements

The following parameters document the required port infrastructure to unload, store, pre-commission, and pre-assemble floating offshore wind farm components per the BOEM Port of Coos Bay study (Moffatt & Nichol 2022).

2.2.1 Port Wharf and Loading Requirements

Per discussions with industry, the S&I wharf shall accommodate the delivery of components and at least two turbine assemblies moored adjacent to one another, resulting in approximately 1,500 feet of quayside space, as summarized in **Table 2**. For O&M and component manufacturing facilities, the length of the wharf is dependent on the vessel type it serves. For example, SOV and CTV for O&M facilities and delivery vessels and delivery barges for component manufacturing facilities.

In general, the wharf and uplands area for component manufacturing sites shall have a capacity of 2,000 – 3,000 pounds per square foot (psf) to support offshore wind turbine generator (WTG) components. At S&I sites, the wharf loading will be higher where the crane for turbine assembly is located. Existing crawler cranes, such as the Liebherr 1300, are not large enough to assemble turbines greater than 15 MW. Thus, ring cranes or larger crawler or mobile cranes will likely be required to integrate components, requiring a loading capacity of 6,000 psf on the wharf. Loading at O&M facilities is expected to range from 100 – 500 psf.

The size of a site is also dependent on the type of facility it is. For an O&M facility, the site shall be approximately 5 – 10 acres. For component manufacturing and staging and integration sites, a range of 30 – 100 acres is requested depending on the developer and their use.

Table 2. Port infrastructure requirements

Floating Offshore Wind Turbine	Approximate Criteria for S&I Sites	Approximate Criteria for MF Sites	Approximate Criteria for O&M Sites
Acreage, minimum	30 – 100 acres	30 – 100 acres	5 – 10 acres
Wharf Length	1,500 ft	800 ft	300 ft
Minimum Draft at Berth	38 ft	38 ft	20 – 30 ft
Draft at Sinking Basin*	40 – 100 ft	N/A	N/A
Wharf Loading	> 6,000 psf	Up to 6,000 psf	100 – 500 psf
Uplands / Yard Loading (for WTG components)	> 2,000 – 3,000 psf	> 2,000 – 3,000 psf	N/A

*Options for transfer of floating foundation from land to water include use of semi-submersible barge and sinking basin, ramp system, or direct transfer methods (lifting portions or complete foundation units from land into water)

2.2.2 Floating Foundation Type and Launching

Currently, there are three types of floating foundations for floating offshore wind turbines, as shown in **Figure 3**:

- **Spar:** A Spar floating foundation, constructed of either concrete, steel, or a hybrid combination, is a cylinder that floats vertically in the water.

- **Tension Leg Platform (TLP):** A TLP floating foundation, constructed of steel, is comprised of multiple columns and pontoons. It's mooring system requires vertical tensioned tendons, which provide stability to the structure.
- **Semi-submersible:** A semi-submersible floating foundation, constructed of either concrete, steel, or a hybrid combination, is comprised of a submerged hull with multiple pontoons and columns.

Figure 3. Illustration of floating foundation types (left to right: spar, semi-submersible, TLP) (NREL 2022)

Although a semi-submersible floating foundation requires increased port infrastructure capacity, it is the most probable technology to be used on the U.S. West Coast as Spar foundations are not feasible on the West Coast, due to required deep draft, and offshore wind developers have indicated that semi-submersible foundations are preferred. Therefore, by assuming semi-submersible foundations will be utilized for offshore wind development on the West Coast, the port requirements developed in **Table 2** are also suitable for TLP foundations – if utilized – as they are smaller and require less port infrastructure capacity.

A major challenge the industry identified is the transfer of the completed floating foundation from the assembly wharf into the water (i.e., launching). Several options are available to overcome this challenge and each developer may prefer a different option; however, a few common approaches were identified:

- **Semi-Submersible Barge:** The floating foundation is moved from the wharf onto the barge and the barge is moved to a 40 – 100-foot-deep sinking basin where the barge is partially submerged by taking on ballast and the foundation is floated off the barge.

- **Ramp System:** The floating foundation is moved onto a rail system and travels down a sloped ramp into the water. This methodology is similar to a marine railway ship launching system.
- **Direct Transfer:** Methods that include lifting the floating foundation directly from the wharf into the water (includes methods that involve placing pieces of the foundation into the water and finalizing the construction in the water).

2.2.3 Wet Storage Requirements

Wet storage space is also required in addition to the water frontage and upland acreage. Ports must have locations where floating foundation or integrated turbines can be safely moored to mitigate the risk of weather downtime, vessel traffic, entrance channel congestion, and other transportation risks. This also allows the developers to store and test the completed units and floating foundations to ensure they can deliver the lease area on schedule. The size of the wet storage area is dependent on the developer's strategy, deployment schedule, and downtime risk.

2.2.4 Additional Port Requirements

Several additional port requirements include the following:

- **Roll-on/Roll-Off (RORO) Capabilities:** port sites shall have RORO capability built into the wharf and yard to allow for a range of fabrication and assembly needs. Of particular importance would be to allow for inside port transfers between multiple facilities. This may require the construction of a sinking basin deeper than the proposed navigation channel depth.
- **Green Port:** new port terminals shall have infrastructure and equipment to support state and federal carbon reduction initiatives, including electrification of the terminal operations and the ability to accommodate vessel shore power. Considering greenhouse gas emission reduction initiatives and desire to develop green ports, considerable load on the transmission grid may be needed. An assessment of power grid upgrades for the proposed development site will be needed to assess the range of power transmission upgrades needed to meet the vessel and terminal operational needs.
- **Shoreside Vessel Services:** port sites will require all standard ship services (e.g., potable water), shore power and security requirements.
- **Buildings:** indoor storage/warehouses are required for some items (e.g., floating foundation mechanical equipment, painting, welding, etc.).

2.3 Design Life

All new marine structures at the port shall be designed for a 50-year service life. Design service life is generally considered as the period of time during which a properly built and maintained structure is expected to operate as designed without requiring major replacement or rehabilitation.

2.4 Governing Codes, Standards, and References

The following codes, standards, and references govern the design of port infrastructure and offshore wind vessels.

American Bureau of Shipping (ABS):

- Guide for Building and Classing Floating Offshore Wind Turbine Installation, updated July 2014

American Concrete Institute (ACI):

- ACI 318-19, Building Code Requirements for Structural Concrete

American Institute for Steel Construction (AISC):

- AISC 303-16, Code of Standard Practice for Steel Buildings and Bridges
- AISC 341-16, Seismic Provisions for Structural Steel Buildings
- AISC 360-16, Specification for Structural Steel Buildings

American Petroleum Institute (API):

- API RP 2A-LRFD, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Load and Resistance Factor Design

American Society of Civil Engineers (ASCE):

- ASCE 7-16, Minimum Design Loads for Buildings and Other Structures
- ASCE 61-14, Seismic Design of Piers and Wharves

American Welding Society (AWS):

- AWS D1.1, Structural Welding Code, 2015

California Building Code (CBC):

- 2022 California Building Codes

National Fire Protection Association (NFPA):

- NFPA 307, Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves

Oil Companies International Marine Forum (OCIMF):

- Mooring Equipment Guidelines (MEG4), 4th Edition, 2018

Permanent International Association of Navigation Congresses (PIANC):

- PIANC MarCom WG 145, Berthing Velocity Analysis of Seagoing Vessels over 30,000 dwt, 2022
- PIANC WG 121, Harbour Approach Channels – Design Guidelines, 2014
- PIANC WG 33, Guidelines for the Design of Fenders Systems, 2002
- PIANC WG 34, Seismic Design Guidelines for Port Structures, 2001
- PIANC WG 153, Recommendations for the Design & Assessment of Marine Oil & Petrochemical Terminals, 2016

United States Army Corps of Engineers (USACE):

- USACE EM 1110-2-1100, Coastal Engineering Manual, 2002
- USACE EM 1110-2-1613, Hydraulic Design of Deep-Draft Navigation Projects, 2006
- USACE EM 1110-2-2502, Retaining and Flood Walls, 1989

Unified Facilities Criteria (UFC):

- UFC 4-152-01 Design: Piers and Wharves, 2017
- UFC 4-159-03 Design: Moorings, 2020

3 Deployment Scenarios

On March 29, 2021, the Biden Administration established the goal of deploying 30 GW of offshore wind power in the U.S. by 2030, which will largely be met using fixed-bottom wind turbines on the East Coast and in the Gulf of Mexico (U.S. Government 2021). However, the water on the West Coast is significantly deeper and will require floating wind turbines. Therefore, on September 15, 2022, the Biden Administration announced the goal of deploying 15 GW of *floating* offshore wind power in the U.S. by 2035, building on the existing goal of 30 GW by 2030 (U.S. Government 2022).

In a letter to the California Air Resources Board (CARB) dated July 22, 2022, Governor Gavin Newsom urged the California Energy Commission (CEC) to establish an offshore wind planning goal for the state of California of at least 20 GW by 2045 (Newsom 2022). On August 1, 2022, the CEC established a preliminary offshore wind planning goal of 2-5 GW by 2030 and 25 GW by 2045 (Flint 2022). Using these goals as a baseline, this study assessed a range of deployment scenarios for 2030 through 2050, specifically for the state of California. This section outlines the deployment scenarios and identifies the number of port sites needed to achieve those goals.

3.1 Deployment Targets and Planning Goals

On June 6, 2022, BOEM, CSLC, and Moffatt & Nichol (M&N) held a Deployment Scenarios Workshop to identify five deployment scenarios for 2030 through 2050. Using the CEC offshore wind planning goals as the medium baseline, as discussed above, the additional deployment scenarios were established using an incremental value of 0.5 GW per year. **Table 3** summarizes these deployment targets.

Table 3. Deployment targets

Year	Low (0.5 GW/yr)	Low-Medium (1 GW/yr)	Medium (1.5 GW/yr)	Medium-High (2 GW/yr)	High (2.5 GW/yr)
2030	1 GW	2 GW	3 GW	4 GW	5 GW
2035	3.5 GW	7 GW	10.5 GW	14 GW	17.5 GW
2038	5 GW	10 GW	15 GW	20 GW	25 GW
2045	8.5 GW	17 GW	25.5 GW	34 GW	42.5 GW
2048	10 GW	20 GW	30 GW	40 GW	50 GW
2050	11 GW	23 GW	33 GW	44 GW	55 GW

3.2 Required Number of Port Sites

From the various deployment targets, the required number of S&I and MF sites needed within California to meet these targets can be determined. For this study, four different MF sites were considered:

- Blade MF Sites: a site that receives raw materials and manufactures blades
- Tower MF Sites: a site that receives raw materials and manufactures tower sections
- Nacelle Assembly Sites: a site that receives furnished parts of the nacelle and assembles the full nacelle for turbine integration
- Foundation Assembly Sites: a site that receives furnished parts of the floating foundation and assembles the full foundation system for turbine integration

The determination of the number of O&M sites will be provided in the future AB 525 Strategic Plan. **Table 4** summarizes the number of S&I and MF sites required to meet the 2045 deployment targets identified above.

Table 4. Required number of sites to meet 2045 deployment targets

Type of Site	Low (0.5 GW/yr)	Low-Medium (1 GW/yr)	Medium (1.5 GW/yr)	Medium-High (2 GW/yr)	High (2.5 GW/yr)
S&I Sites	1	2	3	4	5
Blade MF Sites	1	2	2	3	3
Tower MF Sites	1	1	1	1	2
Nacelle Assembly Sites	1	1	1	1	1
Foundation Assembly Sites	1	2	2	3	4

Note: Number of port sites for each target and site type have been rounded up to the nearest whole number.

The following sections list the number of S&I and MF sites required to meet the deployment scenarios as described in **Table 3**.

3.2.1 Required Number of Staging and Integration Sites

To meet the five deployment scenarios for 2030 through 2050, California would require the number of S&I sites shown in **Table 5**. For **Table 5** through **Table 10**, not applicable (N/A) is used to demonstrate when it is not feasible to meet a target due to the assumed date when port sites are available for industry use due to planning, permitting and regulatory approvals, engineering, and construction.

Table 5. Required number of S&I sites to meet deployment scenario targets

Year	Low (0.5 GW/yr)	Low-Medium (1 GW/yr)	Medium (1.5 GW/yr)	Medium-High (2 GW/yr)	High (2.5 GW/yr)
2030	1	N/A	N/A	N/A	N/A
2035	1	N/A	N/A	N/A	N/A
2038	1	3	4	N/A	N/A
2045	1	2	3	4	5
2048	1	2	3	4	5
2050	1	2	3	4	5

Note: Number of S&I sites for each target and year have been rounded up to the nearest whole number.

S&I Site Assumptions:

- **Yard/Wharf Site Requirements:** Sites in an existing California port are assumed to be upgraded to provide at least 1,500 feet of heavy lift wharf with greater than 6,000 psf capacity and a minimum of 75 acres of available land for developer use.
- **Timing:**
  - Sites 1 and 2 are assumed to be located within the same port and ready for developer use by 2028 and 2030, respectively.
  - Sites 3 – 5 are assumed to be located within the same port complex and ready for developer use by 2035.
- **Turbine Size:** Turbine sizes are assumed to be 15 MW up to 2035, then 20 MW after 2035.
- **Production Rate:** Assumed turbine system production rates per site are shown in **Table 6**.

Table 6. Assumed turbine production rate per week

Year	Site 1	Site 2	Site 3	Site 4	Site 5	Total
2028 – 2030	0.75	0	0	0	0	0.75
2030 – 2035	0.625	0.625	0	0	0	1.25
After 2035	0.625	0.625	1	1	1	4.25

3.2.2 Required Number of Blade Manufacturing / Fabrication Sites

To meet the five deployment scenarios for 2030 through 2050, California would require the number of blade MF sites shown in **Table 7**. Note that this analysis assumes that blades required for projects before 2030 would need to be sourced outside of California. N/A is used to demonstrate when it is not feasible to meet a target due to the assumed date when port sites are available for industry use due to planning, permitting and regulatory approvals, engineering, and construction.

Table 7. Required number of blade MF sites to meet deployment targets

Year	Low (0.5 GW/yr)	Low-Medium (1 GW/yr)	Medium (1.5 GW/yr)	Medium-High (2 GW/yr)	High (2.5 GW/yr)
2030	N/A	N/A	N/A	N/A	N/A
2035	1	2	N/A	N/A	N/A
2038	1	2	3	N/A	N/A
2045	1	2	2	3	3
2048	1	1	2	3	3
2050	1	1	2	3	3

Note: Number of MF sites for each target and year have been rounded up to the nearest whole number.

Blade MF Site Assumptions:

- **Yard/Wharf Site Requirements:** Sites in an existing California port are assumed to be upgraded to provide at least 600 feet of heavy lift wharf with greater than 6,000 psf capacity and a minimum of 100 acres of available land for manufacturer use.
- **Timing:** Sites are assumed to be ready for use by 2030, 2032, and 2035.
- **Production Rate:** Blade MF sites are assumed to have a production rate of 182 blades per year. Three blades are required for each turbine system.
- **Turbine Size:** Turbine sizes are assumed to be 15 MW up to 2035, then 20 MW after 2035.

3.2.3 Required Number of Tower Manufacturing / Fabrication Sites

To meet the five deployment scenarios for 2030 through 2050, California would require the number of tower MF sites shown in **Table 8**. Note that this analysis assumes that tower sections required for projects before 2030 would need to be sourced outside of California. N/A is used to demonstrate when it is not feasible to meet a target due to the assumed date when port sites are available for industry use due to planning, permitting and regulatory approvals, engineering, and construction.

Table 8. Required number of tower MF sites to meet deployment targets

Year	Low (0.5 GW/yr)	Low-Medium (1 GW/yr)	Medium (1.5 GW/yr)	Medium-High (2 GW/yr)	High (2.5 GW/yr)
2030	N/A	N/A	N/A	N/A	N/A
2035	1	1	2	2	N/A
2038	1	1	1	2	2
2045	1	1	1	1	2
2048	1	1	1	1	2
2050	1	1	1	1	2

Note: Number of MF sites for each target and year have been rounded up to the nearest whole number.

Tower MF Site Assumptions:

- **Yard/Wharf Site Requirements:** Sites in an existing California port are assumed to be upgraded to provide at least 600 feet of heavy lift wharf with greater than 6,000 psf capacity and a minimum of 100 acres of available land for manufacturer use.
- **Timing:** Sites are assumed to be ready for use by 2030 and 2032.
- **Production Rate:** Tower MF sites are assumed to have a production rate of 500 sections per year. Four tower sections are required for each turbine system.
- **Turbine Size:** Turbine sizes are assumed to be 15 MW up to 2035, then 20 MW after 2035.

3.2.4 Required Number of Nacelle Assembly Sites

To meet the five deployment scenarios for 2030 through 2050, California would require the number of nacelle assembly sites shown in **Table 9**. Note that this analysis assumes that nacelles required for projects before 2030 would need to be sourced outside of California. N/A is used to demonstrate when it is not feasible to meet a target due to the assumed date when port sites are available for industry use due to planning, permitting and regulatory approvals, engineering, and construction.

Table 9. Required number of nacelle assembly sites to meet deployment targets

Year	Low (0.5 GW/yr)	Low-Medium (1 GW/yr)	Medium (1.5 GW/yr)	Medium-High (2 GW/yr)	High (2.5 GW/yr)
2030	N/A	N/A	N/A	N/A	N/A
2035	1	1	1	1	N/A
2038	1	1	1	1	1
2045	1	1	1	1	1
2048	1	1	1	1	1
2050	1	1	1	1	1

Note: Number of nacelle assembly sites for each target and year have been rounded up to the nearest whole number.

Nacelle Assembly Site Assumptions:

- **Yard/Wharf Site Requirements:** Sites in an existing California port are assumed to be upgraded to provide at least 600 feet of heavy lift wharf with greater than 6,000 psf capacity and a minimum of 100 acres of available land for manufacturer use.
- **Timing:** Sites is assumed to be ready for use by 2030.

- **Production Rate:** Nacelle assembly sites receive components and assemble the nacelles at a rate of 275 nacelles per year. One nacelle is required for each turbine system.
- **Turbine Size:** Turbine sizes are assumed to be 15 MW up to 2035, then 20 MW after 2035.

3.2.5 Required Number of Foundation Assembly Sites

To meet the five deployment scenarios for 2030 through 2050, California would require the number of foundation assembly sites shown in **Table 10**. N/A is used to demonstrate when it is not feasible to meet a target due to the assumed date when port sites are available for industry use due to planning, permitting and regulatory approvals, engineering, and construction.

Table 10. Required number of foundation assembly sites to meet deployment targets

Year	Low (0.5 GW/yr)	Low-Medium (1 GW/yr)	Medium (1.5 GW/yr)	Medium-High (2 GW/yr)	High (2.5 GW/yr)
2030	1	N/A	N/A	N/A	N/A
2035	1	2	N/A	N/A	N/A
2038	1	2	2	4	4
2045	1	2	2	3	4
2048	1	2	2	3	4
2050	1	2	2	3	3

Note: Number of foundation assembly sites for each target and year have been rounded up to the nearest whole number.

Foundation Assembly Site Assumptions:

- **Yard/Wharf Size Requirements:** Sites in an existing California port are assumed to be upgraded to provide at least 1,200 feet of heavy lift wharf with greater that 6,000 psf capacity and a minimum of 75 acres of available land for developer use.
- **Timing:**
  - Sites 1 and 2 are assumed to ready for developer use by 2028 and 2030 respectively.
  - Sites 3 and 4 are assumed to be ready for developer use by 2035.
- **Production Rate:** Foundation assembly sites receive components and assemble the foundations at a rate of 52 foundations per year. One foundation is required for each turbine system.
- **Turbine Size:** Turbine sizes are assumed to be 15 MW up to 2035, then 20 MW after 2035.

4 Port Outreach

Once the deployment targets and number of required port sites were identified, an inventory of potentially available port sites was taken. M&N, BOEM, and CSLC conducted outreach meetings with the following seventeen (17) California ports/facilities:

- June 30, 2022: City of Alameda
- July 05, 2022: Port of San Francisco
- July 07, 2022: Port of Oakland
- July 08, 2022: Diablo Canyon
- July 11, 2022: Port of West Sacramento
- July 12, 2022: Humboldt Bay Harbor District (Port of Humboldt)
- July 13, 2022: Crescent City Harbor District
- July 14, 2022: Port of Los Angeles
- July 25, 2022: Port of Benicia
- July 25, 2022: Port San Luis
- July 26, 2022: City of Morro Bay
- July 26, 2022: Port of Long Beach
- July 27, 2022: Port of San Diego
- July 28, 2022: Port of Redwood City
- July 29, 2022: Port of Hueneme
- August 05, 2022: Port of Stockton
- August 09, 2022: Port of Richmond

During the meetings with the Port of San Diego and Port of Benicia, the following four (4) port tenants/operators were recommended for additional outreach meetings:

- August 04, 2022: NASSCO (Port of San Diego)
- August 10, 2022: Pasha Automotive Services (Port of San Diego)
- August 16, 2022: BAE Systems (Port of San Diego)
- August 17, 2022: AMPORTS (Port of Benicia)

The following topics were discussed in the outreach meetings to determine interest for offshore wind development and assess availability of potential sites without pushing out existing uses (e.g., container, rail, etc.).

- Type and size of offshore wind components/equipment
- Port requirements for component delivery and integration of finished components
- Device integration operational requirements
- Installed wind farm operational and maintenance needs
- Physical, operational, and regulatory capabilities and constraints of port facilities and infrastructure
- Interest in offshore wind development
- Available sites within the port

Feedback provided by the ports/facilities and port tenants/operators during outreach meetings is summarized in **Table 11** in **Section 5**.

5 Port Inventory and Assessment

Following outreach efforts with the California ports to discuss potential sites that are available or could be made available for the offshore wind industry, an assessment of the ports was conducted. It is important to note that currently, existing port sites on the U.S. West Coast are not ready to serve the offshore wind industry from a port infrastructure perspective (i.e. wharf, navigation channel, backlands, etc.). All potential port sites will require some level of investment to upgrade existing facilities, such as construct a new wharf to withstand heavier loading or dredge the navigation channel and/or berth pockets. It should also be noted that this study does not consider the displacement of any port operators/tenants. An assessment of military facilities was not included in this study.

This assessment focuses on S&I, MF, and O&M sites. The following general criteria were utilized to assess each port:

- Distance to nearest boundary of BOEM lease areas
- Availability of adequate acreage of uplands area with capability to support or be improved to support heavy loading operations
- Adequacy of existing navigation channel, including entrance channel depth and width, channel depth and width for both existing and planned conditions including maintenance dredging requirements
- Existing and planned infrastructure projects (bridges, airports, tunnels) that may impact operations
- Air draft at bridges or other overhead obstructions (e.g., overhead power lines)
- Potential for port expansion or development of a new in-water area

The figures and table presented in the following sections utilize a symbol and color-coding system to represent a port's potential for offshore wind development for the various facility types – S&I, MF, and O&M:

♦ (green): Port is a good candidate site for offshore wind development

♦♦ (yellow): Port is a moderate candidate for offshore wind development

♦♦♦ (red): Port is not a candidate for offshore wind development

It is important to note that the U.S. Coast Guard (USCG) is currently conducting a port access route study (PARS) to evaluate safe access routes for the movement of vessel traffic proceeding to or from ports or places along the western seaboard of the U.S. and to determine whether a Shipping Safety Fairway and/or routing measures should be established, adjusted, or modified (USCG 2021). The PARS will evaluate the continued applicability of, and the need for modifications to, current vessel routing measures.

5.1 Staging and Integration (S&I) Sites

S&I sites are where the turbine components, such as tower sections, nacelles, blades, and the floating foundations, are received via waterborne transport, stored in the uplands area, and then assembled and erected by a large crane at the quayside. These sites are more difficult to identify within existing ports because they require a large amount of space, need deep draft channels, and cannot have any air draft restrictions since the fully assembled turbine systems, which are 1,100 feet above water, need to be towed out to the installation site at the WEA. The following ports, ordered north to south, were identified to have **good S&I candidate** sites with adequate acreage:

- Port of Humboldt

- Port of Los Angeles
- Port of Long Beach

These three (3) ports have potential sites that are in front of bridges so there are no air draft restrictions, have large amounts of acreage – greater than 100 acres, and have deep draft navigation channels. These S&I port locations can also be combined with MF and O&M facilities if space allows. Currently, the Port of Humboldt is in the detailed design and permitting phase for a 180-acre offshore wind S&I and/or MF site and the Port of Long Beach is in the conceptual design phase for a 300 to 400-acre offshore wind S&I and/or MF site.

All other port locations either don't have enough potential acreage available or have air draft restrictions, such as the ports within the Bay Area with bridges, and thus do not have any S&I candidate sites. **Figure 4** and **Table 11** summarize the mentioned S&I candidate status for each port and potentially available sites.

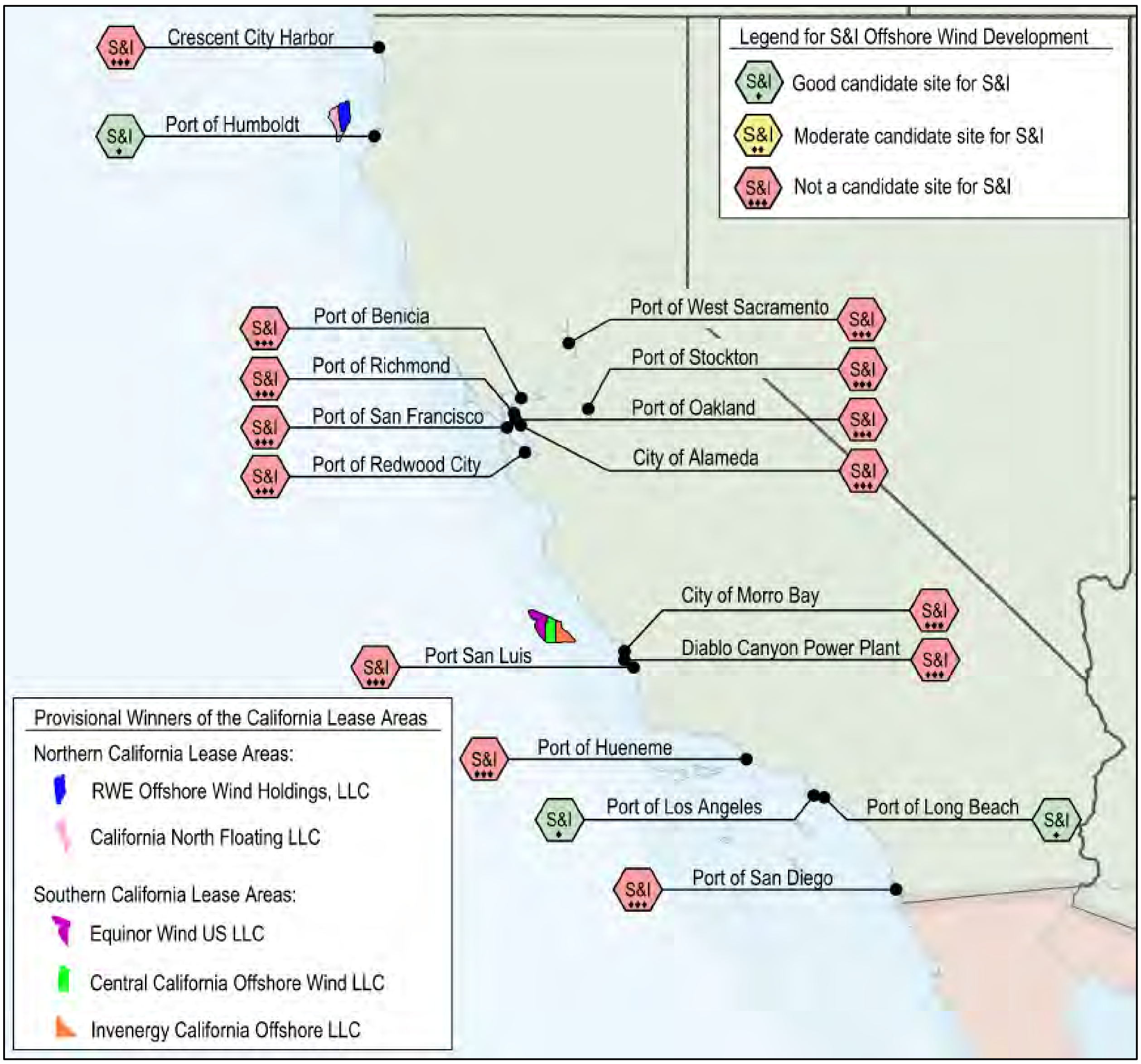

Figure 4. Staging and integration (S&I) candidate status of each port

5.2 Manufacturing / Fabrication (MF) Sites

MF sites receive raw materials via road, rail, or waterborne transport and create larger components in the offshore wind supply chain that will be exported via waterborne transport on a vessel or barge. These sites can occupy less space than S&I sites and be at locations with air draft restrictions since the components (e.g., tower sections, nacelles, blades, and floating foundations) can be transported horizontally via vessel or barge. Therefore, ports located behind bridges, such as those in the Bay Area, are candidates for offshore wind development as MF sites. The following ports, ordered north to south, were identified to have **good MF candidate** sites with adequate acreage:

- Port of Humboldt
- Port of Benicia
- Port of Stockton
- Port of Richmond
- Port of San Francisco
- Port of Redwood City
- Port of Los Angeles
- Port of Long Beach
- Port of San Diego
    - Foundation component manufacturing at NASSCO
    - Steel component fabrication and ship repair services at BAE Systems

The following ports, ordered north to south, were identified to have **moderate MF candidate** sites:

- Port of Oakland
- City of Alameda

Currently, a potential MF site of up to 130 acres was identified at the Port of Oakland; however, it may be used by other industries in the future. At the City of Alameda, a potential 25- to 60-acre site was identified; however, it does not have direct access to the waterfront, so it is categorized as a moderate candidate.

All other port locations don’t have enough potential acreage available and thus no MF candidate sites. **Figure 5** and **Table 11** summarize the MF candidate status for each port and potentially available sites.

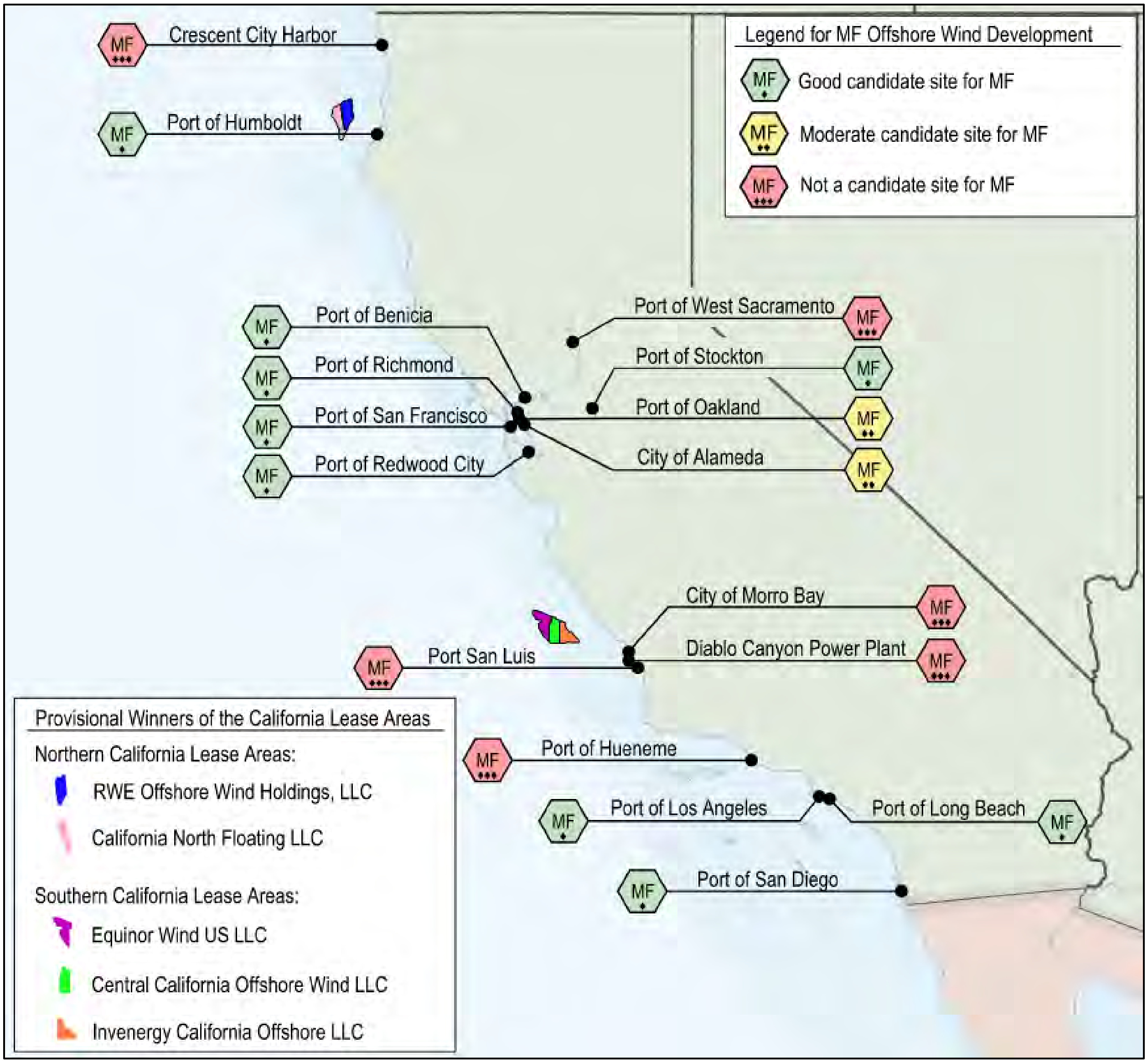

Figure 5. Manufacturing / fabrication (MF) candidate status of each port

5.3 Operations and Maintenance (O&M) Sites

O&M sites serve as a home port site for O&M vessels and supporting warehouse/offices during the operation period of the offshore wind farm. Ideally, these O&M sites that transfer crew to and from the offshore wind farm shall be close to the wind farm location to minimize travel time. Other maintenance activities, where the turbine system needs to be towed back to port from the offshore wind farm, would be performed at the S&I sites where the large assembly cranes are – Port of Humboldt, Port of Los Angeles, and Port of Long Beach. The following ports, ordered north to south, were identified to have **good O&M candidate** sites:

- Crescent City Harbor District
- Port of Humboldt
- City of Morro Bay

- Diablo Canyon Power Plant
- Port San Luis
- Port of Hueneme

Crescent City Harbor District is ideal for crew transfer due to its proximity to the Humboldt WEA. The Port of Humboldt can perform both crew transfer and maintenance of the fully assembled turbine system due to its proximity to the Humboldt WEA and S&I site capabilities, respectively. The City of Morro Bay, Diablo Canyon Power Plant, Port San Luis, and Port of Hueneme are ideal for crew transfer due to their proximity to the Morro Bay WEA, in comparison to the other ports; however, they do not have enough acreage for an S&I site and would not be able to service a fully assembled turbine system from the offshore wind farm – this turbine system would need to be towed to the Port of Los Angeles or Port of Long Beach. The following ports, ordered north to south, were identified to have **moderate O&M candidate** sites:

- Port of Richmond
- Port of Oakland
- Port of San Francisco
- City of Alameda

These ports are categorized as moderate O&M candidates due to their distance from the Humboldt and Morro Bay WEAs, making them less preferable for crew transfer since there are closer sites identified. While this study focuses on assessing the seventeen (17) existing California ports/facilities, another study for the CSLC assessed additional existing harbors and marine sites between San Francisco and Long Beach to identify additional O&M sites that are closer to the Morro Bay WEA (Moffatt & Nichol 2023b). Therefore, the ports within the Bay Area and south of the Port of Hueneme are less preferable for O&M due to distance.

All other sites not listed are not ideal O&M sites due to the substantial distance to the WEAs. **Figure 6** and **Table 11** summarize the O&M candidate status for each port and number of potentially available sites.

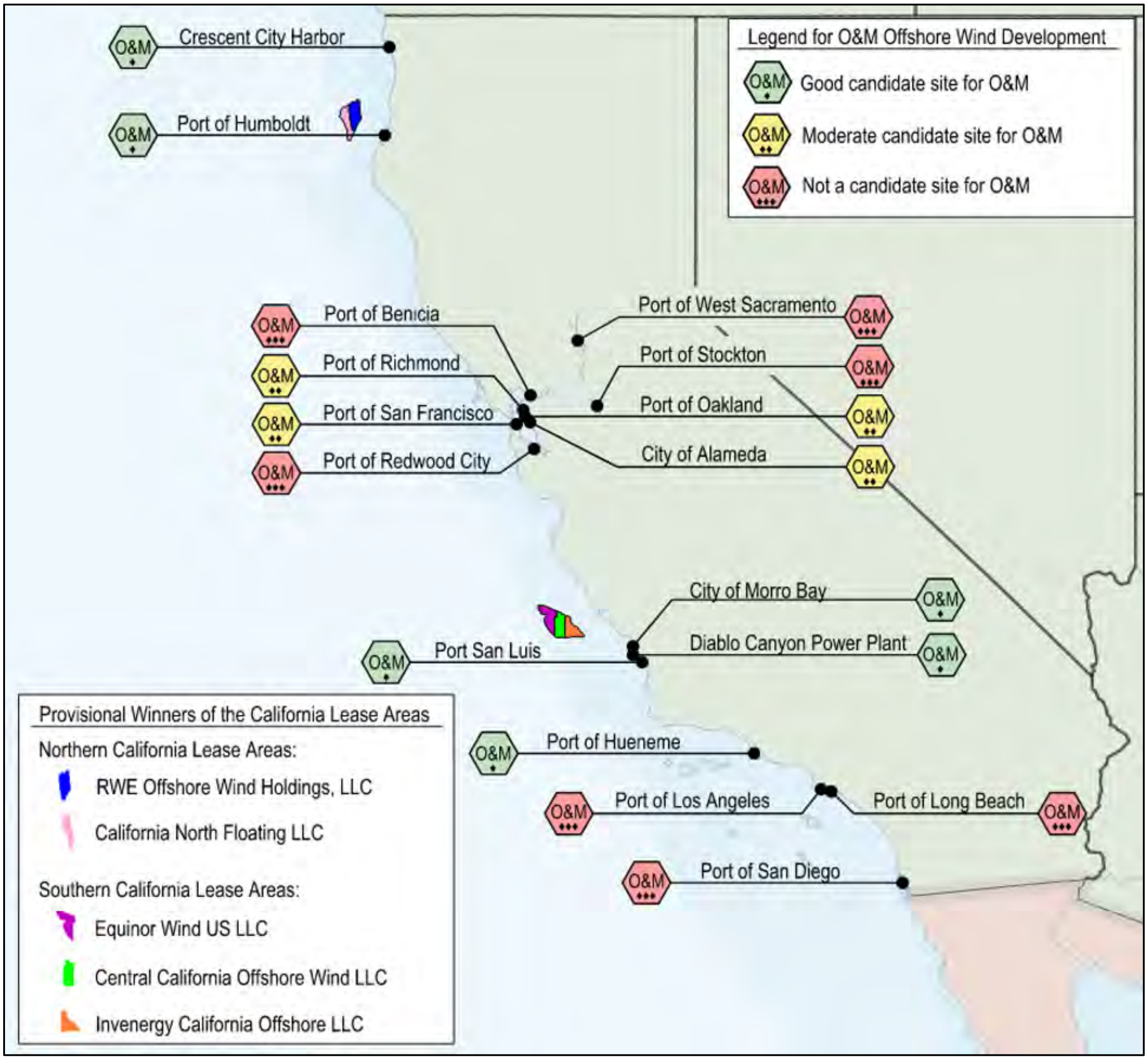

Figure 6. Operation and maintenance (O&M) candidate status of each port

5.4 Summary

A map that combines the S&I, MF, and O&M candidate status at each port is shown in **Figure 7**. **Table 11** summarizes the following:

- Interest in offshore wind
  - ♦ (green): Port is interested in offshore wind development
  - ♦♦ (yellow): Port is somewhat interested in offshore wind development
  - ♦♦♦ (red): Port is not interested in offshore wind development or may not have available sites
- Bridge clearances
- Distance to Humboldt and Morro Bay WEAs

- Channel depths
- S&I, MF, and O&M candidate status
    - ♦ (green): Port is a good candidate site for offshore wind development
    - ♦♦ (yellow): Port is a moderate candidate site for offshore wind development
    - ♦♦♦ (red): Port is not a candidate site for offshore wind development
- Number and size of potential sites at each port

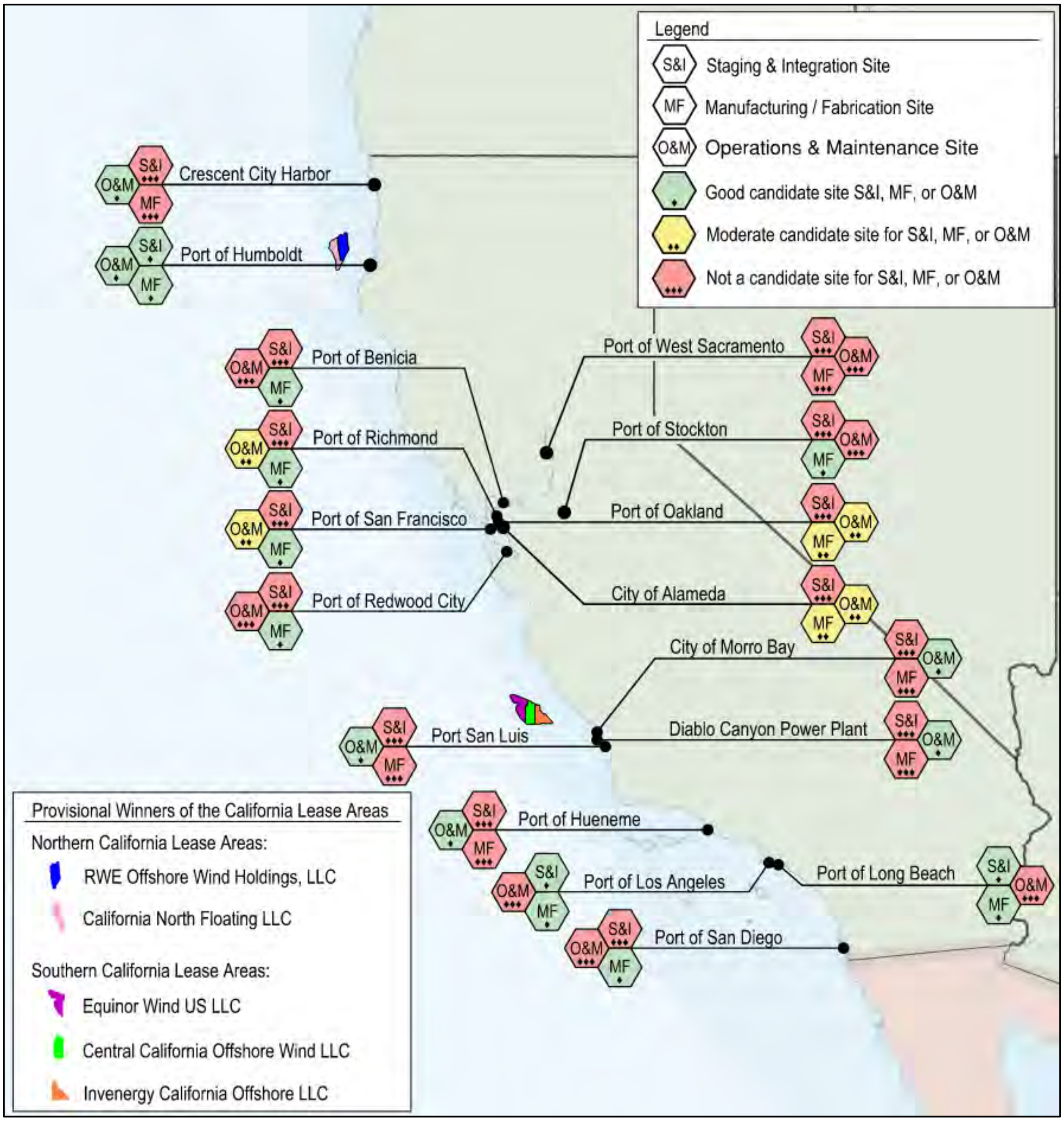

Figure 7. S&I, MF, and O&M candidate status for each port

Table 11. Summary of potential California offshore wind port sites

Port Location	Interest in OSW	Bridge Vertical Clearance *(ft)*	Distance to Humboldt WEA *(NM)*	Distance to Morro Bay WEA *(NM)*	Channel Depth *(ft)*	S&I Candidate Status	MF Candidate Status	O&M Candidate Status	Potential Sites
Crescent City Harbor District	♦	None	50	400	14-20	♦♦♦	♦♦♦	♦	(1) <10-ac O&M site
Port of Humboldt	♦	None	30	360	38	♦	♦	♦	(2) 180-ac sites (4) <10-ac O&M sites
Port of West Sacramento	♦♦♦	132	330	235	30	♦♦♦	♦♦♦	♦♦♦	No sites available
Port of Stockton	♦	132	295	200	35	♦♦♦	♦	♦♦♦	(1) 20-40-ac MF site (1) 150-200-ac MF site (<1 mile from the water)
Port of Benicia	♦	132	275	180	45	♦♦♦	♦	♦♦♦	(1) 10-40-ac MF site
Port of Richmond	♦	210	255	160	38	♦♦♦	♦	♦♦	(1) 30-40-ac MF site
Port of Oakland	♦♦	174	255	160	50	♦♦♦	♦♦	♦♦	(1) <130-ac MF site (may be used by other industries prior to 2030)
Port of San Francisco	♦	174	255	160	> 40 ***	♦♦♦	♦	♦♦	(1) 50-ac MF site (1) 15-ac MF
City of Alameda	♦	174	255	160	20-30	♦♦♦	♦♦	♦♦	(1) 25-60-ac O&M / MF site
Port of Redwood City	♦	135	275	180	30	♦♦♦	♦	♦♦♦	(1) 20-80-ac MF site
City of Morro Bay	♦	None	430	55	15-24	♦♦♦	♦♦♦	♦	(1) O&M site
Diablo Canyon Power Plant	♦	None	445	70	< 25	♦♦♦	♦♦♦	♦	(1) O&M or construction support site
Port San Luis	♦	None	450	75	< 40	♦♦♦	♦♦♦	♦	(1) O&M site
Port of Hueneme	♦	None	570	200	30-45	♦♦♦	♦♦♦	♦	(1) O&M site. See **** for MF candidate status
Port of Los Angeles	♦	See *	630	260	> 50	♦	♦	♦♦♦	(1) 100-200-ac S&I site (2) 10-30-ac MF sites
Port of Long Beach	♦	See **	630	260	> 50	♦	♦	♦♦♦	(1) >300-ac S&I / MF site (1) 20-ac MF site
Port of San Diego	♦	175	700	340	> 35	♦♦♦	♦	♦♦♦	(1) Floating Foundation MF site (1) Steel component fabrication/ship repair site

* There are sites available in front of the Vincent Thomas Bridge (185 feet) at the Port of Los Angeles, so there are no air draft restrictions for these sites.

** There are sites available in front of the Long Beach International Gateway Bridge (205 feet) at the Port of Long Beach, so there are no air draft restrictions for these sites.

*** There are potential sinking basin(s) with water depth 60 – 100 ft within the San Francisco Bay that may be feasible for offshore wind floating foundation use. Note, these potential sinking basin locations will need to be verified with the U.S. Coast Guard and the S.F. Bar Pilots.

****An assessment of military uses was not addressed in this study.

Based on the above inventory of potentially available port sites, California has enough potential port sites to meet the five deployment targets ranging from low to high, as shown in **Table 3**. The offshore wind port sites require a significant amount of investment to upgrade and improve the existing infrastructure to serve the offshore wind industry. As part of the next BOEM study titled *California Floating Offshore Wind Regional Ports Feasibility Analysis,* cost estimates and project timelines for developing these offshore wind port sites will be provided. This study will also support the AB 525 Strategic Plan, due June 30, 2023.

6 Offshore Oil and Gas Decommissioning Considerations

According to Title 30 Code of Federal Regulations (30 CFR 250.1716(a) and 250.1728(a)), decommissioning of offshore oil and gas platforms is required when the facilities are no longer useful for operations or, in other words, when a lease expires (National Archives and Records Administration 2012). As the twenty-three (23) Federal oil and gas platforms offshore southern California reach the end of their production lifetimes, decommissioning is the next step. There are several options to decommission the offshore platforms, each with their own legal, environmental, socioeconomic, and policy issues. However, the state of California has historically only allowed one method of decommissioning, complete removal. This presents not only a challenge in removing the platforms, but for port infrastructure capabilities as well, as eight platforms off southern California are in water depths exceeding 400 feet, with the deepest at 1,198 feet at platform Harmony. The steel jacket (support structure) for platform Harmony, pre-installation, is shown in **Figure 8**, (Bernstein 2017).

Figure 8. Platform Harmony jacket onshore prior to installation (Bull 2018)

As of this writing, eight Federal offshore oil and gas platforms off the coast of California have already ceased production, therefore requiring the platforms to undergo the decommissioning process. Identifying port requirements and capabilities to support the current and increasing Pacific OCS oil and gas decommissioning activities is an important outcome of this study as up to eight platforms may be decommissioned within 10 years (InterAct PMTI 2020). This section identifies port requirements for oil and gas decommissioning assuming the complete removal option will be utilized as this option will impose the highest strain on the port and, as a result, generate the most conservative port infrastructure requirements. This section also determines whether these activities can be co-located with offshore wind development within the ports.

6.1 California Offshore Oil and Gas Platforms Background

There are currently twenty-seven (27) oil and gas platforms off the California coast, four (4) located in State waters and twenty-three (23) located in Federal waters (Argonne National Laboratory 2022. There are also five (5) production facilities located in State waters that are artificial islands, however this report focuses on decommissioning of offshore oil and gas platforms at port facilities, therefore these five production facilities were not included in developing the port infrastructure requirements.

The platforms are positioned as far south as San Pedro Bay and as far north as the Santa Maria Basin. The beginning stages of decommissioning have commenced at five (5) Federal platforms – Gail, Grace, Harvest, Hermosa, and Hidalgo, and one (1) State platform – Holly. Three (3) Federal platforms – Habitat, Hogan, and Houchin – currently have no active leases and will soon start the decommissioning process (IDWG 2019).

The twenty-seven (27) platforms are owned by several operators and are in varying water depths. **Table 12** and **Table 13** summarize the operators and water depths, as well as the topside and jacket weights and **Figure 9** shows the locations of the offshore oil and gas platforms.

Table 12. Data for platforms in state waters

Platform	Operator[1]	Water Depth (ft)	Topside Weight (tons)	Jacket Weight (tons)
Emmy	So. Cal Holdings	47	2,201	1,746
Esther	DCOR	35	2,000	1,597
Eva	DCOR	41	2,000	1,050
Holly	CSLC	211	2,890	2,882

Water depth obtained from *A Citizen's Guide to Offshore Oil and Gas Decommissioning in Federal Waters Off California* (IDWG 2019)
Topside/jacket weight obtained from *Evaluating Alternatives for Decommissioning California's Offshore Oil and Gas Platforms: A Technical Analysis to Inform State Policy* (Bernstein 2017)

Table 13. Data for platforms in federal waters

Platform	Operator[1]	Water Depth (ft)	Topside Weight (tons)	Jacket Weight (tons)
A	DCOR	188	1,357	1,500
B	DCOR	190	1,357	1,500
C	DCOR	192	1,357	1,500
Edith	DCOR	161	4,134	3,454
Ellen	Beta Operating Company	265	5,300	3,200
Elly	Beta Operating Company	255	8,000	3,300
Eureka	Beta Operating Company	700	4,700	19,000
Gail	Beacon West Energy Group	739	7,693	18,300
Gilda	DCOR	205	3,792	3,220
Gina	DCOR	95	447	434
Grace	Beacon West Energy Group	318	3,800	3,090
Habitat	DCOR	290	3,514	2,550

Platform	Operator[1]	Water Depth (ft)	Topside Weight (tons)	Jacket Weight (tons)
Harmony	Exxon-Mobil	1,198	9,839	42,900
Harvest	Freeport-McMoRan	675	9,024	16,633
Henry	DCOR	173	1,371	1,311
Heritage	Exxon-Mobil	1,075	9,826	32,420
Hermosa	Freeport-McMoRan	603	7,830	17,000
Hidalgo	Freeport-McMoRan	430	8,100	10,950
Hillhouse	DCOR	190	1,200	1,500
Hogan	Pacific Operators Offshore	154	2,259	1,263
Hondo	Exxon-Mobil	842	8,450	12,200
Houchin	Pacific Operators Offshore	163	2,591	1,486
Irene	Freeport-McMoRan	242	2,500	3,100

Water depth obtained from *A Citizen's Guide to Offshore Oil and Gas Decommissioning in Federal Waters Off California* (IDWG 2019)
Topside/jacket weight obtained from *Decommissioning Cost Update for Pacific OCS Region Facilities, Volume 1* (BSEE 2020)

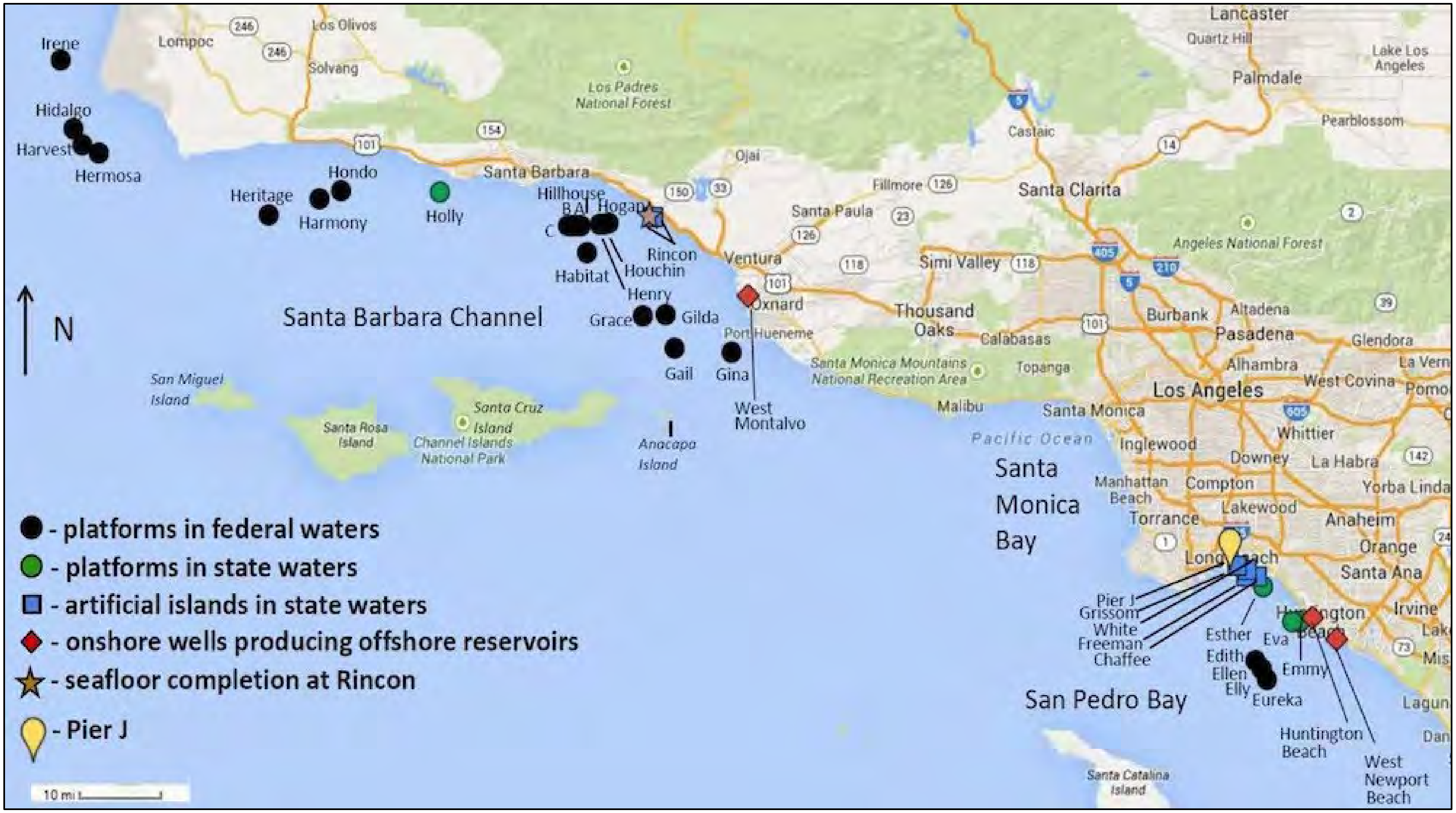

Figure 9. California offshore oil & gas platforms (CSLC 2018)

Oil and gas platforms typically consist of two main components:

- Topside: this consists of everything above the waterline. The topside holds the living quarters, production equipment, drilling rig, and any other equipment necessary for drilling and production activities.
- Jacket (Support Structure): this consists of everything between the waterline and seabed, as shown in **Figure 10**. Typically, the support structure is either a steel jacket or concrete gravity-based structure (GBS). All oil platforms off the California coast are supported by steel jackets. The steel jacket supports the topside and is secured to the seabed by steel skirt piles driven through pile sleeves that are attached to the legs of the jacket, as shown in **Figure 11.**

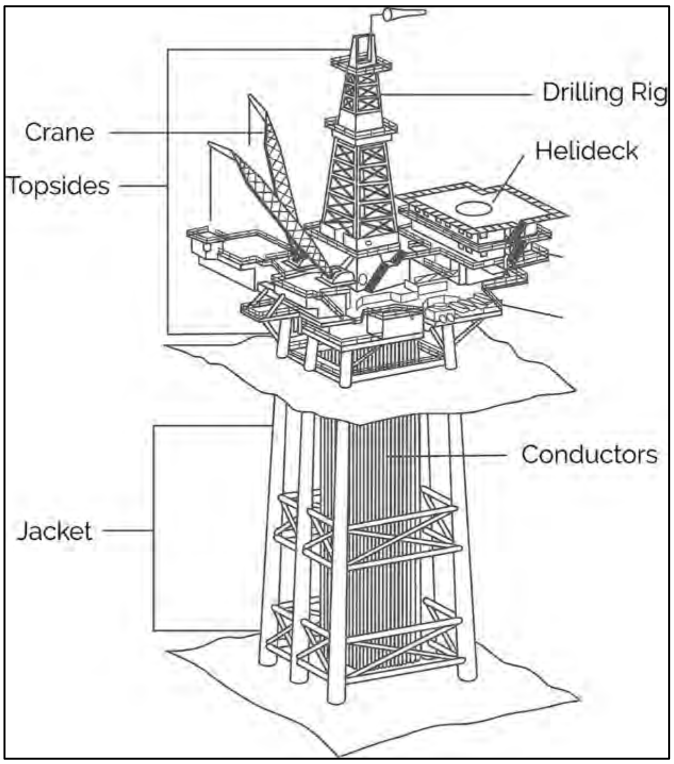

Figure 10. Schematic of typical offshore oil & gas platform (Bernstein 2017)

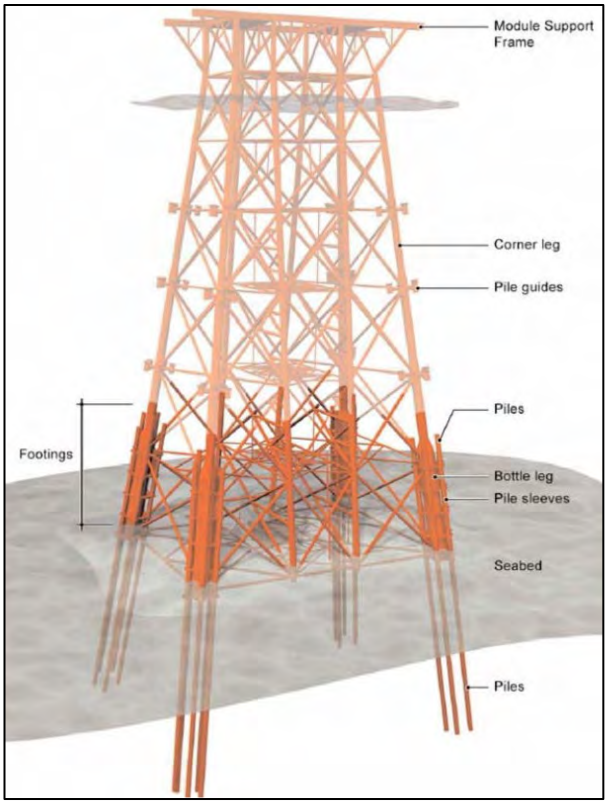

Figure 11. Schematic of skirt piles (Frieze, year unknown)

6.2 Planning Process for Decommissioning Offshore Oil and Gas Platforms on the Pacific Federal OCS

The general decommissioning planning process for offshore oil and gas platforms located in Federal waters is summarized below per the Interagency Decommissioning Working Group (IDWG) comprised of BOEM, Bureau of Safety and Environmental Enforcement (BSEE), and CSLC. Detailed information can be found in *A Citizen's Guide to Offshore Oil and Gas Decommissioning in Federal Waters Off California*, issued by the IDWG in 2019.

1. Early Notification of Intent to Decommission
    - Facility operator required to submit initial platform removal application to BSEE 2+ years before production will cease.
        - BSEE informs BOEM about planned decommissioning.
        - BSEE/BOEM inform IDWG about planned decommissioning.
        - Lead federal and state agencies meet, as needed.
2. Pre-Application Meetings
    - Operator meets with IDWG and/or federal, state, and local regulatory agencies and stakeholders to discuss plans, issues, and information needs.
3. Operator Submits & Revises its Final Application
    - Based on information exchanged during Step 2, Operator submits a final platform removal application to BSEE, CSLC, and other federal, state, and local agencies.

- Agencies review application for completeness and notify Operator of information needs.
- Operator revises and resubmits application, as needed.
- Lead federal, state, and local agencies deem final application complete.

4. Environmental Review Process
   - The platform removal is evaluated according to federal (National Environmental Policy Act, NEPA) and state (California Environmental Quality Act, CEQA) laws with an Environmental Impact Statement (EIS) and Environmental Impact Report (EIR), respectively. Agencies may decide to prepare a joint EIS/EIR.
     - State or federal lead agency selects environmental consultant to prepare EIS and EIR, or joint EIS/EIR.
     - Lead agencies publish Notice of Intent (NOI)/Notice of Preparation (NOP) to issue EIS and EIR (or joint EIS/EIR), hold public scoping meetings and evaluate comments.
     - Lead agencies prepare an administrative draft EIS and EIR (or joint EIS/EIR), conduct agency review and revision of the document(s), and prepare draft version(s) for public review.
     - Lead agencies publish Notice of Availability (NOA)/NOP of the draft EIS and EIR (or joint EIS/EIR), hold public hearings on the draft(s), and respond to comments.
     - BSEE and Operator conduct consultations and/or issue permits with federal, state, local, and/or tribal entities, as needed.
     - Lead agencies publish final EIS and EIR (or joint EIS/EIR) and federal Record of Decision (ROD).
5. State Lead Agency Decisions
   - CSLC and County Planning Department each hold hearings on the project, certify the final EIS and EIR (or joint EIS/EIR), and issue decisions on the project.
6. BSEE Approves the Project

The general decommissioning process summarized above is similar for offshore platforms located in State waters. The lead agency for decommissioning offshore oil and gas platforms in State waters is the California Natural Resources Agency consulting with state resource agencies for CEQA purposes. The platform operators must still coordinate with Federal entities that have authority in State waters.

6.3 Case Study – Decommissioning of Brent Field Platforms Alpha and Delta

To identify port requirements for offshore oil and gas decommissioning activities, two representative case studies of successful offshore oil and gas platform decommissioning projects were reviewed – Brent Alpha, decommissioned in 2020 and Brent Delta, decommissioned in 2017. These two offshore oil and gas platforms were two of four platforms located in Brent Field in the North Sea, 320 miles northeast of Aberdeen, Scotland. Both platforms were installed in 1976 and operated by Shell United Kingdom (U.K.) Limited. Additionally, both decommissioning projects included platforms larger than, or similar in size to, the largest platform off the California coast, platform Harmony. A comparison of platforms Brent Alpha, Brent Delta, and Harmony is provided in **Table 14** below.

Table 14. Comparison of platforms Brent Alpha, Brent Delta, and Harmony

Dimension	Brent Alpha	Brent Delta	Harmony
Topside Weight	18,650 tons	25,900 tons	9,839 tons
Supporting Structure Type	Steel Jacket	Concrete GBS	Steel Jacket
Supporting Structure Weight	34,200 tons	365,017 tons	42,900 tons
Water Depth	460 ft	460 ft	1,198 ft

The topside weight for Platform Brent Alpha was found in *Decommissioning Progress Report: Brent Alpha Topside*, issued by Shell U.K. Limited in 2020 (Shell 2020a).
The supporting structure type and weight, as well as water depth, for Platform Brent Alpha were found in "Brent Field Alpha Jacket" on the Shell U.K. Limited website (Shell c2022).
The topside weight for Platform Brent Delta was found in *Brent Delta Topside Decommissioning Close-out Report*, issued by Shell U.K. Limited in 2019 (Shell 2019).
The supporting structure type and weight, as well as water depth, for Platform Brent Delta were found in *Brent Bravo, Charlie, and Delta GBS Decommissioning – Technical Document*, issued by Shell U.K. Limited in 2017 (Shell 2017a).
All information for Platform Harmony was found in *Decommissioning Cost Update for Pacific Outer Continental Shelf Region Facilities, Volume 1*, issued by the Bureau of Safety and Environmental Enforcement (BSEE) in 2020.

Brent Alpha's topside was supported by a steel jacket substructure with six full-height legs, as shown in **Figure 12**, similar to platforms off the California coast, and Brent Delta's topside was supported by a three-legged concrete GBS, as shown in **Figure 13**. Shell had the decommissioned topsides of both platforms transported to the Able Seaton Port facility at Teesside in the U.K. to be dismantled and recycled (Shell 2020a and 2020b).

For the supporting substructure, the top portion of the Brent Alpha's steel jacket was removed and transported to the AF Environmental Base Vats in Rogaland, Norway for dismantlement and recycling (Shell 2020b). Shell has not yet published a progress report for the removal of Brent Delta's concrete GBS; therefore, the removal method is currently unknown.

Figure 12. Photo of Brent Alpha prior to decommissioning in the North Sea (Shell 2020a)

Figure 13. Photo of Brent Delta prior to decommissioning in the North Sea (Adams 2015)

6.3.1 Topside Removal

All information regarding the Brent Alpha topside decommissioning was found in *Decommissioning Progress Report – Brent Alpha Topside*, issued by Shell U.K. Limited in 2020 (Shell 2020a). All information regarding the Brent Delta topside decommissioning was found in *Brent Delta Topside Decommissioning Close-out Report*, issued by Shell U.K. Limited in 2019 (Shell 2019).

The approach to remove Brent Alpha and Brent Delta's topsides involved using a heavy lift vessel known as the *Pioneering Spirit*, in conjunction with the *Iron Lady* cargo barge, both owned and operated by Allseas, refer to **Figure 14** and **Figure 15**. The *Pioneering Spirit* was used to remove each platform topside in a single unit in open water after it was cut away from its supporting structure. The topside was then transferred to the *Iron Lady* barge in the sheltered harbor of the River Tees estuary for delivery to Able Seaton Port. The barge was fit with the necessary skidding equipment prior to mobilization from Port of Rotterdam to transfer the load of the topside onto the barge and to later load the topside onto the wharf at the Able Seaton Port facility. Vessel characteristics for the *Pioneering Spirit* and *Iron Lady* are shown in **Table 15**.

Figure 14. ***Pioneering Spirit*** **transporting the Brent Delta topside (Shell 2019)**

Figure 15. ***Iron Lady*** **barge transporting the Brent Delta topside (Shell 2017b)**

Table 15. Design vessel characteristics

Characteristic	*Pioneering Spirit* (Heavy Lift Vessel)	*Iron Lady* (Cargo Barge)
Length	1,253 ft	656 ft
Breadth	407 ft	164 ft
Operating Draft	33 – 89 ft	33 ft (assumed)
Topside Lift Capacity	52,911 tons	N/A
Jacket Lift Capacity	22,046 tons	N/A
Cargo Capacity	N/A	42,680 tons

Vessel characteristics for the *Pioneering Spirit* were found on the Allseas website: www.allseas.com
Vessel characteristics for the *Iron Lady* were found on the vessel tracking website: www.fleetmon.com

Once the topside was secure on the *Iron Lady*, the barge was towed directly to the transfer site by tugs and moored with its stern to the wharf. To ensure the barge remained level as the topside was skidded onto the wharf, the barge carefully ballasted down until it rested on a pre-installed grounding bed prior to the transfer, shown below in **Figure 16**. The heavy lifting specialist Mammoet then fit skid beams from the wharf, across the wharf wall, and onto the barge, as shown in **Figure 17** and **Figure 18**. The beams were also shimmed and grouted to ensure they remained in place and level during the transfer process. The skidding operation was completed in one day (Shell 2019). Able Seaton Port reports the capacity of their heavy lift pad, which each topside rested on, as 12,290 psf (60 metric tons/m^2) and the capacity of the uplands area as 2,050 psf (10 metric tons/m^2) (Able UK Limited 2013).

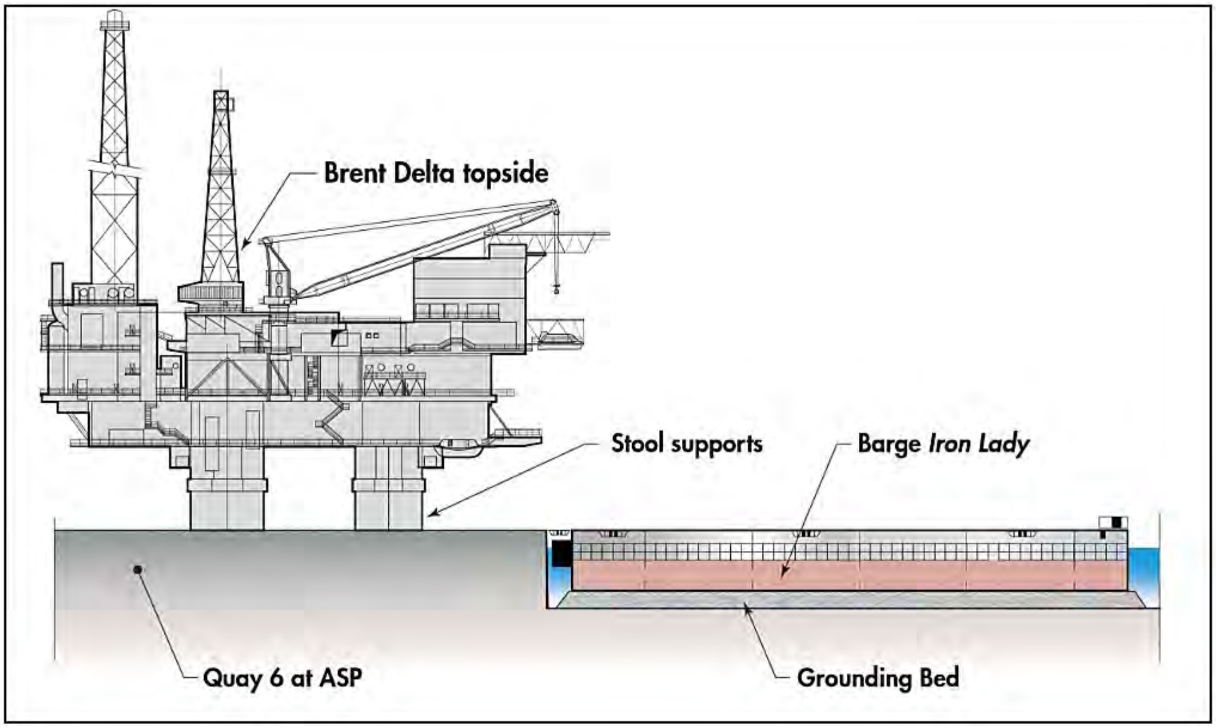

Figure 16. Skidding the Brent Delta topside from *Iron Lady* to Quay 6 at the Able Seaton Port Facility, U.K. (Shell 2019)

Figure 17. Skidding Brent Delta topside onto Able Seaton Port (Shell 2019)

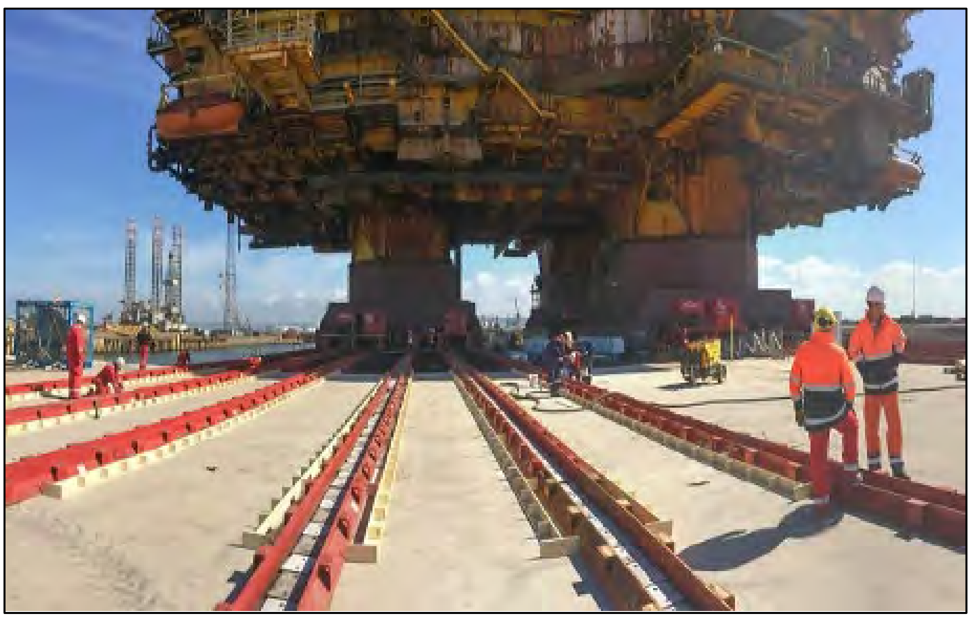

Figure 18. Skidding Brent Delta topside onto Able Seaton Port (Shell 2019)

Following the skidding operation, the dismantling and disposal operation occurred. The terminal operator first surveyed and cleaned the topside components of any remaining hazardous materials before commencing dismantlement. Then the topside was "soft stripped" of a "wide range of relatively small and easily removed items such as non-perishable foodstuff, furniture, fittings, domestic and recreational equipment, tools, and small pieces of equipment. Where possible, these were distributed to local charities and emergency services" (Shell 2019). Air compressors, leg levelling and monitoring equipment, pigging valves, a fire pump control panel, an emergency generator, a fire pump module, and personal protection equipment (PPE) were removed and transported to Aberdeen for re-use by Shell.

Using the Liebherr LHM 600 SHL mobile harbor crane and the Liebherr LR 1300 crawler crane and several other smaller cranes, a sequential top-down approach was implemented in the dismantlement of the main structure (Offshore & Heavy Lift Services c2015). The approach consisted of weakening parts of the structure by cutting and/or pulling with ropes and allowing them to drop onto the ground. To absorb the force of the falling components, as well as protect the wharf deck, large amounts of sand were placed around the base of the topside (Shell 2019). Scheuerle 6 axle self-propelled modular trailers (SPMTs) and forklifts were then utilized in moving and stripping these separated components for scrap to be recycled. More than 97% of the material from the Brent Delta topside was recycled. The percentage of topside material recycled from the Brent Alpha is currently unknown as Shell has not yet published the close-out report for this topside decommissioning.

6.3.2 Steel Jacket Removal

All information regarding the Brent Alpha jacket decommissioning was found in *Decommissioning Progress Report – Brent Alpha Jacket*, issued by Shell U.K. Limited in 2020 (Shell 2020b). The approach to remove Brent Alpha's steel jacket involved using the semi-submersible crane vessel named the *Sleipnir*, owned and operated by Heerema Marine Contractors. The *Sleipnir* was used to remove the top 280 feet of the steel jacket in a single unit in open water after it was cut away from the lower section, as shown in **Figure 19**. The upper section was then transported to AF Environmental Base Vats in Rogaland, Norway for dismantling and disposal. Vessel characteristics for the *Sleipnir* are shown in **Table 16** below.

Figure 19. *Sleipnir* transporting upper Brent Alpha's upper jacket (Heerema Marine Contractors)

Table 16. Vessel characteristics

Characteristic	*Sleipnir* (Semi-submersible Crane Vessel)
Length	722 ft
Breadth	335 ft
Operating Draft	39 – 105 ft
Lift Capacity	22,046 tons

Vessel characteristics for the *Sleipnir* were found on the Heerema Marine Contractors website: heerema.com

After all leg cuts were complete, the upper section of the jacket was lifted clear of the lower section "by a combination of hoisting by the cranes and deballasting of the heavy lift vessel to account for the increase in the weight of the upper jacket as it was raised out of the water" (Shell 2020b). Once the upper jacket section was lifted clear, it was secured to the stern of the *Sleipnir* using two restraining clamps. The *Sleipnir* then transported the jacket section to the AF Offshore Decommissioning (AFOD) facility at Vats where it was lowered onto pre-installed steel and concrete supports, as shown in **Figure 20**. The total mass of the removed upper jacket section delivered to the AFOD facility was 10,360 tons.

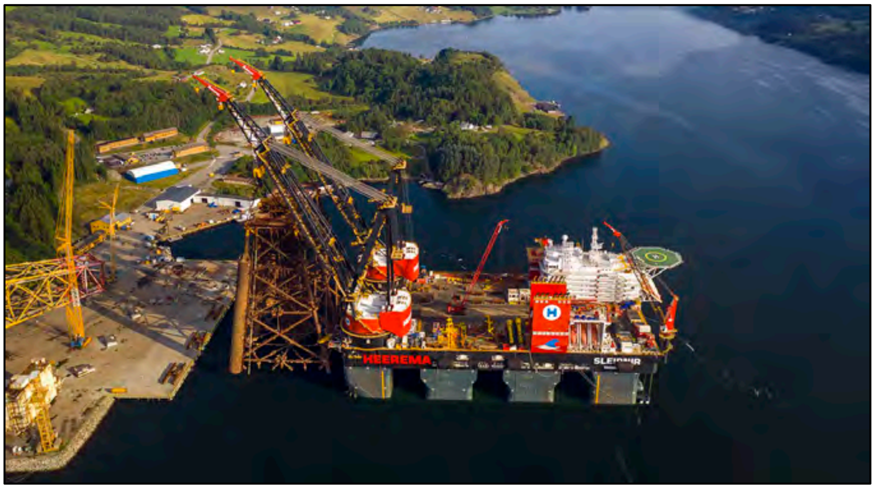

Figure 20. *Sleipnir* loading Brent Alpha's upper jacket onto the wharf at AFOD Facility in Norway (Heerema Marine Contractors)

6.4 California Port Needs

There are several options to decommission the offshore platforms, each with their own legal, environmental, socioeconomic, and policy issues. However, the state of California has historically only allowed one method of decommissioning, complete removal. BSEE requires all bottom-founded components of the jacket to be severed at least 15 feet below the mudline to avoid interference with any future leases or other activities in the area. To establish the most conservative design criteria for ports and port infrastructure, this study assumes complete removal of the California platform jackets down to 15 feet below mudline and a similar decommissioning approach to platform Brent Delta. The following decommissioning approach is assumed to establish California port infrastructure requirements:

1. Prior to any removal activities, the platform must be cleaned of any hazardous materials such as hydrocarbons, asbestos, etc. Surveys will be conducted once onshore to ensure no hazardous materials remain.
2. The topside is severed from its supporting structure (i.e., jacket) and the jacket is removed from its foundation by severing all bottom-founded components at least 15 feet below mudline, per Title 30 Code of Federal Regulations (30 CFR 250.1716(a) and 250.1728(a)) (National Archives and Records Administration 2012).
3. The topside and jacket are each removed and transported to a protected port or harbor (e.g., breakwater) by heavy lift vessel.
4. Once inside protected harbor, the heavy lift vessel transfers the components – topside or jacket – to a cargo barge to be towed to the dismantling location.

5. Once the barge has reached the pre-determined dismantling location, the component is loaded onto the wharf by crane or skidding equipment.
6. Each component is then dismantled and sorted for recycling.
7. All recyclable materials are transported to a recycling facility and all non-recyclable materials are properly disposed of.

This strategy allows for the most efficient and safe removal of platforms by minimizing the number of crane lifts at sea, the number of trips to and from the platform site, the amount of time spent at sea, the amount of work to be performed at sea, and the environmental impacts caused by decommissioning. By assuming that the entire platform – including topside and jacket – will be completely removed, this strategy also provides the most flexibility for decommissioning options as the decommissioning port facility will need to be able to accommodate not only both the topside and jacket, but all platform sizes as well. Therefore, this strategy accounts for the worst-case-scenario, which will result in conservative port requirements.

Consequently, to determine the largest possible demand on the port infrastructure, it is assumed that the heavy lift vessel, the *Pioneering Spirit*, and the cargo barge, the *Iron Lady*, will be utilized in the decommissioning activities. Additionally, to determine the required size and capacity of the heavy lift pad, platform Harmony was chosen as the design platform since it is the largest platform off the California coast. Clearance for heavy lift equipment will also need to be accounted for in the size of the heavy lift pad.

Since the transfer of the platform components from the *Pioneering Spirit* to the *Iron Lady* barge requires protected harbor, the channel entrance must be wide enough to accommodate twice the width of the *Pioneering Spirit* as a safety precaution. Once the cargo is safely on the barge, it will be towed to berth, requiring the navigable width of the channel to be at least twice the width of the *Iron Lady* to allow room for tugboats. The length of the berth will need to be, at a minimum, the length of the *Iron Lady* and the depth will need to be quite shallow as the barge will likely need to rest on a grounding bed for stability, as previously shown in **Figure 16**.

The amount of acreage required for the dismantlement process, including the heavy lift pad and uplands, was estimated based on the size of Able Seaton Port. This port has dismantled several offshore oil and gas platforms larger than the platforms off the California coast, such as Brent Delta; therefore, it can be assumed that the acreage estimation is conservative. The capacity of the heavy lift pad was then determined by dividing the weight of platform Harmony's topside by its footprint area and then multiplying by the skid rail spacing, which was assumed to be approximately 8.2 feet (2.5 m). A load factor of 1.2 was applied to achieve a conservative capacity. The capacity of the uplands area was chosen based on the capacity used at Able Seaton Port.

Due to the considerable height of the topsides when placed on the *Iron Lady* barge, the dismantling site must not have any air draft restrictions, as it would significantly increase cost and safety risks.

A few notable air draft restrictions include the following:

- Golden Gate Bridge (San Francisco) = 210 feet
- Vincent Thomas Bridge (Los Angeles) = 185 feet
- Long Beach International Gateway (Long Beach) = 205 feet

The Vincent Thomas Bridge and Long Beach International Gateway Bridge only impact locations within the inner harbors of the ports. Both the Port of Los Angeles and Port of Long Beach have many locations outside of the above air draft restrictions. The port infrastructure requirements discussed above are summarized in **Table 17** below.

Table 17. Port infrastructure requirements for offshore oil & gas platform decommissioning

Port Infrastructure Requirement	Dimensions (US)	Dimensions (metric)	Reasoning
Acreage, minimum	35 acres	142,000 m^2	Estimated size for topside and jacket dismantlement operations occurring separately
Ideal Acreage	≥ 70 acres	284,000 m^2	Estimated size for topside and jacket dismantlement operations occurring simultaneously
Berth Length	660 ft	200 m	Length of *Iron Lady* barge
Berth Depth	33 ft	10 m	Assumed operating draft of *Iron Lady* barge
Heavy Lift Pad Length, minimum	350 ft	107 m	Length of platform Harmony + 100-ft clearance for equipment
Heavy Lift Pad Width, minimum	350 ft	107 m	Width of platform Harmony + 100-ft clearance for equipment
Heavy Lift Pad Loading	> 4,000 psf	> 20 t/m^2	Weight of Platform Harmony Topside x Skid Rail Spacing x Load Factor / Topside Footprint Area
Uplands / Yard Loading	> 2,000 psf	> 10 t/m^2	Uplands Capacity at Able Seaton Port, U.K.*
Channel Entrance Width	815 ft	248 m	Double the width of *Pioneering Spirit*
Channel Navigation Width	330 ft	100 m	Double the width of *Iron Lady* barge
Channel Entrance Depth	33-89 ft	10-27 m	Operating draft of *Pioneering Spirit*
Air Draft Clearance	500 ft	140 m	Height of platform Brent Delta topside while on *Iron Lady* barge*. Value to be replaced with height of CA platform Harmony when confirmed

**Able Seaton Port Site Plan*, 2016, provided on the Able U.K. website: ableuk.com.

**Platform Brent Delta was dismantled at the Able Seaton Port facility in the U.K. All information regarding this dismantlement was found in *Brent Delta Topside Decommissioning Close-out Report*, issued by Shell U.K. Limited in 2019 (Shell 2019).

In addition, some of the required port equipment include:

- Heavy lift capacity crawler / ring crane (the larger capacity, the better)
- Additional smaller crawler cranes
- Rough terrain crane
- SPMTs
- Various sizes of forklifts
- Heavy weight skidding system

A significant amount of material recovered during dismantlement can be recycled; therefore, proximity to metal recycling facilities is an important factor in determining the dismantlement location. For recycling facilities to be able to accept the material, it must be cleaned of any hazardous materials such as hydrocarbons, asbestos, etc. All debris must be disposed of or recycled in accordance with hazardous waste requirements. Possible metal recycling companies to process the recyclable material obtained during dismantlement are SA Recycling, which has several locations from San Diego to Fresno, and Schnitzer Steel, which has locations in Fresno, Oakland, Sacramento, and San Jose – refer to **Figure 21**.

6.5 Port Assessment

By assuming the complete removal option will be utilized for the largest California offshore platform, the port infrastructure requirements developed in **Section 6.4** are conservative. This results in an ideal port facility for offshore oil and gas decommissioning that could accommodate any chosen decommissioning strategy. In addition, the ideal port facility should accommodate all California platform sizes, will be in a location that best reduces offshore work and time spent offshore, minimize the distance from platform to port, and minimize the number of trips to and from the platform. Further, minimization of environmental impacts from decommissioning is an important factor that will need to be studied in more detail.

The locations of the offshore oil and gas platforms, in relation to the locations of the ports and recycling facilities, are shown in **Figure 21** below. M&N has not yet approached any California ports regarding interest in offshore oil and gas decommissioning, but this is an important next step in planning for the increasing decommissioning activity in the Pacific OCS region.

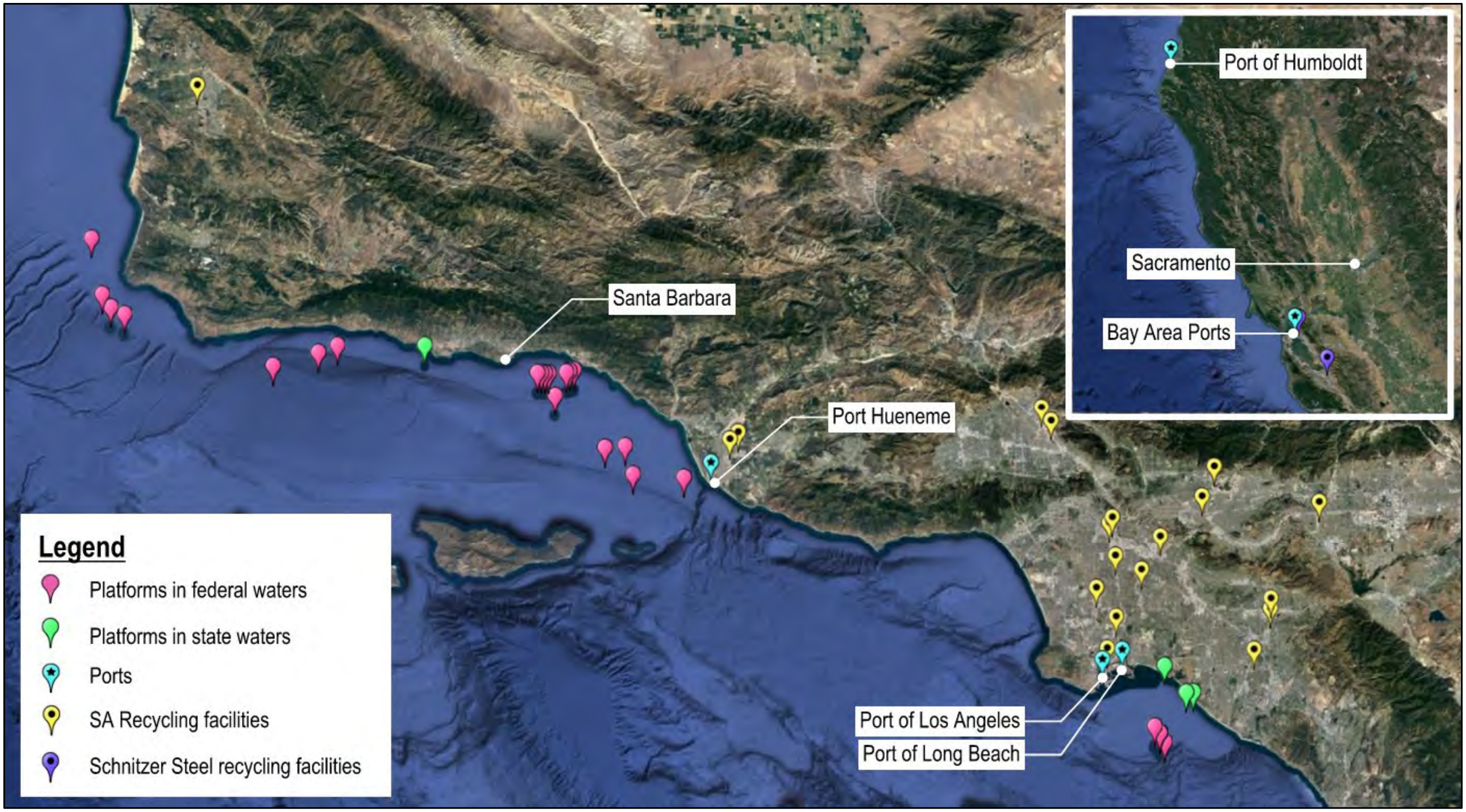

Figure 21. Locations of offshore oil & gas platforms, ports, and metal recycling facilities

Taking all port requirements specified in **Section 6.4** into account, an assessment of the California ports is summarized in **Table 18** below.

Table 18. Port assessment for offshore oil & gas decommissioning

Criteria	Humboldt Bay	Bay Area Ports	Central Coast	Port of Hueneme	Port of LA / LB	Port of San Diego
Channel Entrance Width	2	1	3	3	1	2
Distance to Oil & Gas Platforms	3	3	3	1	1	2
Air Draft Clearance	1	3	1	1	1	3
Proximity to Recycling Facilities	3	2	3	2	1	2
Available Terminal Acreage	1	1	3	3	1	2
Total Points	**10**	**10**	**13**	**10**	**5**	**11**

The point system used in **Table 18** ranks lower numbers better than higher ones (i.e., 1 is better than 2, 2 is better than 3, and so on). The legend for point values is as follows:

- Channel Entrance:
  - (1) Green: channel entrance is greater than twice the width of *Pioneering Spirit*
  - (2) Yellow: cannot accommodate *Pioneering Spirit*, but could accommodate the *Iron Lady* barge
  - (3) Red: channel entrance is too narrow for both *Pioneering Spirit* and *Iron Lady* barge
- Distance to Offshore Oil & Gas Platforms:
  - (1) Green: relatively short distance
  - (2) Yellow: fair distance
  - (3) Red: significant distance
- Air Draft Clearance:
  - (1) Green: no air draft restriction
  - (3) Red: air draft restriction(s)
- Proximity to Recycling Facilities:
  - (1) Green: close proximity to several recycling facilities
  - (2) Yellow: relatively close to a few recycling facilities
  - (3) Red: no recycling facilities in proximity
- Available Terminal Acreage:
  - (1) Green: has available terminal acreage or the ability to create terminal acreage
  - (2) Yellow: may have the required terminal acreage
  - (3) Red: no available terminal acreage

With the lowest number of total points ranked first and the highest number of total points ranked last, per **Table 18**, the Ports of Long Beach and Los Angeles are identified as the best potential port locations for offshore oil and gas decommissioning facilities. The ranking is as follows:

1. Port of Los Angeles / Port of Long Beach
2. Humboldt Bay / Bay Area Ports / Port of Hueneme
5. Port of San Diego
6. Central Coast

6.6 Recommendations / Synergies Between OSW and Offshore Oil and Gas Decommissioning

Based on the rankings that resulted from the assessment summarized in **Table 18**, locating offshore oil and gas decommissioning port facilities at the Port of Los Angeles and/or Port of Long Beach provides the shortest transit from platform locations, shortest transit to recycling facilities, and has the best potential for developing port infrastructure that reduces the cost of platform decommissioning.

When comparing port requirements for offshore oil and gas platform decommissioning and offshore wind development, it is evident that there are some synergies between the two, such as the required acreage and wharf loading criteria – refer to **Table 19**. However, the main difference between the two is draft at berth. Decommissioning offshore oil and gas platforms will likely require a grounding bed and shallow berth depth to ensure the barge and wharf are at the same level, while the offshore wind industry requires deeper water at the berth. This makes it difficult to have both activities located at the same port facility and share the same berth space. Furthermore, an offshore wind project may require the wharf and uplands area at a site with little to no interruptions to operations for multiple years at a time. Similarly, a decommissioned offshore oil and gas platform may be at a port facility for multiple years while being dismantled and recycled. Co-locating the two activities at the same port site would require one activity to be put on pause while the other is actively using the site, significantly increasing the timeline and cost for each activity. Therefore, these two activities could not occur simultaneously at the same port site. In addition, for offshore oil and gas decommissioning, the proximity to recycling facilities is an important factor for easy waterborne, road, or rail transport of recycled components, while this does not have to be considered for the offshore wind industry.

Although the two activities cannot be at the same port site, they could be located within the same port, at separate and/or adjacent facilities with separate upland and berth space. Offshore wind development and offshore oil and gas decommissioning have similar business lines from a terminal equipment, operator, and vessel perspective, making it ideal to have the two facilities located within the same port.

Table 19. Comparison of offshore wind and offshore oil & gas decommissioning key criteria

Criteria	Offshore Wind (S&I Site)	Offshore Oil & Gas Decommissioning
Acreage, minimum	30 – 100 acres	35 – 75 acres
Wharf Length	1,500 ft	660 ft
Minimum Draft at Berth	38 ft	33 ft
Wharf Loading	> 6,000 psf	> 4,000 psf
Uplands / Yard Loading	> 2,000 – 3,000 psf	> 2,000 psf
Air Draft	No air draft restrictions allowed	No air draft restrictions allowed

6.7 Industrial Circular Economy: Energy Transition Facility – Ardersier Port, U.K.

An excellent example of an offshore wind development facility and an offshore oil and gas decommissioning facility working in tandem within the same port can be found at the Ardersier Port in Scotland, U.K. As shown in **Figure 22**, the two activities are placed next to one another, allowing each activity to have their own designated berth and upland area.

Over the next five (5) years, the following work will be completed for this port project (Fleschen 2021):

- Completion of major dredging and channel deepening
- Construction of an oil rig decommissioning facility
- Construction of a waste from energy recovery facility designed specifically to deal with special wastes
- Construction of a green steel plant powered by offshore wind and energy from waste
- Construction of a concrete production plant utilizing dredged sand from the port, by-products from the steel plant, and energy from the waste facility
- Construction of a dedicated floating wind hub for concrete floating wind foundation manufacturing

Figure 22. Ardersier Port site plan (Industrial Circular Economy 2021)

Once completed, the Ardersier Port will be Europe's first fully circular energy transition facility. This purpose-built facility uses the circular economy approach to decommission fossil-fueled energy assets and replace them with renewable energy infrastructure in an economically and environmentally beneficial way. This process is summarized in **Figure 23**.

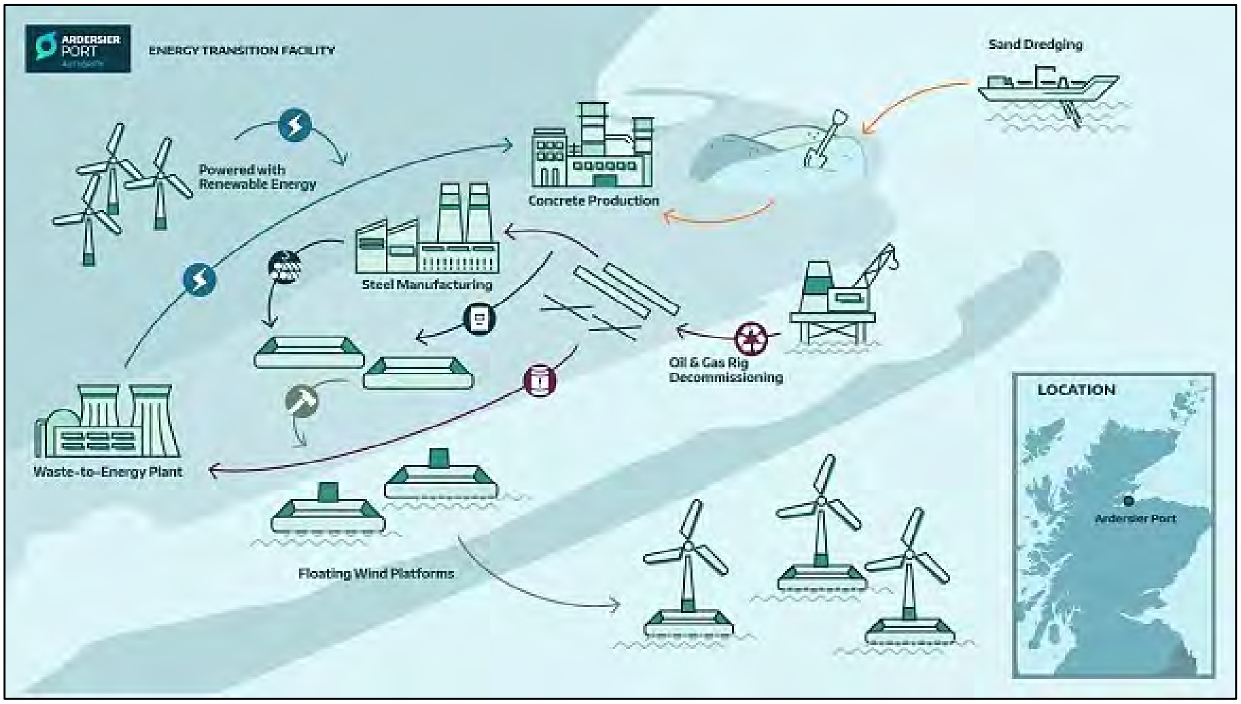

Figure 23. Ardersier Port fully circular energy transition facility (Industrial Circular Economy 2021)

7 Conclusion and Next Steps

The goals of this study were to:

1. Identify port requirements and deployment scenarios needed to support an offshore wind industry in California, concurrently with reasonably foreseeable OCS oil and gas decommissioning activities; and,
2. Assess physical, operational, and regulatory capabilities and constraints of port facilities and infrastructure.

Offshore Wind Port Needs

Section 2 documents the port requirements from the BOEM Port of Coos Bay study (Moffatt & Nichol 2022). **Section 3** identifies the various deployment scenarios for 2030 through 2050 and determines the number of required S&I and MF sites needed to meet those deployment scenarios. **Section 4** and **Section 5** discuss the port outreach that was conducted to identify the number and type of port sites that are potentially available for offshore wind development without displacing existing industries and uses.

In order to meet the medium deployment target of 1.5 GW/year to reach 25.5 GW by 2045, a minimum of three S&I sites are required. The existing California ports with the best capability to meet the offshore wind needs for S&I sites are the Ports of Humboldt, Los Angeles, and Long Beach. The Port of Humboldt is located close to the northern California WEA, while the Ports of Los Angeles and Long Beach are located closer to the central California WEA. Additionally, the Port of Humboldt is the only port in the state of California that is categorized as a good candidate site for all three categories of port uses (i.e., S&I, MF, and O&M). As such, it is a critical port for the development of offshore wind to meet the renewable energy goals set by the state, as well as critical to the feasibility of the northern California WEA development. Moreover, S&I sites are the limiting factor for offshore wind industry development as they have the least number of potential locations that could be improved to meet the offshore wind industry's needs.

Based on the results of this study, many port sites will need to be upgraded or developed for the offshore wind industry to meet the identified offshore wind deployment targets. Fortunately, per port outreach, many existing port sites were identified that could be used to meet these goals. This will require the use of multiple ports throughout the state. Purpose-built infrastructure for all selected sites will need to be planned, funded, permitted, designed, and constructed to meet the offshore wind industry requirements. These projects can take 3 – 5 years, from planning to finished construction, to complete.

The information gathered from this, and previous studies, will inform the next BOEM study titled *California Floating Offshore Wind Regional Ports Feasibility Analysis*, which will assess the feasibility of port upgrades and associated cost estimates and construction timelines. In addition, the AB 525 Strategic Plan, with support from the BOEM and CSLC studies, will include the following:

- Identify required port infrastructure improvements, including cost and schedule,
- Identify impacts to natural and cultural resources, including coastal resources, fisheries, and Native American and Indigenous peoples,
- Rank the recommended port sites,
- Determine workforce development needs, training, and strategy,
- Develop the seaport chapter for the AB 525 Strategic Plan due June 30, 2023.

Synergies Between OSW and Offshore Oil and Gas Decommissioning

There are some synergies between the offshore wind industry and the offshore oil and gas decommissioning industry. These synergies include similar business lines from a terminal equipment, operator, and vessel perspective, making it ideal to have the two facilities located within the same port. However, they cannot be located at the same port site as both need designated berth and upland space for long periods of time. The Port of Los Angeles and Port of Long Beach were identified to be the ideal locations for offshore oil and gas platform decommissioning due to proximity to the offshore oil and gas platforms, recycling facilities, potentially available port sites, no air draft restrictions, and wide entrance and navigation channels. An important next step in planning for the increasing decommissioning activity in the Pacific OCS region is to conduct outreach with the identified ports to determine interest and suitability for offshore oil and gas decommissioning.

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[USCG] U.S. Coast Guard. 2021. Port access route study: The Pacific coast from Washington to California. Federal Register. Docket No.: USCG-2021-0345.

List of Relevant Literature

The following lists the information and data gathered from a range of offshore wind industry, offshore oil and gas decommissioning, and government sources to provide a baseline of best available information on offshore wind, decommissioning activities, and ports.

Offshore Wind Literature

Bureau of Ocean Energy Management (BOEM):

- Determining the Infrastructure Needs to Support Offshore Floating Wind and Marine Hydrokinetic Facilities on the Pacific West Coast and Hawaii [ICF International] (BOEM 2016-011)
- Floating Offshore Wind in California: Gross Potential for Jobs and Economic Impacts from Two Future Scenarios [NREL] (BOEM 2016-029)
- Floating Offshore Wind Turbine Development Assessment: Final Report and Technical Summary [ABSG Consulting Inc.] (BOEM 2021-030)
- Port of Coos Bay Port Infrastructure Assessment for Offshore Wind Development [Moffatt & Nichol] (BOEM 2022-073)
- Potential Offshore Wind Energy Areas in California: An Assessment of Locations, Technology, and Costs [NREL] (BOEM 2016-074)
- Presentation BOEM California Leasing Update – 10-6-22 (BOEM 2022)

California Energy Commission (CEC):

- AB 525 Goals – Resources Considered (as of March 3, 2022), March 10, 2022 (CEC 2022)
- Commission Report – Offshore Wind Energy Development off of California Coast, August 1, 2022, CEC-800-2022-001-REV (CEC 2022)
- Presentations – AB 525 Workshop, March 3, 2022 (CEC 2022)
- Presentation – Preparing a Strategic Plan for Offshore Wind Energy Development Staff Workshop 10-6-22, October 6, 2022 (CEC 2022)

California State Lands Commission (CSLC):

- Alternative Port Assessment to Support Offshore Wind Feasibility Assessment Report [Moffatt & Nichol] (CSLC, Unpublished Report)

National Renewable Energy Laboratory (NREL):

- 2014-2014 Offshore Wind Technologies Market Report (NREL 2015)
- 2016 Offshore Wind Energy Resource Assessment of the United States (NREL 2016)
- 2017 Offshore Wind Technologies Market Update (NREL 2018)
- 2019 Offshore Wind Technology Data Update (NREL 2019)
- An Assessment of the Economic Potential of Offshore Wind in the United States from 2015 to 2030 (NREL 2017)
- Cost of Floating Offshore Wind Energy Using New England Aqua Ventus Concrete Semisubmersible Technology (NREL 2020)
- Definition of the IEA Wind 15-Megawatt Offshore Wind Turbine (NREL 2020)
- Large-Scale Offshore Wind Power in the United States: Assessment of Opportunities and Barriers (NREL 2010)
- The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032 (NREL 2020)

- The Demand for a Domestic Offshore Wind Energy Supply Chain (NREL 2022)

Schatz Energy Research Center (Schatz):

- American Jobs Project: The California Offshore Wind Project: A Vision for Industry Growth (Schatz 2019)
- California North Coast Offshore Wind Studies (Schatz 2020)
- Del Norte County Offshore Wind Preliminary Feasibility Assessment: Final Report (Schatz 2021)
- Port Infrastructure Assessment Report (Schatz 2020)

U.S. Department of Energy (USDOE):

- Assessment of Ports for Offshore Wind Development in the United States (USDOE 2014)
- National Offshore Wind Strategy (USDOE 2016)
- Offshore Wind Market Report: 2021 Edition (USDOE 2021)

Additional California Regional Port Assessment Studies:

- California Offshore Wind: Workforce Impacts and Grid Integration (UC Berkeley Labor Center 2019)
- California's Offshore Wind Electricity Opportunity (USC Schwarzenegger 2021)
- Economic Impact of Offshore Wind Farm Development on the Central Coast of California (Cal Poly SLO 2021)
- Scenarios for Offshore Wind Power Production for Central California Call Areas (Cal Poly SLO 2020)
- Supply Chain Contracting Forecast for U.S. Offshore Wind Power – The Updated and Expanded 2021 Edition (The Special Initiative on Offshore Wind 2021)

Offshore Oil and Gas Decommissioning Literature

Bureau of Ocean Energy Management (BOEM):

- Air Emissions Associated with Decommissioning Operations for Pacific Outer Continental Shelf Oil and Gas Platforms Volume 1: Final Report [MRS Environmental, Inc.] (BOEM 2019)
- Environmental Setting of the Southern California OCS Planning Area [Argonne National Laboratory] (BOEM 2019)
- Environmental Studies Program, Studies Development Plan 2021-2022 (BOEM 2020)
- FAQ: Decommissioning and Rigs to Reefs in the Pacific Ocean (BOEM 2017)
- Final Environmental Assessment Santa Clara Unit (Platforms Grace and Gail) Conductor Removal Program (BOEM 2021)
- Oil and Gas Leasing on the Outer Continental Shelf (BOEM)
- Santa Clara Unit (Platforms Grace and Gail) Conductor Removal Program Environmental Assessment (BOEM 2021)
- Selected BOEM & BSEE-Funded Research Informing Oil & Gas Decommissioning Offshore California (BOEM and BSEE 2019)

Bureau of Safety and Environmental Enforcement (BSEE):

- Decommissioning Cost Update for Pacific OCS Region Facilities Volume 1 [InterAct PMTI] (BSEE 2020)
- Decommissioning Cost Update for Pacific OCS Region Facilities Volume 2 [InterAct PMTI] (BSEE 2020)
- Final Freeport-McMoRan Point Arguello Unit Well Conductors Removal, Finding of No Significant Impact and Environmental Assessment (BSEE 2020)
- Programmatic Environmental Impact Statement for Oil and Gas Decommissioning Activities on the Pacific Outer Continental Shelf (BSEE 2021)

California State Lands Commission (CSLC):

- Decommissioning and Removal of Oil and Gas Facilities Offshore California: Recent Experiences and Future Deepwater Challenges (CSLC 1997)
- Report on Abandoned Offshore Oil and Gas Wells (CSLC 2019)
- Safety and Oil Spill Prevention Audit: Platform Emmy (SoCal Holding, LLC and CSLC 2016)
- Safety and Oil Spill Prevention Audit: Platform Esther (DCOR, LLC and CSLC 2016)
- Safety and Oil Spill Prevention Audit: Platform Eva (DCOR, LLC and CSLC 2016)

Interagency Decommissioning Working Group (IDWG):

- A Citizen's Guide to Offshore Oil and Gas Decommissioning in Federal Waters Off California (IDWG 2019)

U.S. Department of the Interior, Minerals Management Service (MMS):

- Estimation of Fisheries Impacts Due to Underwater Explosives Used to Sever and Salvage Oil and Gas Platforms in the U.S Gulf of Mexico (OCS Study MMS 2000-087 2001)
- State of the Art of Removing Large Platforms Located in Deep Water (MMS, Twachtman Snyder & Byrd, Inc. 2000)
- The Politics, Economics, and Ecology of Decommissioning Offshore Oil and Gas Structures (OCS Study MMS 2001-006 2001)

Other Publications and Presentations:

- A Citizen's Guide to the NEPA: Having Your Voice Heard (Council on Environmental Quality, Executive Office of the President 2007)
- Bight '18 Sediment Quality Executive Synthesis (Southern California Bight 2018 Regional Monitoring Program Sediment Quality Assessment Planning Committee 2018)
- Brent Bravo, Charlie, and Delta GBS Decommissioning: Technical Document (Shell U.K. Limited 2017)
- Brent Delta Topside Decommissioning Close-out Report (Shell U.K. Limited 2019)
- Decommissioning California's Oil Platforms: 3 choices, An Undecided Future (The Log 2020)
- Decommissioning of Offshore Structures: Challenges and Solutions (Computational Methods in Marine Engineering 2005)
- Decommissioning of Platforms: On-Shore Disposal, Presentation, 10/20/2010 (Proserv Offshore 2010)
- Decommissioning Progress Report: Brent Alpha Jacket (Shell U.K. Limited 2020)
- Decommissioning Progress Report: Brent Alpha Topside (Shell U.K. Limited 2020)

- Ecological Issues Related to Decommissioning of California's Offshore Production Platforms (The Select Scientific Advisory Committee on Decommissioning University of California 2000)
- Environmental Benefits of Leaving Offshore Infrastructure in the Ocean (Frontiers in Ecology and Environment 2018)
- Evaluating Alternatives for Decommissioning California's Offshore Oil and Gas Platforms: A Technical Analysis to Inform State Policy, (California Ocean Science Trust 2010)
- Interagency Decommissioning Working Group Action Plan (IDWG 1999)
- Offshore Structure Design and Construction (Frieze, year unknown)
- Overview of Rigs to Reefs: Legislation in California and the Gulf of Mexico (Louisiana State University [LSU] Journal of Energy Law and Resources 2020)
- Partial vs. Complete Removal: The Debate Surrounding California's Implementation of the Rigs-to-Reef Project (National Association of Administration Law Judiciary 2012)
- POCSR Decommissioning Cost Estimate Update Presentation (TSB Offshore 2015)
- The Challenges Facing the Industry in Offshore Facility Decommissioning on the California Coast, Presented to Offshore Technology Conference, April 2018 (Byrd 2018)
- What the Regulations Require and How Decommissioning Differs Between the Pacific and Gulf of Mexico (LSU Journal of Energy Law and Resources Decommissioning Symposium 2019)
- Worldwide Oil and Gas Platform Decommissioning: A Review of Practices and Reefing Options (Ocean and Coastal Management 2019)

U.S. Department of the Interior (DOI)

DOI protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

Bureau of Ocean Energy Management (BOEM)

BOEM's mission is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.

California Energy Commission

COMMISSION REPORT

Offshore Wind Energy Development off the California Coast

Maximum Feasible Capacity and Megawatt Planning Goals for 2030 and 2045

Gavin Newsom, Governor
August 2022 | CEC-800-2022-001-REV

California Energy Commission

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ABSTRACT

This report responds to the directive set forth by Assembly Bill 525 (AB 525, Chiu, Chapter 231, Statutes of 2021). The law directs that on or before June 1, 2022, the California Energy Commission (CEC) shall "evaluate and quantify the maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits and shall establish megawatt offshore wind planning goals for 2030 and 2045." This report addresses these requirements. Furthermore, it discusses the potential for offshore wind energy development in federal waters off the California coast to provide a new source of electricity generation, add technology diversity to the state's renewable energy and zero-carbon resource portfolio, and help California meet its ambitious climate and energy goals.

This report is the first of four work products the CEC is directed by AB 525 to prepare. By no later than June 30, 2023, the CEC, in coordination with federal, state, and local agencies and a wide variety of stakeholders, must develop a strategic plan for offshore wind energy developments installed off the California coast in federal waters and submit it to the California Natural Resources Agency and the Legislature. The strategic plan is to be informed by interim activities and products developed by the CEC that include this report and two additional reports due on or before December 31, 2022. The two additional reports include assessing the economic benefits of offshore wind as they relate to seaport investments and workforce development needs and standards and preparing a permitting roadmap that describes time frames and milestones for a coordinated, comprehensive, and efficient permitting process for offshore wind energy facilities and associated electricity and transmission infrastructure off the California coast.

Keywords: Offshore wind energy, floating offshore wind, offshore energy, offshore development, offshore wind planning goals, decarbonization, coastal resources, maximum feasible capacity, renewable energy, reliability, transmission, infrastructure planning, wind energy, Assembly Bill 525, Senate Bill 100

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TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

LIST OF APPENDICES

Page

EXECUTIVE SUMMARY

On September 23, 2021, Governor Gavin Newsom signed into law Assembly Bill 525 (AB 525, Chiu, Chapter 231, Statutes of 2021), which took effect January 1, 2022. AB 525 requires the California Energy Commission (CEC), in coordination with federal, state, and local agencies and a wide variety of stakeholders, to develop a strategic plan for offshore wind energy deployment off the California coast in federal waters. The CEC must submit the strategic plan to the California Natural Resources Agency (CNRA) and the Legislature by no later than June 30, 2023. The following interim activities and products developed by the CEC will contribute to the strategic plan:

1. Evaluate and quantify the maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits, and establish megawatt (MW) offshore wind energy planning goals for 2030 and 2045 by no later than June 1, 2022.[1]
2. Complete and submit to CNRA and the relevant fiscal and policy committees of the Legislature a preliminary assessment of the economic benefits of offshore wind as they relate to seaport investments and workforce development needs and standards by no later than December 31, 2022.
3. Complete and submit a permitting roadmap to CNRA and the relevant fiscal and policy committees of the Legislature that describes timeframes and milestones for a coordinated, comprehensive, and efficient permitting process for offshore wind energy facilities and associated electricity and transmission infrastructure off the coast of California by no later than December 31, 2022.

This report focuses on evaluating and quantifying the maximum feasible capacity of offshore wind in federal waters off the California coast to achieve reliability, ratepayer, employment, and decarbonization benefits. Moreover, the report establishes the MW planning goals for 2030 and 2045. The proposed MW planning goals are for developing the strategic plan. AB 525 requires that the "[d]evelopment of the strategic plan shall incorporate, but not delay, progress to advance responsible development of offshore wind in other relevant policy venues" (Public Resource Code (PRC), section 25991 [a][2]) and incorporates progress toward advancing responsible development of offshore wind in other relevant policy venues and also makes clear that nothing in the provisions of the law "is intended to create a technology set-aside or mandatory minimum for any type of eligible renewable energy resource" (PRC Section 25991.7).

AB 525 further requires the CEC to consider 12 factors when establishing the MW offshore wind planning goals. As discussed in Chapter 3, the CEC assessed all 12 factors. While all

1 This report was originally proposed for consideration at a CEC Business Meeting on May 24, 2022, however, at a May 18, 2022 public workshop commenters identified newly released studies that were not considered in the development of the draft report. To evaluate these new studies and allow for additional public process around how these studies may inform the draft report, consideration of the draft report was postponed to a later date.

factors are important in establishing MW planning goals for the strategic plan, the following five factors have had greater influence on development of the MW planning goals in the draft report published on May 6, 2022:

1. The findings of the *2021 SB 100 Joint Agency Report.*
2. The need to initiate long-term transmission and infrastructure planning to facilitate delivery of offshore wind energy to Californians.
3. The need for reliable renewable energy that accommodates California's shifting peak load.
4. The generation profile of offshore wind off the California coast.
5. The potential impacts on coastal resources, fisheries, Native American and Indigenous peoples, and national defense, and strategies for addressing those potential impacts.

An additional factor that has contributed to the proposed revisions here is factor 11: any executive action from the Governor regarding offshore wind.

The first factor is the findings of the *2021 SB 100 Joint Agency Report*. The *2021 SB 100 Joint Agency Report* evaluates the challenges and opportunities of implementing SB 100. The report provides critical context for the opportunity offshore wind energy represents for California to generate carbon-free energy and diversify the state's renewable energy portfolio, especially considering the scale of the climate crisis. The 100 Percent Clean Energy Act of 2018, commonly referred to as Senate Bill 100 (De León, Chapter 312, Statutes of 2018), is a pillar of the state's clean energy policy.

SB 100 increased the state's Renewables Portfolio Standard to ensure that at least 60 percent of the state's electricity comes from eligible renewable energy resources by 2030. SB 100 also requires that eligible renewable energy resources and zero-carbon resources supply 100 percent of all retail sales of electricity to California customers and 100 percent of electricity procured to serve all state agencies by December 31, 2045. The *2021 SB 100 Joint Agency Report* found that California will need significant development of clean energy generation over the next 25 years. Energy resource computer modeling completed for the report covered a range of scenarios and technologies. Modeling of scenarios to achieve the SB 100 policy used an assumption that a maximum of 10 gigawatts GW of offshore wind is available and all 10 GW were selected by the model in the 2045 Core Scenario as well as in almost all other scenarios.

The second factor is the need to initiate long-term electricity transmission and infrastructure planning to ease delivery of offshore wind energy to Californians. The availability of existing transmission and the need to develop more transmission in specific areas affect the offshore wind MW planning goals the CEC establishes and can expect to achieve over time. The availability and need are particularly critical given that AB 525 requires the CEC to include a transmission planning chapter in the strategic plan to support the 2030 and 2045 offshore wind MW planning goals. The California Independent System Operator (California ISO) has recently completed transmission studies involving offshore wind and is conducting another study as part of the annual transmission planning process (TPP) in collaboration with the

California Public Utilities Commission (CPUC). The MW planning goals, and the forthcoming transmission chapter of the strategic plan will build on those ongoing efforts.

The North Coast wind resource is one of the best in the world with high renewable energy potential and wind speeds consistent and favorable for commercial development. But the electric system in California's North Coast region is relatively isolated from the California grid and serves primarily local community need. Additional transmission infrastructure will be needed to deliver offshore wind energy from this region to the grid. Existing transmission on the Central Coast is robust and near large load centers. Near-term electric generator retirements, such as 2,225 MW from the Diablo Canyon Nuclear Power Plant, provides an opportunity to repurpose existing infrastructure to integrate wind energy developed offshore the Central Coast. However, there is still a need to do long-term planning for the subsea infrastructure and the ability to use existing onshore infrastructure.

The third factor focuses on the need for reliable renewable energy that accommodates California's daily peak load (highest electric demand within a period of time) shifting from later in the afternoon to early evening as solar generation decreases. This shift creates a need for reliable renewable energy sources that continue to generate electricity into the evening hours.

The fourth factor, the generation profile of offshore wind, is closely related to the third. Offshore wind, like other variable-output renewable energy sources, has inherent uncertainty with the associated energy and reliability contributions.

The fifth factor is the potential impacts on coastal resources (including ocean resources and marine ecosystems), fisheries, Native American and Indigenous peoples, and national defense, and strategies for addressing those potential impacts. These impacts are the subject of past and ongoing study and stakeholder and tribal outreach and engagement. Current data and analyses show that approaches to addressing potential impacts, such as avoiding, minimizing, and managing these impacts, can affect the MW planning goals as well as the quantification of the maximum feasible capacity.

In addition to the factors described above, the proposed revisions of the planning goals are supported by factor 11, any executive action from the Governor regarding offshore wind. In a July 22, 2022 letter to the Chair of the California Air Resources Board, the Governor urged bold actions to address the urgency of the climate crisis, and outlining new targets to accelerate progress on California's 2030 climate goals and to get to climate neutrality no later than 2045. In the letter, among other requested actions, the Governor asks the CEC to establish an offshore wind planning goal of at least 20 GW by 2045 and to work with the state's federal partners to accelerate the deployment of offshore wind, noting that California is home to one of the best offshore wind resources in the world and that offshore wind can serve as a clean, domestic source of electricity that can play an important role in meeting the state's growing need for clean energy.[2] The Energy Commission factored this climate urgency and the call for at least a 20 GW goal into these proposed revisions.

AB 525 also requires the identification of suitable sea space for wind energy areas in federal waters sufficient to accommodate the offshore wind MW planning goals. CEC staff, in coordination with other federal, state, and local agencies, has assessed offshore wind since 2016. Based on this experience and existing information, CEC staff recommends that identifying suitable sea space for wind energy areas in federal waters is a condition precedent to being able to quantify the maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits. The considerations the CEC must make to identify suitable sea space are:

- Existing data and information on offshore wind resource potential and commercial viability.
- Existing and necessary transmission and port infrastructure.
- Protecting cultural and biological resources with the goal of prioritizing least-conflict ocean areas.

This work is underway but is not expected to be completed until after this report *Offshore Wind Energy Development off the Coast of California, Maximum Feasible Capacity and Megawatt Planning goals for 2030 and 2045,* is completed based on the sequence of activities prescribed by AB 525. The need to complete this work prevents CEC staff from quantifying the maximum feasible capacity until the strategic plan is developed and could result in refining the offshore wind MW planning goals. As discussed in Chapter 2, the CEC did evaluate studies that have assessed nearly 21.8 GW of offshore wind technical potential in federal waters off the California coast. The assessments are based on wind speed, ocean depth, bottom slope, distance to grid interconnection, and distance to existing port infrastructure that are technically suitable for current floating technologies. The nearly **21.8 GW number is a reference point** for technically *feasible* capacity that the CEC will continue to evaluate as work continues to:

- Identify sea space.
- Evaluate additional technical assessments of transmission need and grid integration strategies.
- Assess port infrastructure.
- Analyze potential impacts on coastal resources and users, fisheries, Native American and Indigenous peoples, and national defense, as required by AB 525.

The CEC staff also considered other planning initiatives for offshore wind energy generation that are already ongoing in California, including planning by non-ISO load-serving entities, publicly owned utility IRPs, and the CPUC's integrated resource planning (IRP) process and the

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2 Governor Gavin Newsom, letter to Chair of the California Air Resources Board. July 22, 2022. https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf?emrc=1054d6

ISO's TPP. The AB 525 offshore wind MW planning goals serve to anchor the state's strategic planning effort called for in AB 525. The AB 525 strategic plan will be an important foundation to set up IRP, the TPP, and other energy resource planning and investment decisions as they relate to procurement of offshore wind generation and transmission. To best serve this approach, the MW planning goals should reasonably exceed current IRP and TPP assumptions and amounts of offshore wind to allow flexibility as those ongoing processes continue to inform and direct the optimal procurement for ratepayers over the coming years. The MW planning goals are not intended as a core input to IRP or TPP analysis, nor should they be seen as a "floor" or "ceiling" for offshore wind procurement in California.

To ensure public engagement, the CEC held three public workshops to inform the planning goals for AB 525. The first workshop, held March 3, 2022, focused on approaches to fulfill the statutory requirements of AB 525 in setting offshore wind energy planning goals for 2030 and 2045. The Bureau of Ocean Energy Management (BOEM) also presented on activities leading to a lease sale auction for the Humboldt and Morro Bay Wind Energy Areas. On May 18, 2022, the CEC held a second workshop to present the draft report and proposed findings and recommendations. Commenters in the May 18 workshop referenced three studies, released after the posting of the draft report, that recommend higher MW offshore wind planning goals than those in the draft report. This final workshop, held June 27, 2022, focused on these and other studies, and how they relate to the AB 525 requirements and the draft report.

The May 6, 2022 draft report proposed a preliminary planning goal of 3,000 megawatts for 2030. For completing the strategic plan, the CEC instead establishes a preliminary planning goal range of **2,000 MW–5,000 MW** (2 GW–5 GW) of offshore wind for 2030. The upper end of this range could come from a full build-out of the Morro Bay Wind Energy Area (WEA) or a combination of a partial build-out of the Morro Bay WEA and Humboldt WEA. The WEAs are areas identified by BOEM in coordination with other federal, state, local, and tribal partners that appear most suitable for commercial wind energy activities while presenting the fewest apparent environmental and user conflicts. The lower end of that range reflects an understanding that achieving a 2030 online date for any proposed offshore wind project will take a significant mobilization of effort and resources, and timely infrastructure investments, among other factors. The CEC will work with state and federal partners to identify process steps and milestones that could allow for a 2030 online date for California's first offshore wind projects.

The May draft report proposed to evaluate an additional 7,000–12,000 MW of offshore wind for 2045, establishing the total 2045 preliminary megawatt planning goals for the strategic plan at 10,000 MW to 15,000 MW (10 GW to 15 GW), and noting that technological developments and related cost reductions could support a larger megawatt planning goal of up to 20 GW between 2045 and 2050. **In light of the Governor's call to adopt a more aspirational target, and on the basis of additional studies and comment received, the CEC establishes a preliminary planning goal of 25,000 MW (25 GW) for 2045. These preliminary planning goals are designed to be potentially achievable but aspirational and are established at levels that can contribute significantly to achieving California's climate goals. These goals reflect the evaluation of the 12**

factors prescribed by AB 525, the improvements in technology referenced above, and the additional information provided to the CEC after the publication of the May draft report.

The MW planning goals will guide the development of the strategic plan for offshore wind in federal waters off the California coast under AB 525. These preliminary planning goals may be refined as part of completing the strategic plan as more information becomes available from the analysis of suitable sea space and potential impacts on coastal resources, fisheries, Native American and Indigenous people, and national defense, as well as other strategic plan topics. These planning goals are not procurement targets. Any future procurement authorization of offshore wind will have to go through all necessary resource planning, procurement, and permitting requirements.

CHAPTER 1:
Background on SB 100 and Offshore Wind

California is working to reduce the pace, magnitude, and costs of climate change impacts by strengthening climate change resilience and reducing greenhouse gas emissions. With the passage of the landmark legislation, the 100 Percent Clean Energy Act of 2018 (Senate Bill [SB] 100, De León, Chapter 312, Statutes of 2018), California requires that eligible renewable energy resources and zero-carbon resources supply 100 percent of total retail sales of electricity in California to end-use customers and 100 percent of electricity procured to serve all state agencies by 2045.

SB 100 also requires that the California Energy Commission (CEC), California Air Resources Board (CARB), and the California Public Utilities Commission (CPUC) prepare a joint report every four years, evaluating the opportunities and challenges of implementing SB 100. The first report, the *2021 SB 100 Joint Agency Report*, was issued in March 2021 and finds that achieving the 2045 policy is technically feasible.[3] The report also finds California will need to roughly triple its current electric power capacity to meet the 2045 target, and a significant buildout of eligible renewable and zero-carbon energy generation will be required over the next 25 years.

In addition to renewable and zero-carbon energy goals, the state set an economywide target of reducing greenhouse gas emissions to 40 percent below 1990 levels by 2030[4] and 80 percent below by 2050.[5] The state is taking bold action to meet these greenhouse gas reduction targets. For example, California has established a loading order to prioritize meeting energy needs first with energy efficiency and demand response; second with renewable energy, including distributed generation and utility-scale; and third with a clean, conventional electricity supply. Every three years, the CEC adopts updated *Building Energy Efficiency Standards* that guide the construction of buildings to better withstand extreme weather, lower energy costs, and reduce climate and air pollution.

California has also established aggressive zero emission transportation goals, including the following:

- All new passenger vehicles sold are to be zero-emission by 2035.
- Transition all drayage trucks to be zero-emission by 2035.

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3 CEC, CPUC, and CARB. 2021. *2021 SB 100 Joint Agency Report Achieving 100 Percent Clean Electricity in California: An Initial Assessment*. Publication Number: CEC-200-2021, https://efiling.energy.ca.gov/EFiling/GetFile.aspx?tn=237167&DocumentContentId=70349.

4 Senate Bill 32 (Pavley, Chapter 249, Statutes of 2016) (SB 32).

5 Senate Bill 100 (De León, Chapter 312, Statutes of 2018) (SB100).

- All medium and heavy-duty vehicles in California are to be zero-emission by 2045 where feasible.

Wind energy developed in federal ocean waters[6] off California's coast is poised to play an important role in diversifying the state's portfolio of resources. Offshore wind can help California achieve its 100 percent renewable and zero-carbon energy goals, as well as the electrification of other sectors, such as transportation.

Resource portfolio modeling completed for the *2021 SB 100 Joint Agency Report* included a range of scenarios and technologies. The model for the Core Scenario[7] included 145 GW of utility-scale capacity additions to achieve the SB 100 policy for 2045, including 10 GW of offshore wind. The estimated total resource cost of the Core Scenario in 2045 is $66 billion. Furthermore, the report included a scenario with no offshore wind, which had an estimated 2045 total resource cost of $67 billion. These modeling results indicate that including 10 GW of offshore wind reduced the modeled 2045 total resource costs by $1 billion.[8] **Figure 1** shows the projected new resource additions for the SB 100 Core Scenario, including 10 GW of offshore wind by 2045.

6 Federal waters extend from 3 nautical miles (nm) offshore to the edge of the Exclusive Economic Zone ending at 200 nm offshore, except within boundaries of any National Park, National Marine Sanctuary, National Wildlife Refuge (or associated systems), or National Monument.

7 The SB 100 Core Scenario is consistent with the joint agencies (CEC, CPUC, and CARB) interpretation of SB 100 and includes only commercialized technologies with publicly available cost and performance data. The Core Scenario includes retail sales and state loads, high electrification demand, and all candidate resources available.

CEC, CPUC, and CARB. 2021. 2021 SB 100 Joint Agency Report Achieving 100 Percent Clean Electricity in California: An Initial Assessment, pages 6-7,
https://efiling.energy.ca.gov/EFiling/GetFile.aspx?tn=237167&DocumentContentId=70349.

8 Ibid, pages 88–89.

Figure 1: Modeling Results from the SB 100 Joint Agency Report Core Scenario

California
Clean Electricity Resources

	Existing Resources	Projected New Resources	
	2019*	2030**	2045**
Solar (Utility-Scale)	12.5 GW	16.9 GW	69.4 GW
Solar (Customer)	8.0 GW	12.5 GW	28.2 GW
Storage (Battery)	0.2 GW	9.5 GW	48.8 GW
Storage (Long Duration)	3.7 GW	0.9 GW	4.0 GW
Wind (Onshore)	6.0 GW	8.2 GW	12.6 GW
Wind (Offshore)	0 GW	0 GW	10.0 GW
Geothermal	2.7 GW	0 GW	0.1 GW
Biomass	1.3 GW	0 GW	0 GW
Hydrogen Fuel Cells	0 GW	0 GW	0 GW
Hydro (Large)	12.3 GW	N/A†	N/A†
Hydro (Small)	1.8 GW	N/A†	N/A†
Nuclear	2.4 GW	N/A†	N/A†

*Includes in-state | **Includes in-state and out of state capacity | †New hydro and nuclear resources were not candidate technologies for this round of modeling and could not be selected*

Source: *2021 SB 100 Joint Agency Report* Summary, March 2021

The *2021 SB 100 Joint Agency Report* acknowledges there are additional investments and actions that would have to occur to realize 10 GW of offshore wind by 2045. While there is a significant wind resource potential off the California coast, there are challenges to developing offshore wind energy. The report states: "Among the foremost challenges are significant anticipated transmission requirements and competing coastal uses, including shipping, fishing, recreation, marine conservation, and Department of Defense activities. Together, these factors severely limit the feasible resource potential."[9] However, the report found that offshore wind energy represents an opportunity for California to generate carbon-free energy and diversify the state's renewable energy portfolio, especially considering the scale of the climate crisis.

The Offshore Wind Energy Opportunity for California

Offshore wind has been identified as an abundant domestic source of clean energy production for the United States because offshore winds tend to be strong, fast, and uniform. However, specific technologies depend on site-specific conditions and characteristics such as water depth, wind speeds, and seabed geology. Floating and fixed-bottom technologies have been

9 Ibid., page 107.

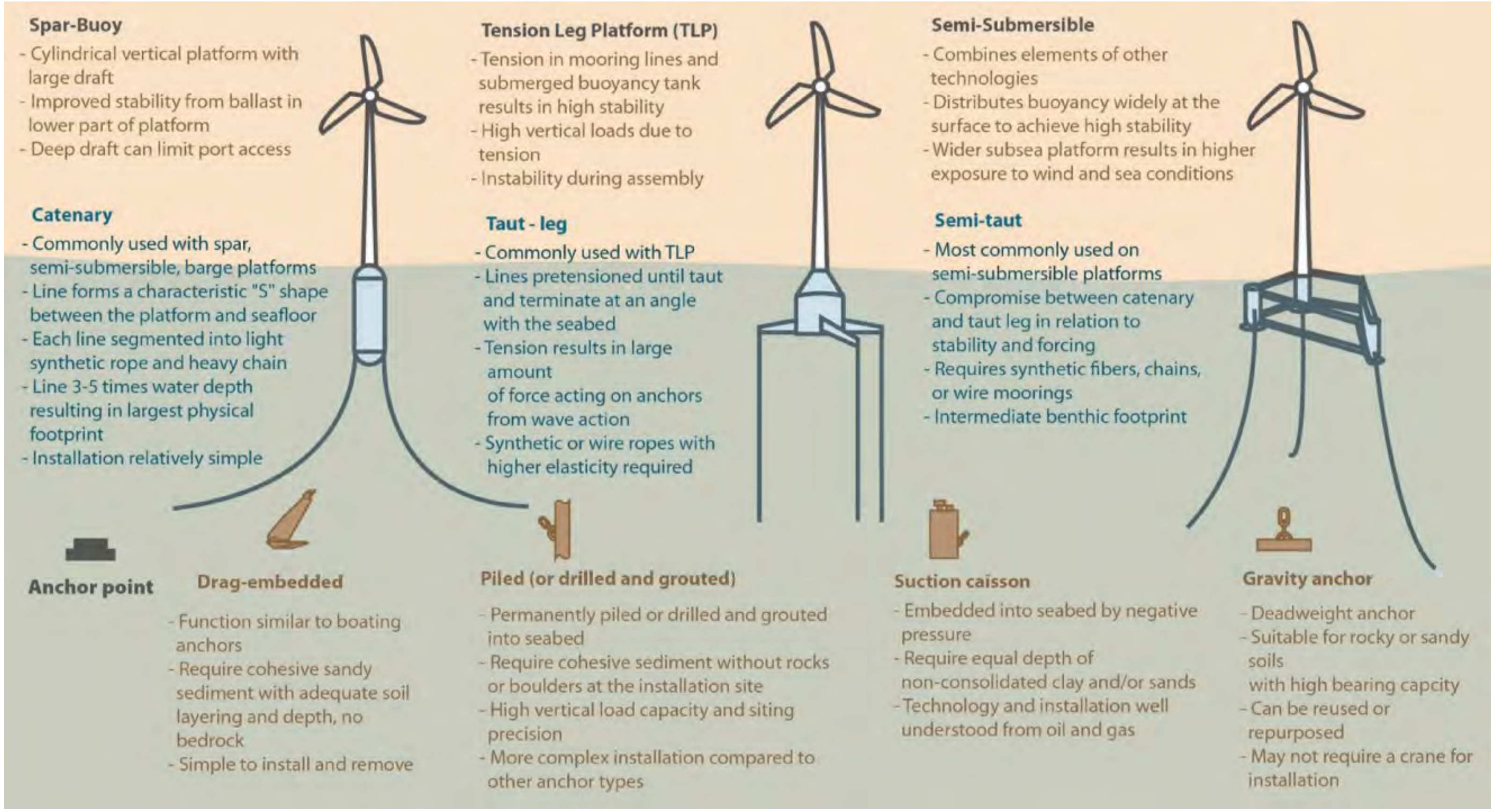
deployed internationally, and there are 50,500 MW of installed capacity of fixed-bottom projects globally, including a pipeline of additional projects under development on the U.S. East Coast, as well as 123 MW of installed capacity of floating projects globally.[10] Whether floating or fixed-bottom, offshore technologies use wind turbines that essentially operate in the same way as onshore wind technologies. Offshore wind turbines and related components are larger than those used for onshore wind energy generation, and current market data indicate they are expected to continue increasing in size.[11] For example, offshore wind turbine hub height averaged 330 feet with a capacity of 6 MW in 2016 and is expected to grow to nearly 500 feet with a capacity of 15 MW or more by 2035.[12] In addition to turbines, floating offshore wind developments will likely include midwater-suspended electrical cables linking the turbines, mooring cables, and anchors attaching the turbines to the seafloor, with an electrical cable to transport the energy from the turbines to a substation, either onshore or offshore. There is also variability among floating offshore wind technologies with regard to some of the examples of currently known platform design, mooring, and anchor configurations being pursued in deep ocean waters, as seen in **Figure 2**.

10 NREL April 7, 2022. "Offshore Wind Briefing for Oregon Department of Energy" presentation. https://www.oregon.gov/energy/energy-oregon/Documents/2022-04-05-ODOE-FOSW-Public-Meeting-PPT.pdf.

11 Optis, Mike, Alex Rybchuk, Nicola Bodini, Michael Rossol, and Walter Musial. 2020. *2020 Offshore Wind Resource Assessment for the California Pacific Outer Continental Shelf*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77642. https://www.nrel.gov/docs/fy21osti/77642.pdf.

12 U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. August 30, 2021. "Wind Turbines: the Bigger the Better." https://www.energy.gov/eere/articles/wind-turbines-bigger-better.

Figure 2: Diagram of Mooring, Anchoring, and Floating Foundations

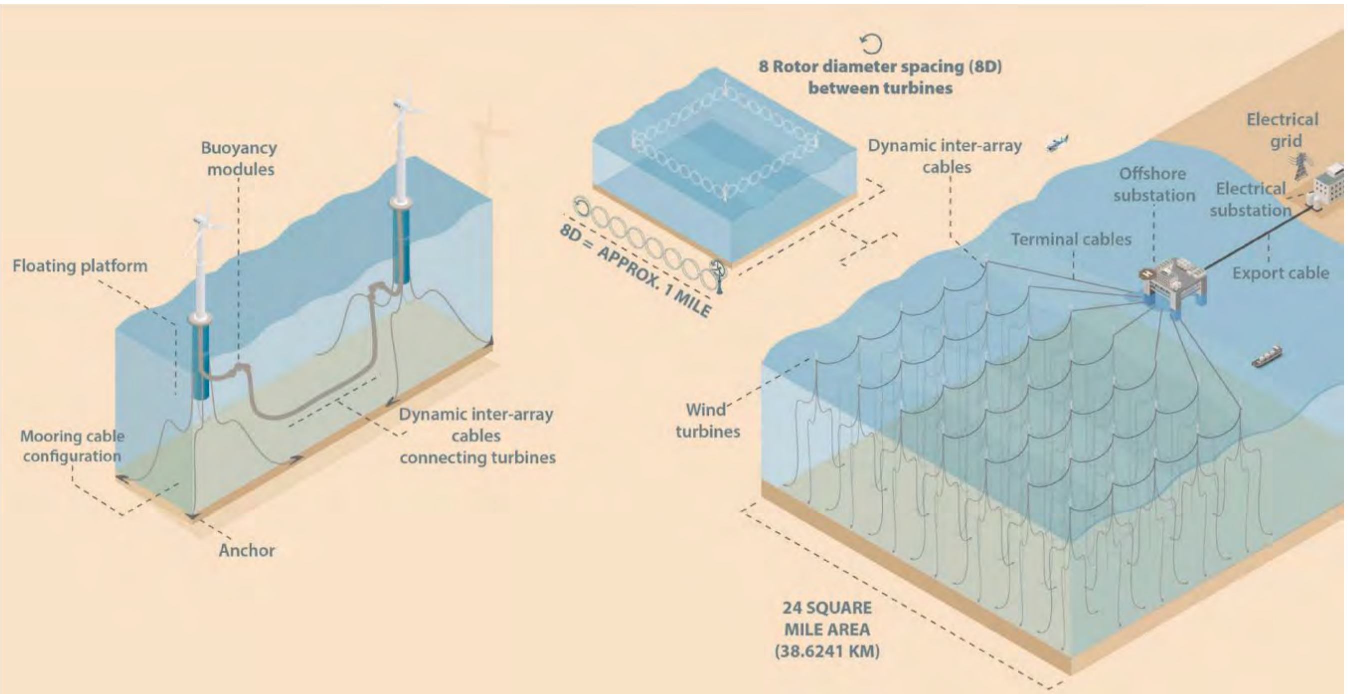


Source: Maxwell et al. 2022.[13]

13 Maxwell, Sara M., Francine Kershaw, Cameron C. Locke, Melinda G. Conners, Cyndi Dawson, Sandy Aylesworth, Rebecca Loomis, and Andrew F. Johnson. 2022. "Potential Impacts of Floating Wind Turbine Technology for Marine Species and Habitats." *Journal of Environmental Management* 307 (2022) 114577. https://doi.org/10.1016/j.jenvman.2022.114577.

To date, most offshore wind energy projects have used fixed-bottom foundations, which are more suitable for shallow waters of 60 meters (about 200 feet) or less. The deep waters of the Pacific Outer Continental Shelf off California's coast have steep drop-offs and will require offshore wind turbines installed on floating platforms to be anchored to the seabed. The schematic shown in **Figure 3** is an example of a floating offshore wind project, though no floating offshore wind projects have been developed at the scale shown in **Figure 3**. While the global floating offshore wind market is still in early stages of development, the technology is projected to quickly advance, with some estimates that the global floating offshore wind energy installed capacity could grow to more than 40 GW by 2036.[14]

Figure 3: Schematic of an Example Full-Scale Floating Wind Energy Development



Source: Image taken from California Coastal Commission CD-0001-22 April 7, 2022, hearing, Exhibit 1-3. Original source from Maxwell et al. 2022.[15]

At the national level, planning for offshore wind energy development on the Outer Continental Shelf (OCS) began to take shape starting in 2009 when the United States Department of the Interior (DOI) developed regulations for renewable energy development in the OCS. In 2011, DOI's Bureau of Ocean Energy Management (BOEM) was created and vested with authority for offshore renewable energy development in federal waters. BOEM's authority extends from 3

14 Guidehouse. May 2022. *California Supply Chain Needs Summary Report* https://efiling.energy.ca.gov/GetDocument.aspx?tn=242928&DocumentContentId=76513.

15 Maxwell, Sara M., Francine Kershaw, Cameron C. Locke, Melinda G. Conners, Cyndi Dawson, Sandy Aylesworth, Rebecca Loomis, and Andrew F. Johnson. 2022. "Potential Impacts of Floating Wind Turbine Technology for Marine Species and Habitats." *Journal of Environmental Management*, 307 (2022) 114577. https://doi.org/10.1016/j.jenvman.2022.114577.

nautical miles (nm) offshore ending at 200 nm offshore, except within boundaries of any National Park, National Marine Sanctuary, National Wildlife Refuge (or associated systems), or National Monument.

In March 2021, President Joseph Biden announced a national goal to deploy 30,000 MW (30 GW) of offshore wind capacity by 2030 to create a pathway to 110,000 MW (110 GW) of offshore wind capacity by 2050.[16] As of June 2021, there were 42 MW of installed offshore wind operating capacity in the United States.[17] Since 2013, BOEM has conducted nine competitive lease sales in the United States — all on the East Coast.[18] On the West Coast, BOEM designated three call areas[19] in 2018 off the coast of California, two of which BOEM identified as wind energy areas in 2021. In April 2022, BOEM announced a Call for Information and Nominations for two areas off the south-central and southern coast of Oregon near the northern coast of California.[20]

The three call areas in federal waters off the coast of California are the Humboldt call area on the North Coast and the Morro Bay and Diablo Canyon[21] call areas, off the Central Coast.

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16 The White House. 2021. "FACT SHEET: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs." Last modified: March 29, 2021. https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/.

17 Musial, Walter, Paul Spitsen, Philipp Beiter, Patrick Duffy, Melinda Marquis, Aubryn Cooperman, Rob Hammond, and Matt Shields. 2021. Offshore Wind Market Report: 2021 Edition. Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy. https://www.energy.gov/sites/default/files/2021-08/Offshore%20Wind%20Market%20Report%202021%20Edition_Final.pdf. The 42 MW of operating offshore wind come from two projects, the Coastal Virginia Offshore Wind Project (12 MW) and the Block Island Wind Farm (30 MW).

18 Fiscal Year 2022 Interior Budget in Brief, Bureau of Ocean Energy Management. (Since publication of the Budget Brief noting 8 lease sales, the New York Bight lease sale occurred.) https://www.doi.gov/sites/doi.gov/files/fy2022-bib-bh021.pdf.

19 "Call areas" are locations identified by BOEM for public comment to explore interest in commercial wind energy leases in the area.

20 BOEM, Oregon Activities. https://www.boem.gov/renewable-energy/state-activities/Oregon.

21 The Diablo Canyon Call Area is within the area nominated by the Northern Chumash Tribal Council to become a national marine sanctuary (Chumash National Marine Sanctuary. 2022. "About the Proposed Chumash Heritage Sanctuary." https://chumashsanctuary.org/about/). In response to this nomination, NOAA has proposed a sanctuary designation that excludes "any geographical overlap with the proposed Morro Bay Wind Energy Area for offshore wind development" (NOAA, "Proposed Designation of Chumash Heritage National Marine Sanctuary." https://sanctuaries.noaa.gov/chumash-heritage/. Accessed April 14, 2022). If the proposed sanctuary designation is approved as described by NOAA with the Diablo Canyon Call Area, under current law BOEM would not have authority to lease from within the Diablo Canyon Call Area: "BOEM lacks the authority to lease within the boundaries of National Marine Sanctuaries." (BOEM. October 18, 2018. Notice. Commercial Leasing for Wind Power Development: Outer Continental Shelf Offshore California. https://www.regulations.gov/document/BOEM-2018-0045-0001). The CEC will continue to engage with NOAA, BOEM, other stakeholders, and tribal governments during development of the AB 525 strategic plan, including identifying suitable sea space in federal ocean waters and related considerations in planning for offshore wind.

Together, these three California call areas have a potential capacity of 8.3 GW,[22] assuming 3 MW per square kilometer.[23] Based on input from California agencies, the federal Department of Defense, and other stakeholders, BOEM analyzed extended areas to the Morro Bay call area following a May 2021 agreement between the federal government and the state of California to advance areas for wind energy development offshore California. BOEM subsequently designated the Humboldt and Morro Bay wind energy areas (WEAs), with a combined potential generation capacity of 4.5 GW.

On May 26, 2022, the DOI announced proposed auction details and lease terms for offshore wind energy development in the Morro Bay and Humboldt WEAs, with a goal of holding a lease sale auction in fall of 2022. The California Proposed Sale Notice (PSN) includes information about potential areas that could be available for leasing within the two WEAs as well as proposed lease provisions, conditions, and auction details.[24] According to BOEM, the Humboldt WEA could bring up to 1.6 GW of energy to the grid,[25] and the Morro Bay WEA could bring up to 2.9 GW.[26] The map in **Figure 4** depicts the three 2018 call areas as well as the WEAs.

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22 One gigawatt is enough to supply the electric demand of about 1 million average California homes. "California Energy Commission, Energy Glossary," https://www.energy.ca.gov/resources/energy-glossary.

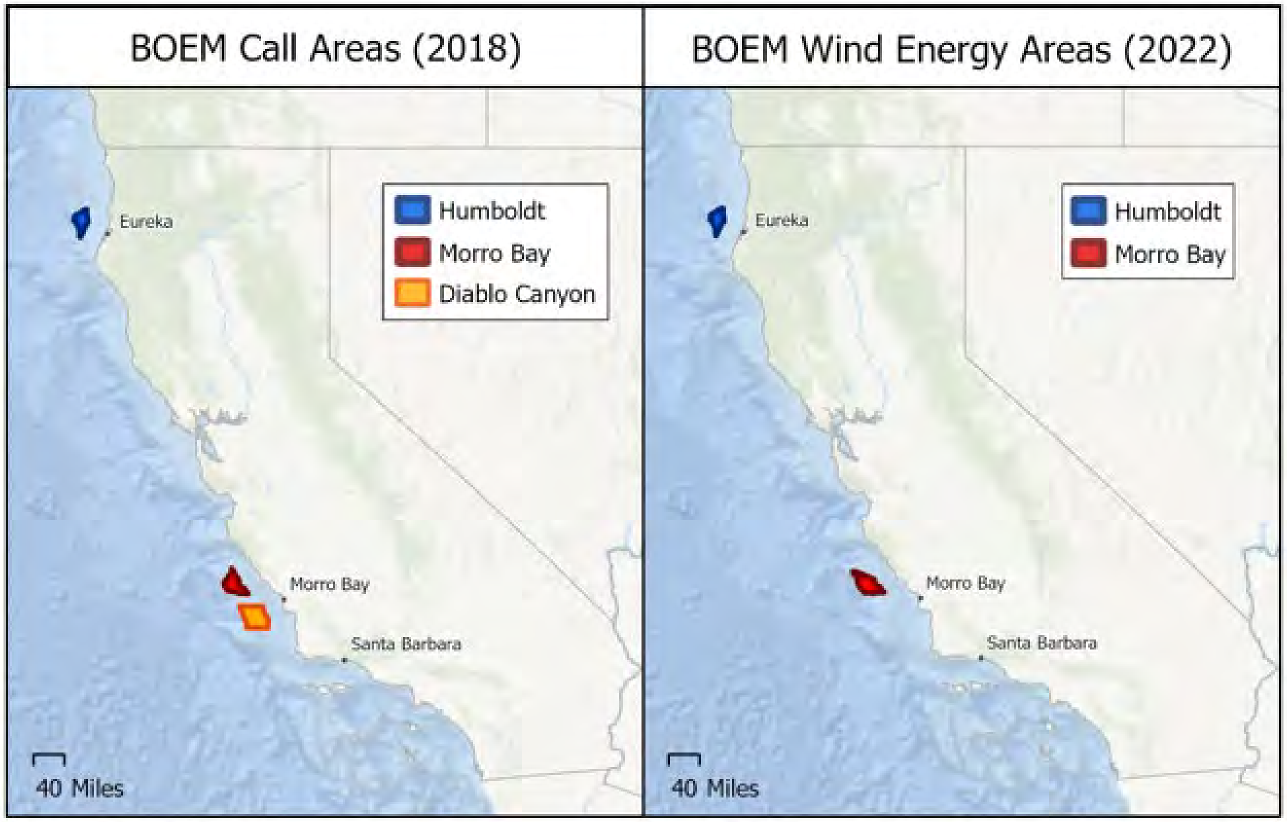
23 About 8,350 MW offshore wind modeled by the ISO (as a sensitivity in the 2021–2022 Transmission Plan) is based on three 2018 BOEM call areas, assuming 3 MW per square kilometer, as transmitted to the ISO by the CPUC in "Attachment A Modeling Assumptions for the 2021-2022 Transmission Planning Process" to Decision 21-02-008 in Rulemaking 20-05-003.
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M366/K452/366452138.PDF. For further information, see page 42 of CPUC Inputs and Assumptions, 2019-2020 Integrated Resource Planning, November 2019 (https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/integrated-resource-plan-and-long-term-procurement-plan-irp-ltpp/2019-2020-irp-events-and-materials/inputs--assumptions-2019-2020-cpuc-irp_20191106.pdf) which uses calculations from Exhibit 8.2 on page 57 of
https://laborcenter.berkeley.edu/pdf/2019/CA-Offshore-Wind-Workforce-Impacts-and-Grid-Integration.pdf.

24 Department of the Interior. May 31, 2022. "Pacific Wind Lease Sale 1 (PACW-1) for Commercial Leasing for Wind Power on the Outer Continental Shelf in California – Proposed Sale Notice."
https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/california/2022-11537.pdf

25 Bureau of Ocean Energy Management. July 2021. "Area ID Memorandum: Humboldt Wind Energy Area."
https://www.boem.gov/sites/default/files/documents//App.%20A%20Area%20ID%20Humboldt%20Memo%20Final.pdf.

26 BOEM. November 10, 2021. "Area ID Memorandum, Morro Bay WEA Final Signed."
https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Area-ID-CA-Morro-Bay.pdf.

Figure 4: Offshore Wind Call Areas and Wind Energy Areas off the Coast of California



Source: California Energy Commission

California's Efforts in Offshore Wind Planning

Since 2016, the state has participated in the BOEM California Intergovernmental Renewable Energy Task Force, which is a partnership of members of state, local, and federal agencies, and tribal governments.[27] The task force examines potential wind leasing areas in federal waters and coordinates related planning and permitting processes. The California Offshore Wind Energy Gateway[28] was created in support of the task force, with publicly available geospatial information on ocean wind resources, ecological and natural resources, commercial and recreational ocean uses, and community values. The Offshore Wind Energy Gateway helps synthesize data and identify areas off California that may be suitable for offshore wind development.

Several California state agencies, as well as the ISO, are individually and collectively working to assess the potential role and opportunity offshore wind can provide for California. Along

27 BOEM. 2017. California Offshore Renewable Energy Fact Sheet. https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/CA/BOEM-Offshore-Renewables-Factsheet--02-22-17.pdf.

28 California Offshore Wind Energy Gateway. Powered by Data Basin. https://caoffshorewind.databasin.org/.

with the CEC, they include the California Department of Fish and Wildlife, the California Ocean Protection Council, the California State Lands Commission, the California Coastal Commission, the CPUC, and the Governor's Office of Planning and Research. The agencies play an important role in California's policy framework, including implementing climate and clean energy goals and protecting and conserving coastal and ocean resources that are experiencing increasing impacts from climate change. The agencies have been working in partnership with BOEM to understand the implications of offshore wind as a potential energy resource and bring forward the best available science regarding environmental considerations and existing uses of the ocean to guide future state and BOEM decision making. These efforts include significant public outreach to stakeholders to identify and collect relevant data and information on existing ocean resources and uses.[29]

The California Coastal Commission implements the Coastal Zone Management Act (CZMA), which provides the state agency with the ability to review federal activities or permits outside the coastal zone, including offshore wind projects, that could influence California's coastal resources. In March 2022, the California Coastal Commission staff issued a recommendation conditionally concurring with BOEM's determination that leasing activities in the Humboldt offshore WEA are consistent with the CZMA.[30] In April 2022, the California Coastal Commission voted on and approved its staff's recommendation of conditional concurrence. Similarly, in April 2022, California Coastal Commission staff issued a recommendation conditionally concurring with BOEM's determination that leasing activities in the Morro Bay WEA are consistent with the CZMA. In June 2022, the California Coastal Commission voted on and approved staff's recommendation of conditional concurrence. These conditional concurrences allow additional study of offshore wind energy development in the Humboldt and Morro Bay WEAs to move forward.

The CEC's Energy Research and Development Division administers the Electric Program Investment Charge (EPIC), which funds research leading to technological advancements and scientific breakthroughs supporting California's clean energy goals, with a focus on providing ratepayer benefits, including reliability, lower costs, and safety. The CEC's EPIC has invested $8 million into floating offshore wind energy technology innovation. In August 2020, the CEC published a report to develop priority recommendations for research and development that would lead to cost-effective offshore wind projects.[31] The EPIC Interim Investment Plan 2021

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29 Bureau of Ocean Energy Management/California Intergovernmental Renewable Energy Task Force. "Public Information Meetings and Outreach Efforts." https://www.boem.gov/renewable-energy/state-activities/public-information-meetings-and-outreach-efforts.

30 California Coastal Commission. March 2022. *Staff Report: Consistency Determination No: CD-0001-22* (Bureau of Ocean Energy Management, Humboldt Co.). https://documents.coastal.ca.gov/reports/2022/4/Th8a/Th8a-4-2022%20staffreport.pdf.

31 Sathe, Amul, Andrea Romano, Bruce Hamilton, Debyani Ghosh, Garrett Parzygnot (Guidehouse). 2020. *Research and Development Opportunities for Offshore Wind Energy in California*. California Energy Commission. Publication Number: CEC-500-2020-053. https://www.energy.ca.gov/sites/default/files/2021-05/CEC-500-2020-053.pdf.

and Proposed 2021–2025 Investment Plan identify research designed to accelerate the market readiness of floating offshore wind.

The CPUC's integrated resource planning (IRP) process seeks to reduce the cost of achieving GHG reductions and other policy goals by looking across load-serving entities' (LSE) boundaries and resource types to identify solutions to reliability, cost, or other concerns that might not otherwise be found without an integrated planning process. The IRP process includes capacity expansion modeling of the electricity system that provides the analytical foundation for the CPUC to require LSEs to procure new energy resources, such as renewable generation and storage resources to achieve California's goals.

Based on the CPUC's portfolio of planned resources, the ISO annually conducts analysis and, if applicable, approval of the transmission needs that would be required from these future resources. The CPUC recently adopted the 2021 Preferred System Plan (PSP), which the ISO will analyze as part of its 2022–23 TPP. This planning portfolio includes 1.7 GW of offshore wind resources by 2032. The ISO's TPP results in an annual transmission plan that is based upon the state's demand forecasts, GHG emissions reductions targets, and the CPUC's adopted portfolio of future generation and storage resources. The annual transmission plan is a key route for ensuring development of the transmission needs in California to accommodate offshore wind resources.

Assembly Bill 525

In January 2022, AB 525 became effective, setting the analytical framework for offshore wind energy development off the California coast in federal waters and tasking the CEC to move swiftly to develop a strategic plan for offshore wind development.

AB 525 requires the CEC to develop the strategic plan and submit it to the California Natural Resources Agency (CNRA) and the Legislature by no later than June 30, 2023. The CEC is to develop the strategic plan in coordination with the California Coastal Commission, Ocean Protection Council, State Lands Commission, Governor's Office of Planning and Research, Department of Fish and Wildlife, Governor's Office of Business and Economic Development, the ISO, the CPUC, and other relevant federal, state, and local agencies as needed.

AB 525 Legislative Findings

In enacting AB 525, the Legislature found and declared, among other things, that:

- If developed and deployed at scale, the development of offshore wind energy can provide economic and environmental benefits to the state and nation.
- Offshore wind energy can advance California's progress toward its statutory renewable energy and climate mandates.
- Diversity in energy resources and technologies lowers overall costs, and offshore wind can add resource and technology diversity to the state's energy portfolio.
- Offshore wind energy development presents an opportunity to attract investment capital and realize community economic and workforce development benefits in California, including the development and preservation of a skilled and trained

construction workforce to carry out projects, long-term job creation, and development of an offshore wind energy supply chain.

- Offshore wind energy can contribute to a diverse, secure, reliable, and affordable renewable energy resource portfolio to serve the electricity needs of California ratepayers and improve air quality, particularly in disadvantaged communities.
- Offshore wind should be developed in a manner that protects coastal and marine ecosystems.
- Investment in offshore wind energy development can offer career pathways and workforce training in clean energy development.

Strategic Plan

AB 525 requires that the CEC's development of the strategic plan "shall incorporate, but not delay progress to advance responsible development of offshore wind in other relevant policy venues."[32]

The strategic plan must include, at a minimum, the following five chapters:

1. Identification of sea space
2. Economic and workforce development and identification of port space and infrastructure
3. Transmission planning
4. Permitting
5. Potential impacts on coastal resources, fisheries, Native American and Indigenous peoples, and national defense, and strategies for addressing those potential impacts

Each chapter must be developed with specific content and public review process as described in section 25991 of the California Public Resources Code.

Identification of Sea Space

The CEC, in coordination with the California Coastal Commission, Department of Fish and Wildlife, Ocean Protection Council, and State Lands Commission, is required to work with stakeholders,[33] other state, local, and federal agencies, and the offshore wind energy industry to identify suitable sea space for wind energy areas in federal waters sufficient to accommodate the offshore wind MW planning goals the CEC is required to establish under AB 525.

AB 525 specifies a sequence of actions requiring that the CEC first identify the sea space identified by BOEM in its 2018 call for nominations for areas offshore the California coast and any other relevant information necessary to achieve the 2030 offshore wind MW planning goals the CEC is required to establish under AB 525. The CEC, in coordination with the

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32 California Public Resources Code, section 25991, subparagraph (a)(2).

33 The term "stakeholders," as used by AB 525, includes, but is not limited to, fisheries groups, labor unions, industry, environmental justice organizations, environmental organizations, and other ocean users. California Public Resources Code, §25991.6.

California Coastal Commission, Department of Fish and Wildlife, Ocean Protection Council, and State Lands Commission, shall next identify suitable sea space for a future phase of offshore wind leasing to accommodate the 2045 offshore wind planning goal the CEC is required to establish under AB 525.

In identifying suitable sea space, the CEC shall consider:

- Existing data and information on offshore wind resource potential and commercial viability.
- Existing and necessary transmission and port infrastructure.
- Protecting cultural and biological resources with the goal of prioritizing least-conflict ocean areas.

In addition, AB 525 requires the CEC to:

- Incorporate the information developed by the Bureau of Ocean Energy Management California Intergovernmental Renewable Energy Task Force.
- Use the California Offshore Wind Energy Gateway, or functionally equivalent publicly accessible, commission-approved internet website, to provide relevant information developed under this section to the public.
- Coordinate with the California Coastal Commission; the Department of Fish and Wildlife; the Ocean Protection Council; the State Lands Commission; stakeholders; other state, local, and federal agencies; and the offshore wind energy industry. They shall make recommendations regarding potential significant adverse environmental impacts and use conflicts, such as avoidance, minimization, monitoring, mitigation, and adaptive management, consistent with California's long-term renewable energy, greenhouse gas emission reduction, and biodiversity goals.

Economic and Workforce Development and Identification of Port Space and Infrastructure

Based on the identified sea space, the CEC, in coordination with relevant state and local agencies and representatives of key labor organizations and apprenticeship programs, must develop a plan to improve waterfront facilities that could support a range of offshore wind energy development activities. These activities include construction and staging of foundations, manufacturing of components, final assembly, and long-term operations and maintenance facilities. AB 525 directs that the strategic plan must include:

- A detailed assessment of the necessary investments in California seaports to support offshore wind energy activities, including construction, assembly, and operations and maintenance. The assessment shall consider the potential availability of land and water acreage at each seaport, including competing and current uses, infrastructure feasibility, access to deep water, bridge height restrictions, and the potential impact to natural and cultural resources, including coastal resources, fisheries, and Native American and Indigenous peoples.
- An analysis of the workforce development needs of the California offshore wind energy industry, including occupational safety requirements, the need to require the use of a

skilled and trained workforce to perform all work, and the need for the Division of Apprenticeship Standards to develop curriculum for in-person classroom and laboratory advanced safety training for workers.

- Recommendations for workforce standards for offshore wind energy facilities and associated infrastructure, including prevailing wage, skilled and trained workforce, apprenticeship, local hiring, and targeted hiring standards that ensure sustained and equitable economic development benefits.

Regarding port infrastructure, the strategic plan must:

- Emphasize and prioritize near-term actions, particularly related to port retrofits and investments and the workforce, to accommodate the probable immediate need for jobs and economic development.
- Strive for compatibility with other harbor tenants and ocean users to ensure that the local benefits related to offshore wind energy construction complement other local industries when considering port retrofits.
- Emphasize and prioritize actions that will improve port infrastructure to support land-based work for the local workforce.

Transmission Planning

The CEC, in consultation with the CPUC and ISO, must assess the transmission investments and upgrades necessary, including subsea transmission options, to support the 2030 and 2045 offshore wind MW planning goals. The assessment must include relevant cost information for subsea transmission and network upgrades, as well as the extent to which existing transmission infrastructure and available capacity could support offshore wind energy development.

Permitting Roadmap

The CEC must develop and produce a permitting roadmap that describes time frames and milestones for a coordinated, comprehensive, and efficient permitting process for offshore wind energy facilities and associated electricity and transmission infrastructure off the California coast. The roadmap must:

- Include a goal for the permitting time frame.
- Clearly define local, state, and federal agency roles, responsibilities, and decision-making authority.
- Include interfaces with federal agencies, including timing, sequence, and coordination with federal permitting agencies, and coordination between reviews under the California Environmental Quality Act and the federal National Environmental Policy Act of 1969.

The permitting roadmap must also be developed in consultation with all relevant local, state, and federal agencies, including the California Coastal Commission, the Department of Fish and Wildlife, and the State Lands Commission, interested California Native American tribes, and affected stakeholders.

Potential Impacts on Coastal Resources, Fisheries, Native American and Indigenous Peoples, and National Defense, and Strategies for Addressing Those Potential Impacts

For this chapter, the CEC, in coordination with the California Coastal Commission, the Department of Fish and Wildlife, the Ocean Protection Council, the State Lands Commission, stakeholders, other state, local, and federal agencies, and the offshore wind energy industry, shall make recommendations regarding the potential impacts on coastal resources, fisheries, Native American and Indigenous peoples, and national defense. This coalition of agencies and industry must develop strategies for addressing those potential impacts.

The strategic plan chapters will also be guided by:

1. The report to evaluate and quantify the maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits and establish MW planning goals for 2030 and 2045, due June 1, 2022.
2. The preliminary assessment of the economic benefits of offshore wind as they relate to seaport investments and workforce development needs and standards, due December 31, 2022.
3. The permitting roadmap that describes time frames and milestones for a coordinated, comprehensive, and efficient permitting process for offshore wind energy facilities and associated electricity and transmission infrastructure off the coast of California, due December 31, 2022.

This report addresses the first product identified in AB 525 by discussing the maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits and establishing MW planning goals for 2030 and 2045, taking into consideration 12 factors addressed in Chapter 3 of this report. The CEC will continue to consider additional information as it becomes available to refine the maximum feasible capacity in future offshore wind plans, including the development of the AB 525-required strategic plan due in June 2023.

To establish the MW planning goals, CEC staff considered other planning initiatives for offshore wind that are already ongoing in California, including planning by non-ISO LSEs, POU IRPs and, part of the CPUC's integrated resource planning (IRP) process and the ISO's TPP. The AB 525 offshore wind MW planning goals anchor the state's strategic planning effort called for in AB 525. The AB 525 strategic plan will be an important foundation to set up IRP, the TPP, and other energy resource planning and investment decisions as they relate to procurement of offshore wind generation and transmission. To best serve this approach, the MW planning goals should reasonably exceed current IRP and TPP offshore wind assumptions, to allow flexibility as those ongoing processes continue to direct the optimal procurement for ratepayers over the coming years. The MW planning goals are not intended as a core input to IRP or TPP analysis, nor should they be seen as a "floor" or "ceiling" for offshore wind procurement in California.

This report is based on currently available information. The preliminary MW planning goals are for developing the strategic plan, as AB 525 states that nothing in the provisions of the law "is intended to create a technology set-aside or mandatory minimum for any type of eligible renewable energy resource."[34]

34 California Public Resources Code, Section 25991.7. https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PRC&sectionNum=25991.7.

CHAPTER 2: Evaluation and Quantification of the Maximum Feasible Capacity of Offshore Wind to Achieve Reliability, Ratepayer, Employment, and Decarbonization Benefits

This chapter addresses the AB 525 requirements to evaluate and quantify the maximum feasible capacity of offshore wind.

Existing studies of technically feasible potential provide a starting point for evaluation, but do not indicate the maximum feasible capacity because they have not been evaluated to ensure offshore wind developments will be located in areas with suitable sea space that minimize potential impacts on coastal resources, fisheries, Native American and Indigenous people, and national defense. Further analysis is also needed to improve understanding of how the feasible capacity relates to reliability, ratepayer, employment, and decarbonization benefits.

After analyses are completed, the CEC will evaluate and quantify maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits. As an interim measure, this report establishes a reference point for technically feasible offshore wind energy potential based on estimates of technically feasible potential repeatedly studied through the issuance of this report.

Definition of Maximum Feasible Capacity

AB 525 directs the CEC to evaluate and quantify maximum feasible capacity but does not provide a definition for "feasible." The CEC staff looked to regulations that govern the CEC proceedings and the legislative findings of AB 525 to give meaning to the term "feasible." California Code of Regulations, Title 20, section 1201(h), defines "feasible" as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors." This definition aligns with a holistic reading of AB 525 legislative findings, which focus on evaluating how California can realize development of offshore wind at utility scale but with realistic projections of what could be achieved by 2030 and 2045, considering a broad range of specified factors. For example, in AB 525, the Legislature finds and declares, "Offshore wind should be developed in a manner that protects coastal and marine ecosystems. The State of California should use its authority under state programs and policies to ensure (1) avoidance, minimization, and mitigation of significant adverse impacts, and (2) monitoring and adaptive management for offshore wind projects and their associated infrastructure."[35] The CEC staff will approach the evaluation of maximum feasible capacity based on these provisions.

California Offshore Wind Technical Potential

The California coast has relatively strong offshore winds averaging up to 10 meters per second and large resource areas with developable depth (<1,300 meters or about 4,200 feet).[36] There have been assessments of California offshore wind technical potential in federal waters, including the National Renewable Energy Laboratory (NREL)[37] and the U.S. BOEM,[38] U.C. Berkeley,[39] the Schatz Energy Research Center,[40] and the CPUC.[41] These studies explore differing amounts of offshore wind generation technical potential with differing focuses, such as supply chain economics, technology costs, levelized cost of energy, and transmission infrastructure needs. The CPUC sourced data from a U.C. Berkeley study to use for capacity expansion modeling in its 2019–2021 IRP cycle for offshore wind potential.[42]

In 2020, NREL produced a cost study for the period between 2019 and 2032. In this study, NREL selected areas with an average wind speed of at least 7 meters per second and a water depth between 40 meters and 1,300 meters. NREL selected the following five study areas for

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35 Assembly Bill 525 (Chiu, Chapter 231, Statutes of 2021).

36 Optis, Mike, Alex Rybchuk, Nicola Bodini, Michael Rossol, and Walter Musial. 2020. *2020 Offshore Wind Resource Assessment for the California Pacific Outer Continental Shelf*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77642. https://www.nrel.gov/docs/fy21osti/77642.pdf.

37 Ibid.

38 Bureau of Ocean Energy Management. July 2021. "Area ID Memorandum: Humboldt Wind Energy Area." https://www.boem.gov/sites/default/files/documents//App.%20A%20Area%20ID%20Humboldt%20Memo%20Final.pdf. Also see, Bureau of Ocean Energy Management. November 2021, "Area ID Memorandum: Morro Bay Wind Energy Area." https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Area-ID-CA-Morro-Bay.pdf.

39 Collier, Robert, Sanderson Hull, Oluwafemi Sawyerr, Shenshen Li, Manohar Mogadali, Dan Mullen, and Arne Olson. September 2019. *California Offshore Wind: Workforce Impacts and Grid Integration*. Center for Labor Research and Education, University of California, Berkeley. https://laborcenter.berkeley.edu/pdf/2019/CA-Offshore-Wind-Workforce-Impacts-and-Grid-Integration.pdf.

40 Severy, M., C. Ortega, C. Chamberlin, and A. Jacobson. 2020. "Wind Speed Resource and Power Generation Profile Report." In M. Severy, Z. Alva, G. Chapman, M. Cheli, T. Garcia, C. Ortega, N. Salas, A. Younes, J. Zoellick, & A. Jacobson (Eds.) *California North Coast Offshore Wind Studies.* Humboldt, CA: Schatz Energy Research Center. https://schatzcenter.org/pubs/2020-OSW-R2.pdf.

41 CPUC. February 2022. *Decision Adopting 2021 Preferred System Plan*. D.22-02-004 in Rulemaking 20-05-003. https://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=451412947. Also, CPUC, February 2022, *Modeling Assumptions for the 2022–2023 Transmission Planning Process*. Staff Report. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K485/451485713.PDF.

42 CPUC. November 2019. *Inputs & Assumptions: 2019-2020 Integrated Resource Planning*. https://files.cpuc.ca.gov/energy/modeling/Inputs%20%20Assumptions%202019-2020%20CPUC%20IRP%202020-02-27.pdf.

detailed cost analysis (**Figure 5**): Morro Bay (Call Area), Diablo Canyon (Call Area), Humboldt (Call Area), Cape Mendocino, and Del Norte.[43] NREL assumed commercial offshore wind development would be technically feasible in these five study areas. The potential study areas sum to more than 21,170 MW of capacity.[44]

The study areas have been identified based on wind speed, ocean depth, bottom slope, distance to grid interconnection, and distance to existing port infrastructure and are technically suitable for current technologies. They are all identified in federal waters, within the leasing jurisdiction of BOEM, and are located outside the network of existing national marine sanctuaries. However, they have not been fully examined for existing coastal and ocean uses and potential effects on those uses. The assessments of these areas indicate that they may be feasible for wind generation from a technical perspective. Due to location, the study areas differ from one another on energy cost, transmission infrastructure, and potential impact to coastal resources and existing ocean uses.

NREL offers the following information regarding these areas:

> Del Norte and Cape Mendocino are additional areas of interest that were adopted from a recent University of California Berkeley study assessing the workforce impacts and grid integration of offshore wind in California (Collier et al. 2019). These sites were derived by Collier from an earlier NREL study (Musial et al. 2016a). This study defined site-selection criteria (e.g., for wind speed, water depth, use conflicts, access to transmission, suitable ports, and distance from shore) and identified sites that met these criteria to sustain a commercial offshore wind project. Neither Collier (2019) nor Musial (2019a) vetted these areas for offshore wind development among stakeholders. These sites should not be confused with the actual BOEM Call Areas. Neither Del Norte nor Cape Mendocino have been designated by BOEM to move forward under any formal regulatory framework.[45]

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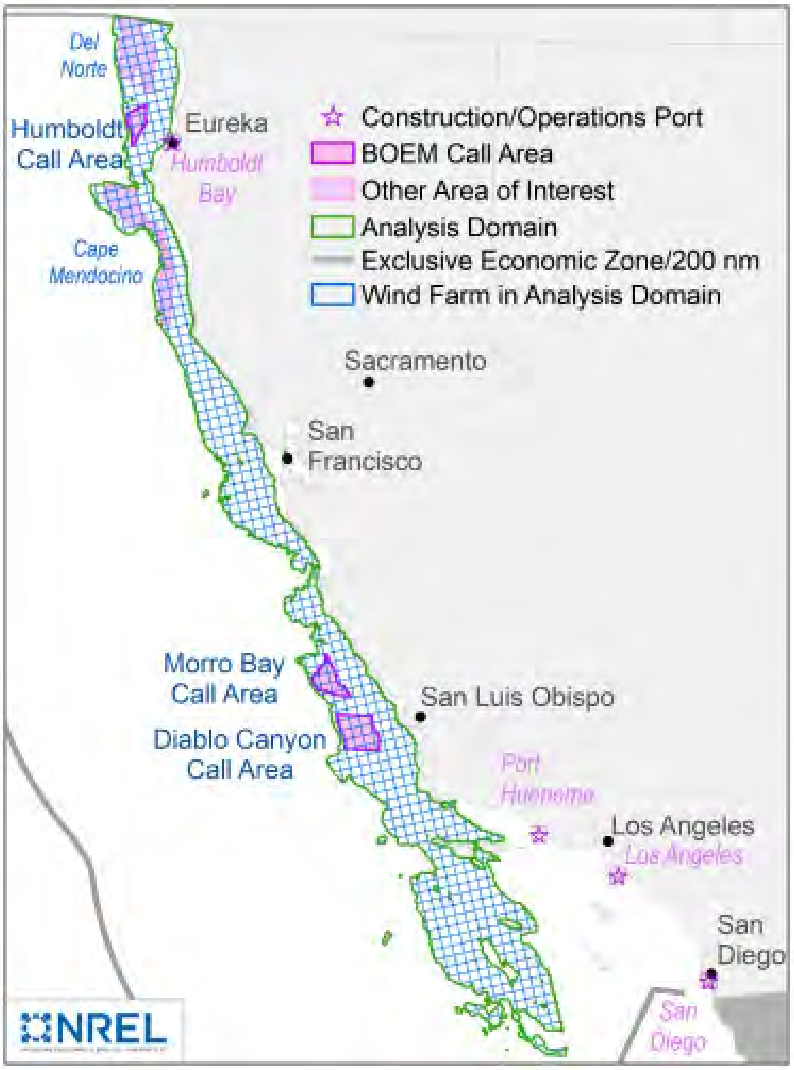
43 Beiter, Philipp, Walter Musial, Patrick Duffy, Aubryn Cooperman, Matt Shields, Donna Heimiller, and Mike Optis. 2020. *The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77384. https://www.nrel.gov/docs/fy21osti/77384.pdf.

44 The five study areas in total include approximately 7,057 square kilometers and assumes an offshore wind turbine power density of 3 megawatts per square kilometer.

45 Beiter, Philipp, Walter Musial, Patrick Duffy, Aubryn Cooperman, Matt Shields, Donna Heimiller, and Mike Optis. 2020. *The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77384. https://www.nrel.gov/docs/fy21osti/77384.pdf. Other studies referenced in this excerpt: Collier, Robert, Sanderson Hull, Oluwafemi Sawyerr, Shenshen Li, Manohar Mogadali, Dan Mullen, and Arne Olson. September 2019. California Offshore Wind: Workforce Impacts and Grid Integration. Center for Labor Research and Education, University of California, Berkeley. https://laborcenter.berkeley.edu/pdf/2019/CA-Offshore-Wind-Workforce-Impacts-and-Grid-Integration.pdf; Musial, Walter, Philipp Beiter, Suzanne Tegen, and Aaron Smith. December 2016a. *Potential Offshore Wind Energy Areas in California: An Assessment of Locations, Technology, and Costs*. NREL. Prepared under IAG No. M14PG00038; task number WFHA.1005. https://www.nrel.gov/docs/fy17osti/67414.pdf. Musial, W., P. Beiter, J. Nunemaker, D. Heimiller, J. Ahmann, and J. Busch. 2019a. *Oregon Offshore Wind Site Feasibility and Cost Study*.

Figure 5: Five Areas Studied in 2020 for Offshore Wind Technical Potential off California's Coast



Source: *The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032,* NREL, November 2020

A 2020 study by the Schatz Energy Research Center analyzed electricity generation scenarios for potential wind development in the Humboldt call area and the Cape Mendocino study area mentioned above.[46]

NREL/TP-5000-74597. National Renewable Energy Laboratory (NREL). https://www.nrel.gov/docs/fy20osti/74597.pdf.

46 Severy, M., C. Ortega, C. Chamberlin, and A. Jacobson. 2020. *Wind Speed Resource and Power Generation Profile Report*. In M. Severy, Z. Alva, G. Chapman, M. Cheli, T. Garcia, C. Ortega, N. Salas, A. Younes, J. Zoellick, and A. Jacobson (Eds.) California North Coast Offshore Wind Studies. Humboldt, CA: Schatz Energy Research Center. https://schatzcenter.org/pubs/2020-OSW-R2.pdf.

In 2021, modeling conducted for the CPUC IRP process allowed selection of offshore wind from the Humboldt, Morro Bay, and Diablo Canyon call areas. For development of the 2021 Preferred System Plan, the model did not select offshore wind capacity from the Humboldt or Diablo Canyon call areas. However, in the final busbar mapping discussed later in this chapter, 120 MW of offshore wind was relocated from the Morro Bay call area to the Humboldt call area as an "energy only" resource.[47]

In 2021, BOEM established the Humboldt wind energy area. After identifying extensions to the 2018 Morro Bay call area and conducting a call for information and nomination for these extended areas, BOEM designated the Morro Bay wind energy area.[48] The size of the Morro Bay wind energy area is larger than the 2018 Morro Bay call area that was used in the assessments described above describing technical potential. Taking this change into account brings the total from 21,170 MW to nearly 21,800 MW (21.8 GW) of offshore technical potential. In developing the wind energy areas, BOEM aimed to "balance commercial project viability with potential impacts to the human, marine, and coastal environment, including consideration of existing OCS users."[49]

The nearly 21,800 MW (21.8 GW) of studied capacity represents a reference point for technically feasible offshore wind potential based on existing studies. It does not represent the quantification of maximum feasible capacity for offshore wind. It simply represents estimated capacity of potential offshore wind capacity located in the Humboldt wind energy area, Morro Bay wind energy area, Diablo Canyon call area, and two additional areas with high wind speeds offshore Northern California. Although elements of these five areas have been repeatedly studied through 2021, additional evaluation is needed to ensure offshore wind energy developments will be located in areas with suitable sea space, whether from within these five areas or outside them, that minimize potential impacts on coastal resources, fisheries, Native American and Indigenous people, and national defense.

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47 CPUC. February 2022. Decision Adopting 2021 Preferred System Plan. D.22-02-004 in Rulemaking 20-05-003. https://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=451412947. Also, CPUC, February 2022, modeling assumptions for the 2022–2023 transmission planning process. Staff report. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K485/451485713.PDF.

48 Bureau of Ocean Energy Management. July 2021. "Area ID Memorandum: Humboldt Wind Energy Area." https://www.boem.gov/sites/default/files/documents//App.%20A%20Area%20ID%20Humboldt%20Memo%20Final.pdf. Also see, Bureau of Ocean Energy Management. November 2021. "Area ID Memorandum: Morro Bay Wind Energy Area." https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Area-ID-CA-Morro-Bay.pdf.

49 For example, a summary of data, resources, and stakeholder comments informing identification of the Morro Bay wind energy area is included in Bureau of Ocean Energy Management's November 2021, "Area ID Memorandum: Morro Bay Wind Energy Area." https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Area-ID-CA-Morro-Bay.pdf.

Achieving Reliability, Ratepayer, Employment, and Decarbonization Benefits

To evaluate and quantify the feasible capacity of offshore wind off California's coast to achieve reliability, ratepayer, employment, and decarbonization benefits, the CEC staff reviewed existing publications and research. Some of the reports, studies, and sources of information include:

- Studies by NREL[50] and the U.S. Department of Energy.[51]
- Resources from the CPUC's IRP process and 2021 Preferred System Plan.[52]
- Materials from the August 27, 2020, CPUC webinar on offshore wind resource profile and technology costs,[53] as well as the December 17, 2021, CPUC Planning Workshop on the Roadmap for Offshore Wind in Integrated Resource Planning.[54]
- A study by the ISO of the CPUC's Offshore Wind Policy-Driven Sensitivity Portfolio for the 2021–22 transmission planning process.[55]
- The *2021 SB 100 Joint Agency Report.*[56]

These studies and other literature referenced in this report indicate that California has some of the best offshore wind energy resources in the world and there is a large technical potential off the state's coast. Costs for deploying floating offshore wind are expected to continue to

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50 Such as National Renewable Energy Laboratory. December 2016. *Potential Offshore Wind Energy Areas in California: An Assessment of Locations, Technology, and Costs*. https://www.nrel.gov/docs/fy17osti/67414.pdf; and Beiter, Philipp, Walter Musial, Patrick Duffy, Aubryn Cooperman, Matt Shields, Donna Heimiller, and Mike Optis. 2020. *The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77384. https://www.nrel.gov/docs/fy21osti/77384.pdf;

51 Musial, Walter, Paul Spitsen, Philipp Beiter, Patrick Duffy, Melinda Marquis, Aubryn Cooperman, Rob Hammond, and Matt Shields. 2021. *Offshore Wind Market Report: 2021 Edition*. Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy. https://www.energy.gov/sites/default/files/2021-08/Offshore%20Wind%20Market%20Report%202021%20Edition_Final.pdf.

52 CPUC. February 2022. Decision Adopting 2021 Preferred System Plan. D.22-02-004 in Rulemaking 20-05-003. https://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=451412947. Also, CPUC, February 2022, modeling assumptions for the 2022–2023 transmission planning process. Staff report. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K485/451485713.PDF.

53 CPUC IRP Modeling Advisory Group. Webinar 5 – 8/27/2020 – Offshore Wind Resource Profile and Technology Costs. Presentation slides and webinar recording available online at https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2019-20-irp-events-and-materials.

54 CPUC IRP Webinar – 12/17/2021 – IRP Offshore Wind Roadmap Workshop. Presentation slides and webinar recording available online at https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-power-procurement/long-term-procurement-planning/2022-irp-cycle-events-and-materials.

55 California ISO. March 2022. *2021–2022 Transmission Plan*. http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf.

56 CEC, CPUC, and California Air Resources Board. 2021. *2021 SB 100 Joint Agency Report Achieving 100 Percent Clean Electricity in California: An Initial Assessment*. https://efiling.energy.ca.gov/EFiling/GetFile.aspx?tn=237167&DocumentContentId=70349.

decrease as floating technology becomes more mainstream throughout the world. Offshore wind can also strengthen system reliability (by increasing the average amount of renewable electricity generation available in the early evening hours as solar generation begins to decline) and help save on overall system costs as California moves to meet the SB 100 clean energy goals. Also, development of offshore wind can create thousands of new high-quality clean energy jobs in California.[57]

CEC staff noted that the CPUC IRP process is required to simplify the planning and procurement by its jurisdictional load-serving entities to meet the state's long-term decarbonization objectives reliably and at least cost to ratepayers. Accordingly, the CPUC IRP process and the partner process, the ISO's TPP, already have planners and stakeholders in California assessing the reliability, ratepayer, and decarbonization benefits of offshore wind. The methods and input data to do so can be considered part of assessing the maximum feasible capacity.

The requirement of AB 525 to also consider employment benefits goes beyond the scope of the CPUC IRP process and ISO TPP. The CEC staff discusses information sources to address this in this section.

Reliability Benefits

Moving to zero-carbon resources is critical to reducing greenhouse gas emissions and addressing the long-term impacts of climate change. Many of these sources do not operate on demand like traditional fossil-fuel generation or as baseload resource such as geothermal. They require more agile management of generation on the grid, greater coordination in the electricity market, and improved resource planning.

Offshore wind turbines are an attractive technology from a system planning perspective due to the high-capacity factor and associated generation profile that complements solar daily and seasonally. These turbines can provide more consistent output during the winter months when solar production is lower.[58] While there is a significant resource potential off the California coast, there are also considerable barriers. Among the foremost challenges are significant anticipated transmission requirements and competing coastal uses, including shipping, fishing, recreation, marine conservation, and Department of Defense activities. These topics will be addressed in the strategic plan.

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57 American Jobs Project. February 2019. *The California Offshore Wind Project: A Vision for Industry Growth*. http://americanjobsproject.us/wp/wp-content/uploads/2019/02/The-California-Offshore-Wind-Project.pdf. Additional job growth estimates are summarized and compared in Rose, A., D. Wei, and A. Einbinder. 2021. *California's Offshore Wind Electricity Opportunity*. Schwarzenegger Institute for State and Global Policy. http://schwarzeneggerinstitute.com/images/files/OSW_Report.pdf.

58 National Renewable Energy Laboratory. December 2016. *Potential Offshore Wind Energy Areas in California: An Assessment of Locations, Technology, and Costs*. https://www.nrel.gov/docs/fy17osti/67414.pdf.

In 2020, Schatz Energy Research Center studied the wind speed resource and power generation profiles off Humboldt Bay, California.[59] This study modeled wind development ranging from 50 MW to 1,800 MW in two locations: the 2018 BOEM Humboldt call area and a second location off Cape Mendocino. The analysis of the wind speed patterns for this study in Northern California shows that wind energy will frequently produce power at the rated capacity. The study provided information on average generation profiles, which appear fairly flat throughout the day, as well as the large seasonal variability of this wind resource. Modeling results for a hypothetical wind development scenario showed no electricity generation for 19 percent of the year (1,670 hours).

This information suggests that while offshore wind does complement solar daily and seasonally and blows more consistently over time than onshore wind, there is still significant variability that may make grid integration a challenge. Studies as part of the CPUC IRP process consider how offshore wind energy generation at specific locations fit with systemwide electrical demand, and the role of other resource types including energy storage to support the integration of offshore wind reliably.

Ratepayer Benefits

CEC staff continues to work closely with the CPUC and the ISO to evaluate offshore wind as part of California's renewable energy portfolio and as part of the portfolio of eligible renewable energy and zero-carbon resources to meet the energy goals of SB 100. The ISO's TPP, which results in an annual transmission plan, is a key route for ensuring development of the transmission needs in California to accommodate offshore wind resources. The TPP is based upon the state's demand forecasts, GHG emissions reductions targets, and a portfolio of future generation and storage resources that minimizes ratepayer costs. Integration of the CPUC IRP and the ISO TPP ensures that ratepayer costs are fully considered.

CPUC's IRP process also ensures implementation of the Senate Bill 350 (De León, Chapter 547, Statutes of 2015) requirements to ensure that load-serving entities (LSEs) meet targets that allow the electricity sector to contribute to California's economywide greenhouse gas emissions reductions goals.

The CPUC included offshore wind as a candidate resource in its integrated resource planning process for the first time as part of the 2019–2021 IRP cycle. The cycle concluded with the CPUC adopting its 2021 Preferred System Plan, which included 195 MW of offshore wind generation by 2030 and a cumulative 1.7 GW of offshore wind generation by 2032. The development of the preferred system plan involved a combination of planning by LSEs (selecting 195 MW by 2030) and capacity expansion modeling by CPUC staff (selecting the additional 1.5 GW by 2032). Partly due to "lack of available transmission in the Humboldt

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59 Severy, M., C. Ortega, C. Chamberlin, and A. Jacobson. 2020. *Wind Speed Resource and Power Generation Profile Report*. In M. Severy, Z. Alva, G. Chapman, M. Cheli, T. Garcia, C. Ortega, N. Salas, A. Younes, J. Zoellick, and A. Jacobson (Eds.). California North Coast Offshore Wind Studies. Humboldt, CA: Schatz Energy Research

area"[60] and the length of time needed to build new transmission, the process to map resources to specific busbars (substations) proposed interconnecting all the offshore wind at Morro Bay. However, in response to comments from the Redwood Coast Energy Authority recommending the CPUC map "100–150 MW of offshore wind to the Humboldt area as energy only resources,"[61] the CPUC "remapped 120 MW of offshore wind to Humboldt from Morro Bay" in the busbar mapping[62] transmitted to the ISO.[63]

To develop cost input assumptions for the IRP, the CPUC worked with NREL to study the trajectory for the levelized cost of energy (LCOE) for offshore wind. A goal of this 2020 NREL cost study, *The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032,* is to "provide cost and performance data that can help state energy analysts evaluate how offshore wind can become part of California's future energy mix from a reliability, greenhouse-gas emissions, and economic perspective."[64] The CPUC IRP process can assess resources at varying levels of geographic detail. For offshore wind, the IRP process distinguishes among five zones that correspond to the study areas in the 2020 NREL cost study. Costs and performance of floating offshore wind are evaluated for those specific locations.

This 2020 NREL cost study[65] provides the following key information to help assess the maximum feasibility of offshore wind related ratepayer benefits:

- "Floating offshore wind technology, which is required for the deep waters along the California coast, is currently in a precommercial phase, with approximately 84 MW installed worldwide at the end of 2019. In Europe there are more than 292 MW of new pilot projects scheduled to be operating by the end of 2022, and the first large-scale commercial projects are already in the permitting phase in Asia and scheduled for operation in 2024. This pace of floating wind technology advancements and commercial development indicates that commercial floating arrays may be technically feasible in California's market as early as the mid-2020s."
- For offshore wind development in the five study areas with commercial operation dates between 2019 and 2032, NREL estimated the LCOE will decline by 44 percent on

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60 CPUC. February 2022. *Modeling Assumptions for the 2022–2023 Transmission Planning Process*. Staff report. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K485/451485713.PDF. Page 13.

61 CPUC. February 2022. Decision Adopting 2021 Preferred System Plan. D.22-02-004 in Rulemaking 20-05-003. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K412/451412947.PDF. Page 174.

62 "Busbar mapping" is the process of refining the geographically coarse portfolios produced in CPUC's IRP proceeding into plausible network modeling locations for transmission analysis in the ISO's annual TPP.

63 CPUC. February 2022. *Modeling Assumptions for the 2022-2023 Transmission Planning Process*. Staff report. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K485/451485713.PDF. Page 70.

64 Beiter, Philipp, Walter Musial, Patrick Duffy, Aubryn Cooperman, Matt Shields, Donna Heimiller, and Mike Optis. 2020. *The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77384. https://www.nrel.gov/docs/fy21osti/77384.pdf.

65 Ibid.

average. NREL estimated the LCOE in the five study areas will reach \$53/MWh–\$64/MWh by 2032.

- The baseline costs for a commercial scale floating offshore wind power plant are projected to decrease because of three factors:
  - Experiential learning within the industry
  - Economies of scale realized through higher capacity turbines and larger projects
  - Impact of technological innovations

The NREL 2021 Annual Technology Baseline (ATB) for Offshore Wind,[66] which examines the future costs for three technology innovation scenarios, includes a conservative, a moderate, and an advanced technology scenario, which are outlined in **Table 1**. For developing the strategic plan, the CEC is considering the range of technology scenarios and will examine, among other sources, the moderate and advanced scenarios, which align best with the assumptions used in the state's approach to offshore wind. Under the moderate scenario, assumptions for representative technology include a 15-MW turbine mounted on a floating substructure using improved and highly tailored technology and materials. The turbine system is installed and operated using greatly enhanced port infrastructure and vessel capabilities relative to what exists today. Under the NREL advanced scenario, an 18-MW turbine would be mounted on a floating substructure using next-generation technology and materials, port infrastructure, and vessel capabilities. Efficiency gains are achieved through accelerated standardization, large economies of scale, and fiercely increased competition.

Under both scenarios, the levelized cost of energy for offshore wind generation is projected to continue to drop, primarily due to increasing capability and efficiency of the supply chain to support offshore wind and economies of turbine size and offshore generation facility scale. **Figure 6** shows the modeled levelized cost of energy based on the technology innovation scenarios in **Table 1**. The continual technology improvements over time and the sustained rate of cost reductions suggest that a high range of MW planning goals can be supported in the 2045–2050 time frame.

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66 "Annual Technology Baseline, Electricity, Offshore Wind, National Renewable Energy Laboratory, 2021." https://atb.nrel.gov/electricity/2021/offshore_wind.

Table 1: Turbine Technology Details by Scenario From the NREL ATB

	Base 2019	Conservative 2030	Moderate 2030	Advanced 2030
Hub height m	100	136	150	161
Number of turbines [-]	167	84	67	56
Rotor diameter m	150	214	240	263
Specific power W/m2	340	334	332	331
Turbine rating MW	6	12	15	18

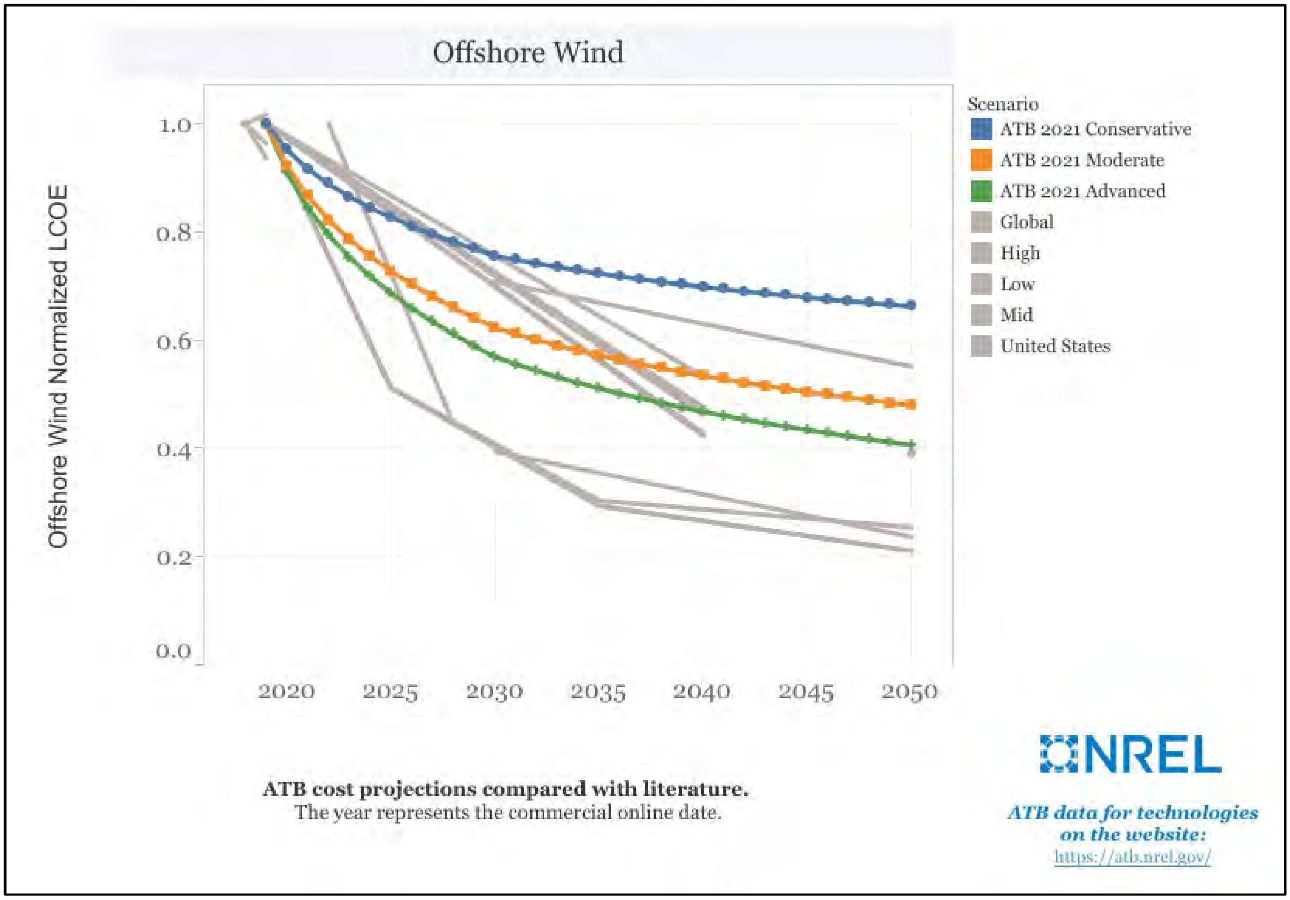
m=meter
W=watt
MW=megawatt

NREL

ATB data for technologies on the website: https://atb.nrel.gov/

Source: NREL 2021 Annual Technology Baseline (ATB) for Offshore Wind

Figure 6: Modeled LCOE Scenario Results for the NREL Scenarios Discussed Above, Compared With Literature Projections



Source: NREL 2021 Annual Technology Baseline (ATB) for Offshore Wind

The ISO TPP provides a comprehensive evaluation of the ISO transmission grid to address grid reliability requirements, identify upgrades needed to successfully meet California's policy goals, and explore projects that can bring economic benefits to consumers. The 10-year ISO transmission plan is updated annually and relies heavily on key inputs from state agencies in translating legislative policy into actionable policy-driven inputs, including the CEC's *Integrated Energy Policy Report*, demand forecast, energy planning products, and the CPUC's IRP process. The ISO studies the base case portfolio adopted by the CPUC as part of its IRP process to evaluate and potentially approve new transmission infrastructure and upgrades to the existing system that are required to meet reliability standards and minimize ratepayer costs. The ISO also examines sensitivity and policy portfolios requested by the CPUC and performs special transmission studies.

In March 2022, the ISO approved a 10-year transmission plan that identified 23 transmission projects at an estimated cost of $2.9 billion for system expansions, upgrades, and reinforcements needed for reliability and to meet the state's clean energy targets. This *2021–2022 Transmission Plan* also included an informational sensitivity study with estimates of potential overland and subsea transmission pathways off the California coast. The ISO's *2021-*

2022 Transmission Plan provides a valuable high-level overview of the transmission needs for development of 21 GW of potential offshore wind generation, including 14.4 GW from California's North Coast and 6.7 GW from California's Central Coast.[67]

Employment Benefits

In adopting AB 525, the Legislature found that offshore wind energy development presents an opportunity to attract investment capital and realize community, economic, and workforce development benefits in California.[68] Among others, these benefits include the development and preservation of a skilled and trained construction workforce to carry out projects, long-term job creation, and development of an offshore wind energy supply chain.

The largest economic benefits for California from an offshore wind industry would be realized with the development of a local supply chain where offshore wind components such as floating platforms, towers, mooring lines, and anchors could be manufactured in-state. A University of Southern California (USC) Schwarzenegger Institute for State and Global Policy study published in 2021 compared scenarios with different levels of in-state manufacturing of offshore wind farm components. The study found that scenarios with higher in-state manufacturing substantially increased projected employment and economic benefits to California from offshore wind development.[69] To encourage development of a local supply chain, a sufficient offshore wind pipeline needs to be identified to provide confidence in the market and support early investment. According to a study conducted by the U.C. Berkeley Center for Labor Research and Education, industry has identified a minimum threshold of 8 GW over a 10-year period to support manufacturing and supply chain investments. Without a minimum threshold of 8 GW over a 10-year period, manufacturers would be less likely to invest in a local supply chain, and the economic benefits would be far less significant.[70]

Based on currently available information, a minimum of 8 GW of offshore wind over the next decade should be considered for maximizing the achievable offshore wind economic benefits. As required by AB 525, a preliminary economic assessment including an analysis of the workforce development needs for a California offshore wind industry will be completed by the CEC on or before December 31, 2022. The economic assessment will provide additional insight into the employment opportunities and benefits of a robust offshore wind industry in California.

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67 California ISO. March 2022. *2021–2022 Transmission Plan*. http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf.

68 Assembly Bill 525 (Chiu, Chapter 231, Statutes of 2021).

69 Rose, A., D. Wei, and A. Einbinder. 2021. *California's Offshore Wind Electricity Opportunity*. Schwarzenegger Institute for State and Global Policy. http://schwarzeneggerinstitute.com/images/files/OSW_Report.pdf.

70 Collier, Robert, Sanderson Hull, Oluwafemi Sawyerr, Shenshen Li, Manohar Mogadali, Dan Mullen, and Arne Olson. *California Offshore Wind: Workforce Impacts and Grid Integration*. Center for Labor Research and Education, University of California, Berkeley. September 2019. https://laborcenter.berkeley.edu/pdf/2019/CA-Offshore-Wind-Workforce-Impacts-and-Grid-Integration.pdf.

Decarbonization Benefits

Meeting the state's decarbonization goals will require significant modernization of the current electric system, including diversifying the energy mix. The *SB 100 Joint Agency Report* assessed how California should approach achieving the goals established by the 100 Percent Clean Energy Act of 2018. Portfolio modeling completed for the *2021 SB 100 Joint Agency Report* included a new assumption of 10 GW of offshore wind resource potential available in the RESOLVE model by 2045. In the resulting analysis, the RESOLVE model selected all 10 GW of offshore wind for the SB 100 Core Scenario.

Similarly, the CPUC found that offshore wind has a significant place in the 2021 Preferred System Plan by 2032. It is likely that the capacity expansion modeling used to arrive at this finding selected offshore wind because of the contribution to decarbonization, as well as reliability.

Offshore wind energy has the potential to be a valuable resource as the generation profile can complement solar. On average, offshore wind continues to generate electricity as solar generation drops off in the evening.[71] In addition to being a renewable generation resource, including offshore wind in the state's energy portfolio may help California reduce the use of gas-fired power plants in the evening hours, helping reduce greenhouse gas emissions and maintain system reliability during net peak.[72] Using a capacity factor of 5.1 percent and a heat rate of 10,450 Btu/kWh,[73] a study by the USC Schwarzenegger Institute for State and Global Policy estimated that if 5 GW of gas peaking capacity can be replaced with the deployment of 10 GW of offshore wind, this scenario could result in a potential reduction of 4.73 million metric tons of carbon dioxide equivalent greenhouse gases in 2040.[74]

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71 Optis, Mike, Alex Rybchuk, Nicola Bodini, Michael Rossol, and Walter Musial. 2020. *2020 Offshore Wind Resource Assessment for the California Pacific Outer Continental Shelf*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77642. https://www.nrel.gov/docs/fy21osti/77642.pdf.

72 California Energy Commission. May 2021. "A Peek at Net Peak." https://www.energy.ca.gov/data-reports/energy-insights/peek-net-peak.

73 Nyberg, Michael. 2020. *Thermal Efficiency of Natural Gas-Fired Generation in California: 2019 Update*. California Energy Commission. Publication Number: CEC-200-2020-003. https://efiling.energy.ca.gov/getdocument.aspx?tn=233380.

74 Rose, A., D. Wei, and A. Einbinder. 2021. *California's Offshore Wind Electricity Opportunity*. Schwarzenegger Institute for State and Global Policy. http://schwarzeneggerinstitute.com/images/files/OSW_Report.pdf.

CHAPTER 3: Megawatt Offshore Wind Planning Goals for 2030 and 2045

As discussed above, AB 525 requires the CEC, on or before June 1, 2022, to evaluate and quantify the maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits and establish offshore wind MW planning goals for 2030 and 2045. This chapter addresses the second requirement to establish MW planning goals for 2030 and 2045.

In establishing the MW planning goals, the CEC is required to consider:

1. The findings of the *2021 SB 100 Joint Agency Report.*
2. The need to develop a skilled and trained offshore wind workforce.
3. The potential to attract supply-chain manufacturing for offshore wind components throughout the Pacific region.
4. The need for reliable renewable energy that accommodates California's shifting peak load.
5. The generation profile of offshore wind off the California coast.
6. The need for economies of scale to reduce the costs of floating offshore wind.
7. The need to initiate long-term transmission and infrastructure planning to expedite delivery of offshore wind energy to Californians.
8. The availability of federal tax incentives for offshore wind investments.
9. The National Renewable Energy Laboratory report finding that California has 200 GW of offshore wind technical power potential.
10. The opportunity for California to participate in the federal government's intention to deploy 30,000 MW of offshore wind by 2030 and create a pathway to unlocking 110,000 MW by 2050.
11. Any executive action from the Governor regarding offshore wind.
12. Potential impacts on coastal resources, fisheries, Native American and Indigenous peoples, and national defense, and strategies for addressing those potential impacts.

During the March 3, 2022, workshop, CEC staff explained that only certain factors are likely to have greater influence on or directly influence shaping the MW planning goals than others, though all the factors are important in establishing the goals and contributing to development of the specific plan.

The factors of particular importance are as follows, and they are given greater attention in the discussion below than the remaining factors:

1. The findings of the *2021 SB 100 Joint Agency Report*
2. The need to initiate long-term transmission and infrastructure planning to expedite delivery of offshore wind energy to Californians
3. The need for reliable renewable energy that accommodates California's shifting peak load
4. The generation profile of offshore wind off the California coast
5. Potential impacts on coastal resources, fisheries, Native American and Indigenous peoples, and national defense, and strategies for addressing those potential impacts

As described in the chapter above regarding maximum feasible capacity, the offshore wind MW planning goals presented in this report have not considered potential impacts. CEC staff will consider the potential impacts described in Number 5 above during development of the strategic plan, including strategies to address those potential impacts.

Factors Considered in Establishing Offshore Wind Megawatt Planning Goals

The legislative factors for consideration in establishing the MW planning goals are discussed in this section.

Findings of the *2021 SB 100 Joint Agency Report*

As previously discussed, resource modeling completed for the *2021 SB 100 Joint Agency Report* covered a range of scenarios and technologies. In the Core Scenario, the modeling used a built-in assumption that 10 GW of offshore wind are available and were selected in the 2045 portfolio. The *SB 100 Joint Agency Report* also acknowledges that there are additional investments and actions that would have to occur to realize 10 GW of offshore wind by 2045.

The SB 100 report and modeling guide the offshore wind MW planning goals, indicating that with additional actions and investments to address challenges such as transmission and competing coastal uses, a minimum of 10 GW of offshore wind could meaningfully support reaching the SB 100 goals by 2045.

The Need to Initiate Long-Term Transmission Planning

Both the availability of existing transmission and the need to develop more transmission capacity in specific areas affect the offshore wind MW planning goals the CEC establishes and what the state can expect to achieve over time. The development of a comprehensive transmission capacity expansion plan can help establish an efficient and economic path for offshore wind transmission development to deliver offshore wind energy to Californians.

The North Coast electric system is relatively isolated from the California grid and serves primarily local community needs. Additional transmission will be needed to deliver offshore wind energy from this region to the grid, and there may be opportunities to coordinate transmission planning for offshore wind generation from California's Northern Coast and the larger Pacific Northwest.[75] Existing transmission on the South-Central Coast is robust and interconnects with the grid near large load centers. Near-term generation retirements, such as 2,225 MW from the Diablo Canyon Nuclear Power Plant, provide opportunities to repurpose existing infrastructure.[76] But there is still a need to do long-term planning for both the at-sea infrastructure and the ability to use existing onshore infrastructure. Ongoing efforts to guide transmission planning and recently completed studies were used to inform the MW planning goals and will support development of the overall strategic plan.

As discussed in Chapter 2, the CPUC's 2021 Preferred System Plan for the IRP included 1.7 GW of offshore wind generation by 2032.[77] This capacity was found by the CPUC to be the optimal amount and timing for offshore wind to come on-line, along with the other new resources needed to meet the state's emissions reduction goals reliably at least cost to ratepayers. Most of the 1.7 GW is expected to interconnect at Morro Bay, with only 120 MW expected to come from the North Coast,[78] where there is a greater potential for offshore wind electricity generation due to higher annual wind speeds. The CPUC regularly updates the IRP, and a new IRP cycle that includes refreshed inputs and assumptions for capacity expansion modeling has begun in 2022.

In March 2022, the ISO Board approved a 10-year transmission plan with significant new investment, specifically 23 transmission projects with an estimated $2.9 billion cost that will reinforce the system for reliability and help meet the state's clean energy targets. This *2021–2022 Transmission Plan* also includes a sensitivity study that provides information on the estimated costs for potential overland and subsea transmission pathways for offshore off the California coast.[79] The ISO provided a high-level discussion of 21 GW of potential offshore

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75 California Independent System Operator. March 2022. *2021–2022 Transmission Plan*. http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf. Page 30.

The CEC is initiating additional transmission studies in partnership with the State of Oregon and the Department of Defense to explore additional North Coast transmission challenges and opportunities. This study will further support development of the strategic plan. U.S. Department of Defense. August 31, 2021. "Notice of Award: Northern California & Southern Oregon Mission Compatibility and Transmission Infrastructure Assessment." Office of Local Defense Community Cooperation. https://www.energy.ca.gov/filebrowser/download/3709.

76 The ISO notes that the owners of the Diablo Canyon Power Plant retain certain deliverability retention options for repowering that can remain in effect for three years following retirement. California Independent System Operator. March 2022. *2021–2022 Transmission Plan*. http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf. Page 30.

77 CPUC. February 2022. Decision Adopting 2021 Preferred System Plan. D.22-02-004 in Rulemaking 20-05-003. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K412/451412947.PDF.

78 The CPUC's 2021 Preferred System Plan includes 1.7 GW of offshore wind interconnecting at Morro Bay; however, in response to comments from the Redwood Coast Energy Authority, the CPUC remapped 120 MW of offshore wind from Morro Bay to Humboldt in the busbar mapping submitted to the ISO. CPUC. February 2022. *Modeling Assumptions for the 2022–2023 Transmission Planning Process*. Staff report. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K485/451485713.PDF. Page 70.

79 California Independent System Operator. March 2022. *2021–2022 Transmission Plan.* http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf.

wind generation, including 14.4 GW from California's North Coast and 6.7 GW from California's Central Coast.[80]

For the North Coast, the ISO identified costs and benefits of three transmission projects and technologies that could be used to bring 1.6 GW south to the San Francisco Bay Area, as well as 12.8 GW of additional offshore wind that was considered as part of a long-term "outlook assessment."

For the Central Coast, the ISO identified costs of alternative technologies that could transfer offshore wind to load from the Diablo Canyon and Morro Bay areas. This analysis recognized the need for a new 500 kV substation to manage the 2.3 GW of offshore wind being modeled for a Morro Bay interconnection. The ISO also confirmed that the existing transmission system in the Central Coast area can accommodate about 5.3 GW of offshore wind, noting that the Diablo Canyon Power Plant will be retiring by the end of 2025 and that gas-fired generation at Morro Bay has already retired.

In May 2022 the ISO also published its first *20-Year Transmission Outlook*, in which the ISO explored transmission options for 10 GW of potential offshore wind development that was identified in the SB 100 starting point scenario for 2040.[81] The outlook assumes 4 GW from the North Coast offshore areas and 6 GW from the Central Coast offshore areas. This study identified three transmission technologies with the potential to combine output from several North Coast offshore wind projects.[82] This study estimated transmission costs of $5.9 billion to $8.1 billion, including: [83]

- 4 GW from North Coast offshore wind could be connected to the ISO bulk transmission grid by 2040 at a cost of $5.8 billion to $8.0 billion.
- 6 GW from the Central Coast could be connected to the ISO bulk transmission grid by 2040 at a cost of $110 million.

As requested by the CPUC, the ISO's *2021–2022 Transmission Plan* included a sensitivity analysis "to test the transmission implications if barriers were to be removed to large-scale development of OSW."[84] For 8.3 GW of offshore wind by 2031, the ISO identified four interconnection options. Including network upgrades, the cost ranged from $2.8 billion to

80 California Independent System Operator. March 2022. *2021–2022 Transmission Plan.* http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf. Page 220.

81 California Energy Commission, California Public Utilities Commission, and California Independent System Operator. September 2021. "SB 100 Starting Point for the CAISO 20-Year Transmission Outlook." https://efiling.energy.ca.gov/GetDocument.aspx?tn=239685&DocumentContentId=73101.

82 California Independent System Operator. May 2022. *20-Year Transmission Outlook.* http://www.caiso.com/InitiativeDocuments/Draft20-YearTransmissionOutlook.pdf.

83 Ibid.

84 CPUC. February 11, 2021. Decision Transferring Electric Resource Portfolios to California Independent System Operator for 2021–2022 Transmission Planning Process. Decision 21-02-008 in Rulemaking 20-05-003. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M366/K426/366426300.PDF.

nearly $6 billion. This analysis included potential North Coast and Central Coast offshore wind generation from the following offshore wind call areas:

- 1.6 GW from the Humboldt Bay area
- 2.3 GW from the Morro Bay area
- 4.4 GW from the Diablo Canyon area

Table 2 lists the five potential offshore wind areas considered by the ISO and the two BOEM WEAs in federal waters off the California coast. The authors emphasize that AB 525 requires the CEC to assess the potential impacts on national defense and strategies for addressing those potential impacts. CEC staff is aware that federal waters off of the Central Coast of California are important to the Department of Defense's (DOD) mission. During development of the strategic plan, the CEC will continue collaborating with DOD and stakeholders to identify potential opportunities for suitable sea space off the Central Coast.

In addition to ongoing work at the CPUC and the ISO, the Schatz Energy Research Center at Cal Poly Humboldt (formerly Humboldt State University) assessed infrastructure for the North Coast. The North Coast assessment evaluated project scenarios ranging from 140 MW to 480 MW by 2030. The study found that a small commercial offshore wind farm, up to 170 MW, could be developed without upgrading the transmission system by allowing some curtailment (estimated at 4 to 6 percent of the time in 2030); however, larger projects would require significant investments in transmission upgrades.[85]

85 Schatz Energy Research Center. July 2021. "Offshore Wind on California's North Coast." Presentation. CEC Docket: 21-IEPR-05, TN# 239028.
https://efiling.energy.ca.gov/GetDocument.aspx?tn=239028&DocumentContentId=72461.

Table 2: Federal Offshore Wind Energy Areas and Other Areas Considered in the ISO Studies by California Offshore Region (From North to South)

Area Name	General Region	Potential Electricity Generation Capacity (GW) Considered in the ISO Studies (January 2022)[86]	Potential Capacity (GW) of BOEM Wind Energy Areas[87]
Del Norte	Northern Coast	6.6	
Humboldt	Northern Coast	1.6	1.6
Cape Mendocino	Northern Coast	6.2	
Morro Bay	Central Coast	2.3	2.9
Diablo Canyon	Central Coast	4.4	

Source: California ISO and BOEM

The CPUC IRP and the ISO TPP examine the energy resources by location and technology and identify the transmission infrastructure and infrastructure upgrades needed to achieve the state's climate and energy goals. They are designed to ensure that the energy system is developed and operated cost-effectively while ensuring system reliability. As such, the outputs from these planning processes provide key information to advise the maximum feasible capacity of offshore wind the state can expect to achieve by 2045 and MW planning goals for 2030 and 2045. The development of new transmission capacity has been identified as necessary to moving offshore wind power from the North Coast to California load centers. The IRP and TPP information discussed above do not correspond directly with the 2030- and 2045-time frames required by AB 525 for the offshore wind MW planning goals. However, the information can guide the MW planning goals as follows: for 2030, it is prudent to plan for more than the current adopted 2032 IRP amount of offshore wind of 1.7 GW, potentially up to about 5 GW, which is what can be accommodated on existing transmission. Beyond this amount appears infeasible from a transmission perspective by 2030. For 2045, there is much greater possibility of achieving some or all of the transmission upgrades examined by the ISO. This possibility suggests the CEC may consider establishing a minimum MW planning goal for 2045 ranging from 10 GW to 14.3 GW (informed by both the ISO *2021–22 Transmission Plan* and the ISO 20-year Transmission Outlook).

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86 California Independent System Operator. March 2022. *2021–2022 Transmission Plan.* http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf

87 U.S. Department of the Interior, Bureau of Ocean Energy Management. January 24, 2022. *Consistency Determination for Leasing Wind Energy Areas Offshore Humboldt County, California*. https://documents.coastal.ca.gov/assets/upcoming-projects/offshore-wind/Humboldt-CD.pdf.

U.S. Department of the Interior. November 10, 2021. "Central California Area Identification Pursuant to 30 C.F.R § 585.211(b)." https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Area-ID-CA-Morro-Bay.pdf.

Need for Renewable Energy to Accommodate California's Shifting Peak Load

On average, California's daily net-peak load is shifting to later into the evening hours when solar generation is substantially diminished or nonexistent.[88] This shift is creating a need for renewable energy sources that continue to generate electricity later into the evening hours. The profile of offshore wind on the North Coast on an average day complements solar resources. The profile for the Central Coast is similar to the North Coast, but there are differences across times of day, season, and total wind resource potential.

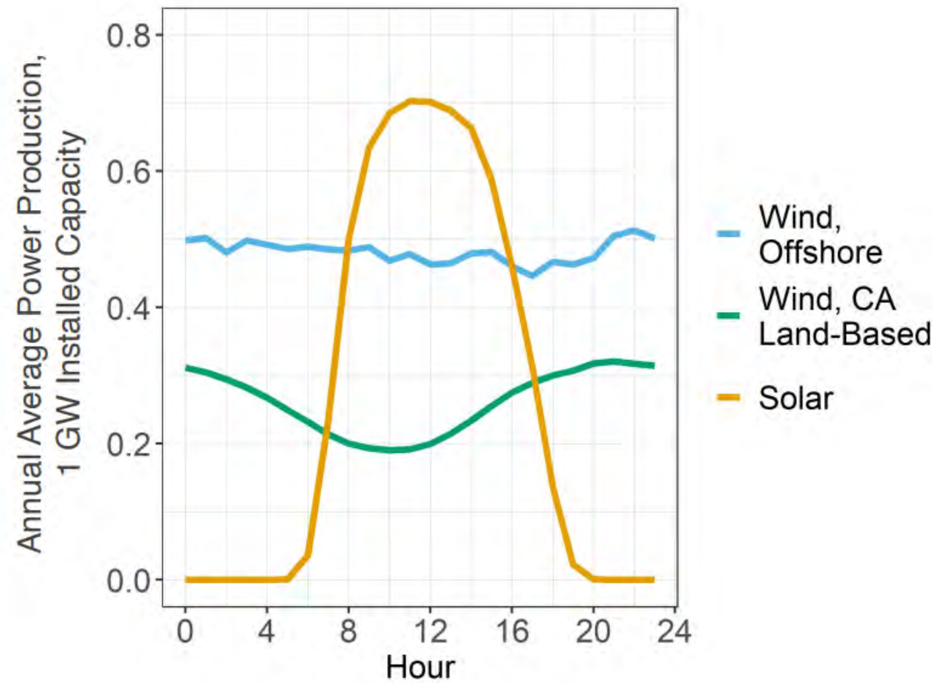
Offshore wind is an attractive technology from a system planning perspective due to the associated generation potential profile that complements solar, with higher output in the evenings, when electricity demand is high and solar production is low. Offshore wind also complements solar in the winter season and can provide more consistent output during winter months when solar production is lower. Furthermore, a recent CPUC published study, *Regional Wind Effective Load Carrying Capability Study Results for 2024*, shows offshore wind has a higher average capacity factor, with steady energy production throughout summer months, compared to land-based wind resources, which decline in total output.[89]

Figure 7 shows that the time of generation of offshore wind can be a useful complement to solar and land-based wind, generating later into the evening hours when solar generation declines.

88 Erne, David, Mark Kootstra, Tom Flynn, Christopher McLean, Angela Tanghetti, and Stephanie Bailey. 2022. *Final 2021 Integrated Energy Policy Report, Volume II: Ensuring Reliability in a Changing Climate*. California Energy Commission. Publication Number: CEC-100- 2021-001-V2. https://efiling.energy.ca.gov/GetDocument.aspx?tn=241583.

89 CPUC. June 1, 2022. *Energy Division Study for Proceeding R.21-10-002. Regional Wind Effective Load Carrying Capability Study Results for 2024*. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M482/K148/482148586.PDF.

Figure 7: Average Annual Generation Profiles of Offshore Wind, Land-Based Wind and Solar



Source: Presentation from the Schatz Energy Research Center, July 2021[90]

The need for renewable energy to accommodate California's shifting peak load informs the MW planning goals. The CPUC IRP process discussed above considers the fit between renewable generation output and electricity demand. A significant amount of offshore wind was found by the CPUC to be optimal for ratepayers in its recently adopted 2021 Preferred System Plan. This optimal amount indicates there is a synergy between offshore wind and solar, both daily and in the winter. If there were not a synergy, the capacity expansion modeling in IRP would have not selected any offshore wind, considering that it is higher cost than solar and energy storage. To connect this factor to the MW planning goals, the CEC staff established offshore wind MW planning goals that are higher than the current adopted amount of offshore wind in the IRP. These higher planning goals allow flexibility as IRP and TPP continue to direct the optimal procurement of generation and transmission for ratepayers over the coming years. Allowing a buffer above the current adopted amount in the IRP helps prepare California to take advantage of the generation profile of offshore wind to help meet load at peak demand and helps ensure California meets its SB 100 energy goals.

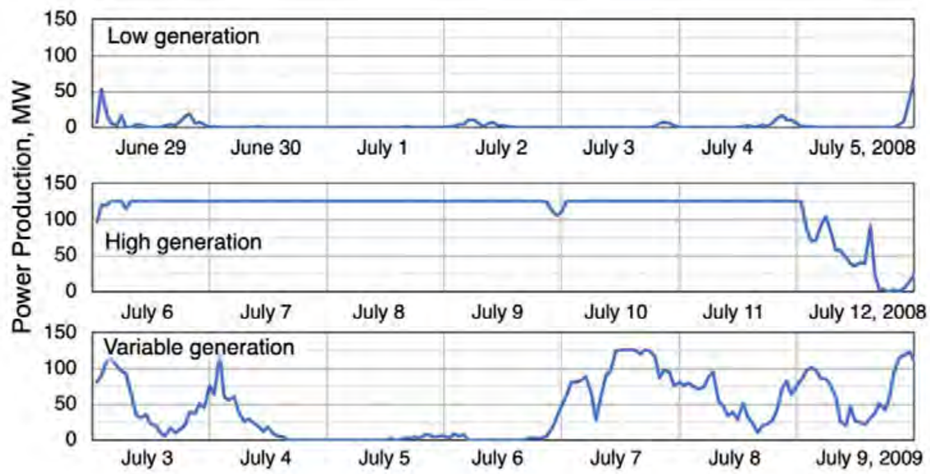
90 Schatz Energy Research Center. July 2021. "Offshore Wind on California's North Coast." Presentation. CEC Docket: 21-IEPR-05, TN# 239028. https://efiling.energy.ca.gov/GetDocument.aspx?tn=239028&DocumentContentId=72461.

Generation Profile of Offshore Wind Off the California Coast

Offshore wind, like other variable-output renewables, has inherent uncertainty associated with projections about the related energy and reliability contributions. In 2020, the Schatz Energy Research Center studied the wind resource generation profile in the Humboldt area and found that power output from offshore wind could be distributed in two extremes, either low to no generation or times of high variability, as seen in **Figure 8**.

Figure 8: Example of Variability in Offshore Wind Power Generation Profile Scenario for the Humboldt Call Area

(Assumes 144 MW Nameplate Capacity)



Source: Schatz Energy Research Center

Regarding Morro Bay, a study modeling 100-meter wind speeds suggested wind speeds in summer months are more predictable than wind speeds in the winter.[91] Another study estimated the generation profile for potential Central California offshore wind farms, including farms in the Morro Bay call area. Hourly spatial-mean generation for Morro Bay was lowest around 10 a.m., ramping up from midmorning to about 7 p.m. The study estimated there would be no generation in the Morro Bay or Diablo Canyon call areas about 11 to 14 percent of the time, mostly due to low-wind conditions.[92]

According to a 2022 study by Abido and colleagues, adding offshore wind to California's renewable energy portfolio can reduce energy storage needs overall but is projected to have greater variability in the times of year when energy storage may be at minimum charge. On

91 Bodini, N., W. Hu, M. Optis, G. Cervone, and S. Alessandrini. 2021. "Assessing Boundary Condition and Parametric Uncertainty in Numerical-Weather-Prediction-Modeled, Long-Term Offshore Wind Speed Through Machine Learning and Analog Ensemble." *Wind Energy. Sci.*, 6(6), 1363–1377. https://doi.org/10.5194/wes-6-1363-2021.

92 Wang, Y.-H., R. K. Walter, C. White, M. D. Kehrli, and B. Ruttenberg. 2022. "Scenarios for Offshore Wind Power Production for Central California Call Areas." *Wind Energy*, 25(1), 23–33. https://doi.org/10.1002/we.2646.

average, the study concludes that winter months around sunrise will pose the most challenging time for a renewable-driven electricity grid in California.[93]

The generation profile for offshore wind energy, along with the shifting peak load factor discussed above, help guide development of the MW planning goals.

CEC and IRP energy modeling considers historical weather patterns, projected climate change, and the impact of these factors on generation and demand. Energy modeling uses this information in stochastic analysis to project expected reliability of future electricity generation portfolios. Because offshore wind involves geographies that are less studied than current generation sources in California, additional analysis will enhance understanding how offshore wind generation supports the energy system and helps meets peak load. BOEM has deployed lidar buoys with remote sensing technology in the WEAs to collect real-time wind data, and NREL continues to improve wind modeling tools to help identify optimal wind resources. As standard practice, this updated information is used in CEC energy modeling, the IRP and TPP processes and this work will also help direct the strategic plan.

Potential Impacts on Coastal Resources, Fisheries, Native American and Indigenous People, and National Defense and Strategies for Addressing Those Impacts

AB 525 requires the CEC to consider potential impacts on coastal resources (including ocean resources and marine ecosystems), fisheries, Native American and Indigenous peoples, and national defense, and strategies for addressing those impacts. Current data and analyses show that avoidance, minimization, mitigation, and adaptive management for these potential impacts can directly affect the MW planning goals. The offshore wind MW planning goals laid out in this report have not considered these potential impacts but will do so during strategic plan development.

Decisions to deploy offshore wind will result in new infrastructure in the marine environment such as floating platforms and turbines, mooring lines and anchors, and electrical cables. This new infrastructure may introduce several impacts to coastal and cultural resources and existing users. However, because the floating offshore wind market is in the early stages and the technology is rapidly advancing, additional study and analysis are needed to fully understand the degree, magnitude, and extent of potential impacts of offshore wind development on coastal resources, fisheries, Native American and Indigenous peoples, and national defense and identify effective strategies for addressing those potential impacts.

Based on existing information including a literature review and thorough extensive outreach, major themes have emerged that help identify a suite of impact concerns. From an ocean uses perspective, tribal governments have identified potential impacts to cultural landscapes and sacred sites. Fishing industry stakeholders have identified potential impacts related to restricted access to fishing grounds, impacts to fish habitat and species, and impacts to

93 Abido, M. Y., Z. Mahmud, P. A. Sánchez-Pérez, and S. R. Kurtz. 2022. "Seasonal Challenges for a California Renewable-Energy-Driven Grid." *Science*, 25(1), 103577. https://doi.org/10.1016/j.isci.2021.103577.

specific types of fishing activities such as midwater and bottom trawl. Coastal communities have identified concerns regarding visual impacts from turbines and lighting, increased vessel traffic, and potential economic impacts to fishing and tourism dependent coastal economies. From the environmental perspective, potential impacts have been identified to pelagic and benthic fish, marine mammals, sea turtles, birds, and bats, seabed and benthic habitat, water quality, and ocean currents and upwelling.

The California Coastal Commission conditionally concurred with BOEM's consistency determination for the Humboldt WEA in April 2022 and for the Morro Bay WEA in June 2022. The California Coastal Commission's reports included similar findings. While the reports focused on analyzing the impacts associated with leasing and survey activities, they also identified potential impacts from the development and operations of offshore wind development and includes conditions that establish a framework for addressing those impacts.

The Coastal Commission's reports were produced in consultation and coordination with subject matter experts from several state and federal agencies. With the information that was able to be analyzed at the time of the reports, the California Coastal Commission found that future offshore wind development in the Humboldt and Morro Bay WEAs could adversely affect marine resources through:

- Seafloor disturbance.
- Turbine strikes.
- Increased entanglement risk.
- Marine species displacement.
- Avoidance or attraction.
- Increased ship strike risk.
- Elevated levels of underwater sound.
- Fish aggregation.
- The artificial reef effect.
- Invasive species.
- Weakened upwelling.
- Electromagnetic fields.

The reports also found that the fishing industry could potentially be impacted through exclusion and displacement from fishing grounds, increased costs and time at sea to reach new fishing grounds, loss of grounds from future fishing activity, and loss or disruption of harbor space and fishing infrastructure at ports. Finally, the reports found that offshore wind development could adversely and disproportionately impact environmental justice communities with environmental impacts associated with infrastructure development, as well as California Native American tribes that could be affected by impacts to culturally important places, species, and traditional marine fishing practices.[94] The conditions in the "consistency determinations" reflect measures and processes necessary to ensure that potential impacts described above are appropriately addressed as the leasing and development of offshore wind move forward.

As part of developing the broader strategic plan, CEC staff will coordinate with the California Coastal Commission; Department of Fish and Wildlife; Ocean Protection Council; State Lands Commission; stakeholders; other state, local, and federal agencies; the offshore wind energy industry; and California Native American tribes to identify suitable sea space for offshore wind energy. They will also make recommendations regarding environmental impacts and use conflicts, and strategies to avoid, minimize, and address significant adverse impacts consistent with California's long-term renewable energy, greenhouse gas emission reduction, and biodiversity goals.

The statutory deadline for establishing the MW planning goals and identifying maximum feasible capacity for offshore wind is before completion of the sea space evaluation, which is an important component of the broader strategic plan. Therefore, the CEC staff has not completed the sea space analysis. Through the sea space analysis, the CEC staff will continue to identify and assess impacts and strategies and use that information to guide the maximum feasible capacity and potentially refine the MW planning goals as needed.

Developing a Skilled and Trained Workforce

Having a skilled and trained workforce will be necessary to successfully deploying offshore wind in California. Investing in offshore wind energy development can offer career pathways and workforce training opportunities in clean energy.

The workforce opportunity from a robust offshore wind industry in California is significant. In a 2019 report, projections by BVG Associates for the American Jobs Project estimate that with additional state policies aimed toward advancing offshore wind and a build-out of 18 GW by 2045, California could see more than 17,000 jobs. Without additional policies supporting the growth of offshore wind, it projected a build-out of 5 GW by 2045, yielding closer to 5,000 jobs.[95]

Conducting new work initiated by the CEC, Guidehouse assessed California workforce needs for various offshore wind deployment scenarios, including 10 GW, 18 GW, and 20 GW by 2042, 2045, and 2050, respectively. Guidehouse found that most jobs needed will be in

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94 California Coastal Commission. March 2022. *Staff Report: Consistency Determination No: CD-0001-22* (Bureau of Ocean Energy Management, Humboldt Co.). https://documents.coastal.ca.gov/reports/2022/4/Th8a/Th8a-4-2022%20staffreport.pdf.

California Coastal Commission. June 2022. *Staff Report: Consistency Determination No: CD-0004-22* (Bureau of Ocean Energy Management, San Luis Obispo Co.). https://documents.coastal.ca.gov/assets/upcoming-projects/offshore-wind/W7a-6-2022-AdoptedFindings.pdf.

95 American Jobs Project. February 2019. *The California Offshore Wind Project: A Vision for Industry Growth*. http://americanjobsproject.us/wp/wp-content/uploads/2019/02/The-California-Offshore-Wind-Project.pdf.

component manufacturing and supply chain and support services, particularly for installation and development, ports and staging, onshore transmission, foundations, towers, and blades. It also concluded that the total workforce needed is roughly the same for all three scenarios.[96]

The CEC recognizes the need to start developing a trained and skilled workforce to support the deployment of offshore wind. This factor does not directly influence the establishment of the MW planning goals as the magnitude of the workforce will adjust with the MW planning goals. The need for a skilled and trained workforce will be explored further in the development of the strategic plan.

Attracting Supply Chain Manufacturing in the Pacific Region

A possible benefit of developing wind offshore in California is the economic development opportunities for California and the Pacific region from scaling-up a new industry. A report — *California Offshore Wind: Workforce Impacts and Grid Integration*, conducted by the UC Berkeley Labor Center — indicates that the largest economic development benefits of an offshore wind industry would come from having a local supply chain for manufacturing components used in project development.[97] Moreover, as offshore wind continues to develop around the world, having a local supply chain and workforce capabilities makes California, the West Coast, and the United States less vulnerable to global supply chain bottlenecks and better positioned to achieve offshore wind deployments at scale. However, offshore wind developers and the supply chain industry need to have confidence in the offshore wind pipeline to support early investments in local supply chain development.

While developing a local supply chain in California and throughout the Pacific region is necessary to maximizing the economic benefits of an offshore wind industry in California, this factor does not directly influence the establishment of the MW planning goals. Like the development of a skilled and trained workforce, the development of a local supply chain will scale from the MW planning goals. The CEC also recognizes the role the MW planning goals will play in sending market signals for early investment in the development of a local supply chain. The need for a local supply chain will be explored further in the development of the strategic plan.

The Need for Economies of Scale to Reduce Costs

In 2020, NREL published results of a study, conducted in partnership with BOEM and the CPUC, updating cost assumptions for offshore wind in California. In 2019, NREL found that the levelized cost of energy for offshore wind ranged from $83/MWh to $180/MWh. The latest estimates indicate costs could decrease by 44 percent on average by 2032, reaching a

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96 Guidehouse. May 2022. *California Supply Chain Needs Summary Report.* https://efiling.energy.ca.gov/GetDocument.aspx?tn=242928&DocumentContentId=76513.

97 Collier, Robert, Sanderson Hull, Oluwafemi Sawyerr, Shenshen Li, Manohar Mogadali, Dan Mullen, and Arne Olson. September 2019. *California Offshore Wind: Workforce Impacts and Grid Integration*. Center for Labor Research and Education, University of California, Berkeley. http://laborcenter.berkeley.edu/offshore-wind-workforce-grid.

levelized cost of energy in the range of $53/MWh to $64/MWh, assuming a global deployment of 8 GW by 2032. The study attributed this potential cost decline to the following factors:[98]

- Turbine upsizing, which will result in lower per-unit costs
- Economies of scale and efficiencies in manufacturing
- Technology innovations, which can reduce material use, improve performance, and improve logistic efficiencies

These cost estimates do not include the other significant investments that will be needed to construct offshore wind, such as the port facilities and transmission that will be necessary. The report states: "Continued turbine and plant upscaling, as well as an expansion of the supply chain, are needed to obtain the costs modeled in this analysis."[99]

The CEC recognizes the importance of economies of scale to reduce offshore wind development costs. While this factor did not influence the offshore wind MW planning goals as significantly as some of the factors previously discussed, it does support more ambitious offshore wind MW planning goals.

The Availability of Federal Tax Incentives

The offshore wind provision of the Business Energy Investment Tax Credit (ITC) allows a 30 percent investment tax credit that applies to capital expenditures on projects that start construction before the end of 2025.[100] A "safe harbor provision" allows projects that start construction or spend at least 5 percent of the total capital expenditure of a project by the end of 2025 and come on-line by 2035 to capture the benefit of the ITC.[101] However, the availability of federal tax incentives after 2025 is uncertain.

The CPUC's 2021 IRP Preferred System Plan includes 1.7 GW of offshore wind energy by 2032, with a key assumption being the 2025 "safe harbor" ITC deadline could be met by developers. The IRP analysis showed that if the ITC is not part of offshore wind cost assumptions, then the optimal resource portfolio does not include any offshore wind by 2032 beyond the 300 MWs included in some load-serving entities' IRPs.[102]

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98 Beiter, Philipp, Walter Musial, Patrick Duffy, Aubryn Cooperman, Matt Shields, Donna Heimiller, and Mike Optis. 2020. *The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77384. https://www.nrel.gov/docs/fy21osti/77384.pdf.

99 Ibid.

100 "Fact Sheet: Advancing the Growth of the U.S. Wind Industry: Federal Incentives, Funding, and Partnership Opportunities." U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. https://www.energy.gov/sites/default/files/2021-07/us-wind-industry-federal-incentives-funding-partnership-opportunities-fact-sheet-v2.pdf.

101 U.S. Internal Revenue Service. 2021. "Notice 2021-05: Beginning of Construction for Sections 45 and 48; Extension of Continuity Safe Harbor for Offshore Projects and Federal Land Projects." https://www.irs.gov/pub/irs-drop/n-21-05.pdf.

102 CPUC. February 2022. Decision Adopting 2021 Preferred System Plan. D.22-02-004 in Rulemaking 20-05-003. https://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=451412947.

When combined with other key offshore wind assumptions, such as generation profile, capital and operating expenses, and financing costs, the ITC has the effect in the IRP capacity expansion modeling of reducing the implied levelized cost of energy from a range of about $60/MWh to $70/MWh to a range of $40/MWh to $50/MWh. In line with standard practice, the levelized cost of energy discussed in the NREL report and for CPUC IRP resource modeling covers generation costs and excludes the costs of major bulk transmission expansions.[103]

While some of the early offshore wind development projects may be able to take advantage of the ITC, there is considerable uncertainty about the availability of the tax credit for projects that do not meet the safe harbor provision by the end of 2025. However, the availability of the ITC for such projects is possible and is reason for establishing MW offshore wind MW planning goals higher than the current adopted amount of offshore wind in IRP.

The National Renewable Energy Laboratory Report Finding That California Has 200 Gigawatts of Offshore Wind Technical Power Potential

In early 2020, NREL updated its 2016 assessment of offshore wind potential based on a state-of-the-art wind resource data set for the Outer Continental Shelf (OCS).[104] The report found significantly higher mean wind speeds modeled in the new data set compared to other models, which showed an increase in the mean 100-m wind speed at the centroids of the Humboldt, Morro Bay, and Diablo Canyon call areas.[105] This report also applied revised input assumptions to generate new estimates of technical potential for offshore wind in California. These new estimates resulted in a finding of increased technical potential for the Pacific OCS of 201 GW. The findings of this report are most applicable to evaluating and quantifying the maximum feasible capacity of offshore wind as discussed in Chapter 2.

The Opportunity for California to Participate in the Federal Government's Offshore Wind Planning Goals

In March 2021, the DOI, the Department of Energy (DOE), and the Department of Commerce announced a shared goal to deploy 30 GWs of offshore wind in the United States by 2030 while protecting biodiversity and promoting ocean co-use. The Biden administration sees the achievement of this target as a pathway to 110 GW by 2050.[106]

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103 Beiter, Philipp, Walter Musial, Patrick Duffy, Aubryn Cooperman, Matt Shields, Donna Heimiller, and Mike Optis. 2020. *The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77384. https://www.nrel.gov/docs/fy21osti/77384.pdf.

104 Musial, Walt, Donna Heimiller, Philipp Beiter, George Scott, and Caroline Draxl. September 2016. *2016 Offshore Wind Energy Resource Assessment for the United States*. Golden. CO: National Renewable Energy Laboratory. NREL/TP-5000-66599. https://www.nrel.gov/docs/fy16osti/66599.pdf.

105 Optis, Mike, Alex Rybchuk, Nicola Bodini, Michael Rossol, and Walter Musial. 2020. *2020 Offshore Wind Resource Assessment for the California Pacific Outer Continental Shelf*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-77642. https://www.nrel.gov/docs/fy21osti/77642.pdf

106 The White House. March 2021. "Fact Sheet: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs." https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/.

The Biden administration and Governor Newsom announced an effort to advance areas for offshore wind off the Northern and Central Coasts of California. The Biden administration contextualizes this announcement as a part of the nationwide 2030 deployment goal. According to the 2021 Edition of the U.S. DOE *Offshore Wind Market Report*, there are eight states with existing offshore wind procurement targets totaling close to 40 GW by 2040.[107] As part of the announcement of setting a 30 GW goal, the Biden administration announced that BOEM is expecting to hold up to seven additional lease sales by 2025, including a lease sale for the Humboldt and Morro Bay wind energy areas in the fall of 2022. BOEM is also planning to review construction and operation plans representing more than 19 GW of offshore wind in the United States by 2025.[108]

A recent study by NREL developed a baseline scenario to achieve the federal deployment goal of 30 GW by 2030. The baseline scenario included 2.5 GW of offshore wind from California by 2030. The study noted that while the timeline may be ambitious and would require work in developing the technology, supply chain, and regulatory and permitting process, it may be possible given the state's support of growing an offshore wind industry.[109] This supports consideration of a 2030 offshore wind planning goal of at least 2.5 GW to contribute to the federal goal of 30 GW by 2030.

Executive Action from the Governor Regarding Offshore Wind

On July 22, 2022, Governor Gavin Newsom issued a letter to the Chair of the California Air Resources Board, outlining new targets to accelerate progress on California's 2030 climate goals and to get to climate neutrality no later than 2045. In the letter, among other requested actions, the Governor asks the CEC to establish an offshore wind planning goal of at least 20 GW by 2045 and to work with the state's federal partners to accelerate the deployment of offshore wind. The letter noted that California is home to one of the best offshore wind resources in the world and that offshore wind can serve as a clean, domestic source of electricity that can play an important role in meeting the state's growing need for clean energy.[110]

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107 U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy. *Offshore Wind Market Report: 2021 Edition.* https://www.energy.gov/sites/default/files/2021-08/Offshore%20Wind%20Market%20Report%202021%20Edition_Final.pdf.

108 "Press Release: U.S. Department of the Interior, October 2021, Secretary Haaland Outlines Ambitious Offshore Wind Leasing Strategy." https://www.doi.gov/pressreleases/secretary-haaland-outlines-ambitious-offshore-wind-leasing-strategy.

109 Shields, Matt, Ruth Marsh, Jeremy Stefek, Frank Oteri, Ross Gould, Noé Rouxel, Katherine Diaz, Javier Molinero, Abigayle Moser, Courtney Malvik, and Sam Tirone. 2022. *The Demand for a Domestic Offshore Wind Energy Supply Chain*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-81602. https://www.nrel.gov/docs/fy22osti/81602.pdf.

110 Governor Gavin Newsom, letter to Chair of the California Air Resources Board. July 22, 2022. https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf?emrc=1054d6

Public Workshops on AB 525 for Establishing Offshore Wind Planning Goals

On March 3, 2022, the CEC held a public workshop on AB 525 that included discussion of CEC staff's approach toward establishing offshore wind MW planning goals. On May 6, 2022, CEC staff published a draft report and held two workshops seeking public comment. Information submitted during the May 18, 2022, public workshop recommended the CEC establish different MW offshore wind planning goals for 2030 and 2045. The information was based on studies released after the draft offshore wind report. The third and final workshop was held on June 27 and provided the public an opportunity to explore these studies and how they relate to the AB 525 requirements and the draft report. The CEC staff received public comments from several individuals and stakeholders representing the offshore wind industry, environmental organizations, labor organizations, environmental justice, fishing, tribal, and the shipping industry, among others.

In the public comments received at the March 3rd workshop, offshore wind industry stakeholders and others provided a range for suggested planning goals starting at 3 GW in 2030 and scaling to between 10 GW and 18 GW by 2045. At the May 18 and June 27 workshops, several stakeholders provided revised offshore wind planning goal recommendations of 5 GW by 2030 and 20 GW by 2045, pointing to newly released offshore wind studies that were not available at the time of the March 3 workshop or during development of the draft report. (See section on "Additional Information Considered" below.) Several stakeholder comments recommending larger planning goals emphasized the importance of the MW planning goals in sending market signals necessary to drive investment in ports, infrastructure, and supply chain development and point to how planning goals and procurement targets have driven offshore wind development on the East Coast.[111] Others commented that the planning goals should be robust enough to drive economies of scale,[112] which will be essential for reducing costs, delivering competitively priced clean power, and encouraging local industry and job development.[113]

Across all three public workshops, other commenters emphasized the importance of ensuring offshore wind growth is equitable, creating long-lasting benefits to local California

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111 RWE Renewables Americas, LLC. March 11, 2022. CEC Docket: 17-MISC-01, TN# 242270. Avangrid Renewables Comments on AB 525 Offshore Wind Goals. CEC Docket 17-MISC-01, TN#242284. American Clean Power – California. March 11, 2022. CEC Docket: 17-MISC-01, TN#242268. Joe Martens. June 26, 2022. Joe Martens Comments-California Offshore Renewable Energy Targets. CEC Docket: 17-MISC-01, TN# 243715.

112 California Wind Energy Association. March 11, 2022. California Wind Energy Association Comments on AB 525 Implementation. CEC Docket: 17-MISC-01, TN#242618.

113 Offshore Wind California. March 11, 2022. Offshore Wind California Comments on AB 525 Planning Goals. CEC Docket: 17-MISC-01, TN#242274

communities.[114] It was also indicated that local economic development should be elevated through a focus on quality jobs and local economic benefits.[115]

Environmental organizations commented that offshore wind goals should be reflective of environmental and social development and the least-cost alternative to get California to the state's economywide decarbonization goals.[116] Comments also asserted that offshore wind planning goals should be aligned with environmentally and socially responsible offshore wind development — avoiding, minimizing, or mitigating significant or adverse impacts to the environment or other ocean users.[117] Ocean users including representatives from the fishing industry raised concerns about unknown environmental, economic, and cultural impacts of developing an offshore wind industry and encouraged strong engagement and coordination while identifying suitable sea space and prioritizing least-conflict ocean areas.[118]

Additional Information Considered

CEC staff examined four new reports that were discussed at the June 27, 2022, Public Workshop. Two primary studies provide additional information to inform the MW planning goals.

The first study is the *Assessment of Offshore Wind Energy Leasing Areas for Humboldt and Morro Bay Wind Energy Areas*.[119] This study, developed for BOEM to inform the federal offshore wind lease process, delineates the number of recommended lease areas for each of the BOEM-identified WEAs. This delineation assessment was completed by examining the potential deployment of a 1 GW facility in each lease area and examined the deployment with three floating platform technologies with optimal turbine layout for each platform type. The report identifies two potential lease areas in the Humboldt WEA, with a total generation capacity of 1.5 GW to 3 GW. For the Morro Bay WEA, NREL identifies three potential lease areas with a total generation capacity between 3 GW and 5 GW. This NREL report confirms

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114 Verbal comments at March 3, 2022 workshop from Sarah Xu, Brightline Defense.

115 Natural Resources Defense Council. March 11, 2022. Natural Resources Defense Council Comments on AB 525 Offshore Wind Planning Goals. CEC Docket 17-MISC-01, TN# 242272.

116 Natural Resources Defense Council. June 28, 2022. Natural Resources Defense Council Comments – Julia De Lamare – Comments Lead Commissioner Workshop. CEC Docket 17-MISC-01, TN#243738.

117 Environmental Defense Center. March 11, 2022. Environmental Defense Center Comments. CEC Docket 17-MISC-01, TN# 242269. Natural Resources Defense Council. March 11, 2022. Natural Resources Defense Council Comments on AB 525 Offshore Wind Planning Goals. CEC Docket 17-MISC-01, TN# 242272.

118 Verbal comments from May 18, 2022, workshop from Mike Conroy, West Coast Fisheries. Stephen Scheiblauer. June 27, 2022. Stephen Scheiblauer Comments – CEC workshop on AB 525 goals. CEC Docket 17-MISC-01, TN# 243736. Pacific Merchant Shipping Association. May 23, 2022. Pacific Merchant Shipping Association Comments on AB 525 CEC Draft Report on Offshore Wind Development off the California Coast. CEC Docket 17-MISC-01, TN# 243220.

119 Cooperman, Aubryn, Patrick Duffy, Matt Hall, Ericka Lozon, Matt Shields, and Walter Musial. April 2022. *Assessment of Offshore Wind Energy Leasing Areas for Humboldt and Morro Bay Wind Energy Areas, California*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-82341. https://www.nrel.gov/docs/fy22osti/82341.pdf.

that by increasing the density of turbines deployed, developers could achieve a range of between 4.5 GW and 8 GW of total generation capacity within these two BOEM call areas. The density of turbines would depend on the type of floating platform technology and anchoring technology selected. This information suggests higher nameplate capacity goals could be achieved in other suitable areas off the California Coast.

The second is a set of studies, the *Achieving an Equitable and Reliable 85 Percent Clean Electricity System by 2030 in California* technical report and the Policy Report by Energy Innovation, Telos Energy, and GRIDLab.[120] These reports complement the 2021 Joint Agency SB 100 Report by examining system reliability for a series of portfolios with a combination of RESOLVE and production cost modeling (PLEXOS) focused on 2030. Findings indicate that California can reliably meet an 85 percent clean electricity standard by 2030 through multiple resource pathways, which are based primarily on wind and solar generation, and battery storage. As modeling assumptions, minimum buildouts of 2 GW of geothermal and 4 GW of offshore wind were used in the modeling work for 2030 and the modeling assumes that the 4 GW of offshore wind is available. CEC staff used information from this study to project an amount of offshore wind capacity for 2045. Starting with the assumption of 4 GW of offshore wind by 2030 and applying a deployment rate of 1 GW to 1.5 GW per year to support ongoing manufacturing and supply chain for offshore wind, the state could expect between 20 GW to 27 GW of capacity to be deployed by 2045.

Two other ongoing studies were also discussed at the workshop. These include a draft working paper from the University of California Berkeley Goldman School of Public Policy, *The Offshore Report: California Plummeting Offshore Wind (OSW) Costs Can Accelerate a Diverse Net-Zero Grid* and the Nature Conservancy's forthcoming study, *Power of Place West*.[121]

The Goldman School of Public Policy working paper examines a range of scenarios that have offshore wind goals for 2045 based on the NREL ATB.[122] An NREL ATB mid case of 50 GW of

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120 GridLab. May 2022. *Reliability Reaching California's Clean Electricity Targets: Stress Testing an Accelerated 2030 Clean Portfolio*. https://gridlab.org/wp-content/uploads/2022/05/GridLab_California-2030-Study-Technical-Report-5-9-22-Update1.pdf.

Energy Innovation. May 2022. *Achieving an Equitable and Reliable 85 Percent Clean Electricity System by 2030 in California*. https://energyinnovation.org/wp-content/uploads/2022/05/Achieving-An-Equitable-And-Reliable-85-Percent-Clean-Electricity-System-By-2030-In-California-1.pdf.

121 Paliwal, Umed, Nikit Abhyankar, David Wooley, Amol Phadke (2022). "The Offshore Report: California, Plummeting offshore wind costs can accelerate a diverse net-zero grid", Working Paper 1, Center for Environmental Pubic Policy, Goldman School of Public Policy, University of California, Berkeley. https://gspp.berkeley.edu/assets/uploads/page/CA_OSW_Assessment_Working_Paper_CEPP.pdf

The Nature Conservancy. June 2022. Power of Place West, forthcoming publication. CEC Docket 17-MISC-01, TN# 243738. https://efiling.energy.ca.gov/GetDocument.aspx?tn=243688&DocumentContentId=77515

122 "Annual Technology Baseline, Electricity, Offshore Wind, National Renewable Energy Laboratory, 2021." https://atb.nrel.gov/electricity/2021/offshore_wind.

offshore wind by 2045 was examined and a $30+ billion estimate for new transmission investment identified.

The Nature Conservancy's study takes a west-wide perspective on optimal resource mixes needed (including offshore wind) to collectively achieve economywide net zero by 2050. The Nature Conservancy believes this type of modeling represents a realistic picture of California's clean energy future and offers efficiency and myriad other benefits that an integrated market represents.

Both studies are in draft form and are expected to be finalized during CEC's continuing work on the AB 525 Offshore Wind Strategic Plan. CEC staff will follow the development of these studies and continue to consider the relevant information they provide to guide the SB 100 implementation process and next report.

CHAPTER 4: Conclusion

To assess the potential quantity of maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits and establish offshore wind MW planning goals for 2030 and 2045, CEC staff used available information as described above to evaluate considerations specified in AB 525. These considerations include floating offshore wind technologies, potential impacts, and infrastructure requirements. The statutory deadline for establishing the MW planning goals and identifying maximum feasible capacity for offshore wind is before completion of the sea space evaluation, which is needed to inform identifying maximum feasible capacity. This sea space evaluation is an important component of the broader strategic plan. As the sea space analysis is being completed, CEC staff will continue to identify and assess impacts and strategies and will use that information to inform the maximum feasible capacity and refine the MW planning goals as needed.

Offshore Wind Technical Potential

Based on existing studies described in this report, nearly 21.8 GW of offshore wind technical potential of the 201 GW of the gross resource estimate has been identified and examined for technical feasibility. This number does not represent the quantification of maximum feasible capacity of offshore wind as defined in this report and required by AB 525; it simply represents the offshore wind technical potential that has been studied to date. As discussed, the estimates of technical potential used in these studies do not account for other important factors such as competing uses or environmental considerations, which will significantly reduce the technical potential. Similarly, technological advancements or identification of new suitable areas may increase the technical potential. CEC staff will continue to examine these areas in the assessment of sea space requirements, transmission need, and potential impacts for the strategic plan. This work is necessary to evaluate and quantify the maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits.

Offshore Wind Megawatt Planning Goals

To establish offshore wind MW planning goals, CEC staff evaluated five factors of particular importance as described in Chapter 3 of this report. A summary of the evaluation for each of the five factors as well as additional information considered and how they guide the MW planning goals are provided below.

1. The findings of the *2021 SB 100 Joint Agency Report.*

   The *2021 SB 100 Joint Agency Report* advises the offshore wind MW planning goals, suggesting the CEC set a minimum of 10 GW for offshore wind as a planning goal for 2045. The report also concludes that offshore wind can contribute to increased resource diversity, which helps lower overall system costs.

2. The need to initiate long-term transmission and infrastructure planning to expedite delivery of offshore wind energy to Californians.

   The CPUC IRP process and the ISO TPP examine the energy resources by location and technology and identify the transmission infrastructure and infrastructure upgrades needed to achieve the state's climate and energy goals. They are designed to ensure that the energy system is developed and operated cost-effectively while ensuring system reliability.

   As such, the outputs from these planning processes provide key information to inform the maximum feasible capacity of offshore wind and MW planning goals for 2030 and 2045. The development of new transmission capacity has been identified as necessary to deliver offshore wind power from the North Coast to California load centers.

   For 2030, it is prudent to have the AB 525 strategic plan evaluate at least the current adopted 2032 IRP amount of offshore wind of 1.7 GW, potentially up to nearly 5 GW, which is what can be accommodated on existing transmission. An amount beyond this appears infeasible from a transmission perspective by 2030. For 2045, there is greater possibility of achieving some or all of the transmission upgrades examined by the ISO. This suggests the CEC may consider establishing a MW planning goal for 2045 of at least 10 GW to 14.3 GW for 2045 (informed by both the ISO *2021–2022 Transmission Plan* and the ISO *20-Year Transmission Outlook*).

3. The need for reliable renewable energy that accommodates California's shifting peak load.

   The need for renewable energy to accommodate California's shifting peak load guides the maximum feasible capacity of offshore wind and the MW planning goals. The complementary nature of offshore wind to solar, both daily and in the winter, suggests the CEC establish offshore wind MW planning goals that are reasonably higher than the current adopted amount of offshore wind in IRP. These higher planning goals would allow flexibility as IRP and TPP and other LSEs in the state continue to direct the optimal procurement of generation and transmission for ratepayers over the coming years. Allowing for a buffer above the current adopted amount in IRP helps prepare California to take advantage of the generation profile of offshore wind to help ensure California meets its SB 100 energy goals.

4. The generation profile of offshore wind off the California coast.

   The generation profile of offshore wind goes hand in hand with the shifting peak load factor above in terms of informing the MW planning goals. Reliability modeling considers historical weather patterns, projects climate change and the related impact on generation and demand and uses this information in stochastic analysis to project expected reliability of future electricity generation portfolios. Further real-time wind data collection and ongoing modeling as part of efforts including the IRP process and other studies will continue to improve understanding of the inherent patterns of variability across specific areas with offshore wind technical potential. More study is also needed to investigate strategies that maximize the use of storage technologies and other grid integration solutions with offshore wind resources as part of a portfolio of renewable and zero-carbon resources.

5. Potential impacts on coastal resources, fisheries, Native American and Indigenous peoples, and national defense, and strategies for addressing those potential impacts.

   The degree, magnitude, and extent of potential impacts of offshore wind generation will be identified and assessed by CEC staff during and after the AB 525 identification of sea space component of the strategic plan. The recommended MW planning goals do not consider potential impacts to ocean use and environmental considerations. The assessment of potential impacts and the strategies for addressing those impacts that are identified for the strategic plan will inform and may potentially limit the amount of maximum feasible capacity of offshore wind and the MW planning goals that are ultimately identified in the strategic plan

As discussed in Chapter 2, CEC staff reviewed the NREL 2021 ATB for Offshore Wind,[123] which examines the future costs for three technology innovation scenarios, including conservative, moderate, and advanced technology scenarios. The technology assumptions of these three scenarios are highlighted below:

- Conservative Technology Innovation Scenario (Conservative Scenario): turbine size remaining at a level consistent with the technology solutions available in today's markets; limited advancements in technology innovation are characteristic of this scenario. Logistical and manufacturing constraints are similar to those today, and they limit turbine size growth.
- Moderate Technology Innovation Scenario (Moderate Scenario): turbine size increasing at a rate commensurate with growth in recent years. Logistical, manufacturing, operating and performance constraints are addressed by technology innovation in turbine, substructure, and port and vessel capabilities to enable the next generation of offshore wind technology. These increases in turbine size are accompanied by continued increases in supply chain efficiencies.
- Advanced Technology Innovation Scenario (Advanced Scenario): turbine size increasing at a rate that is considerably higher than in recent years. Accelerated technology innovation enables large turbine systems and fundamentally changes the manufacturing, installation, operation, and performance of a wind plant.

For developing the strategic plan, the CEC is considering the range of technology scenarios and will examine, among other sources, the Moderate and Advanced Scenarios, which align best with the assumptions used in the state's approach to offshore wind. Under the Moderate Scenario, assumptions for representative technology include a 15 MW turbine mounted on a floating substructure using improved and highly tailored technology and materials. The turbine

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123 "Annual Technology Baseline, Electricity, Offshore Wind, National Renewable Energy Laboratory, 2021." https://atb.nrel.gov/electricity/2021/offshore.

system is installed and operated using greatly enhanced port infrastructure and vessel capabilities relative to what exists today. Under the NREL Advanced Scenario, an 18 MW turbine would be mounted on a floating substructure using next-generation technology and materials, port infrastructure, and vessel capabilities. Efficiency gains are achieved through accelerated standardization, large economies of scale, and increased competition.

Under both scenarios, the levelized cost of energy for offshore wind generation is projected to continue to drop. This drop is primarily due to increasing capability and efficiency of the supply chain to support offshore wind and to the economies of turbine size and offshore generation facility scale. Technological developments for offshore wind infrastructure may include advanced monitoring systems, mooring systems, flexible cabling, and increased turbine size. The CEC staff will evaluate this potential as it continues to identify sea space and develop the strategic plan. The CEC staff will continue to work with stakeholders to create a strategic plan that takes technological innovation into account.

The primary studies discussed at the CEC's June 27, 2022, workshop provided additional information to inform the MW planning goals.

The NREL *Assessment of Offshore Wind Energy Leasing Areas for Humboldt and Morro Bay Wind Energy Areas* report identifies two potential lease areas in the Humboldt WEA, with a total generation capacity of 1.5 GW to 3 GW.[124] For the Morro Bay WEA, NREL identifies three potential lease areas with a total generation capacity between 3 GW and 5 GW. This NREL report confirms that by increasing the density of turbines deployed, developers could achieve a range of between 4.5 GW and 8 GW of total generation capacity within these two BOEM call areas. The density of turbines would depend on the type of floating platform technology and anchoring technology selected. This information suggests higher nameplate capacity goals could potentially be achieved in other suitable areas off the California coast.

A set of studies, by Energy Innovation, Telos Energy, and GridLab indicated that California can reliably meet an 85% clean electricity standard by 2030 through multiple resource pathways, which are based primarily on wind and solar generation, and battery storage.[125] As modeling assumptions, minimum buildouts of 2 GW of geothermal and 4 GW of offshore wind were used in the modeling work for 2030 and assumes that 4 GW of offshore wind is available. CEC staff used information from this study to project an amount of offshore wind capacity for 2045. Starting with the assumption of 4 GW of offshore wind by 2030 and applying a deployment rate of 1 GW to 1.5 GW per year to support ongoing manufacturing and supply chain for offshore wind, the state could expect between 20 GW to 27 GW of capacity to be deployed by

124 Cooperman, Aubryn, Patrick Duffy, Matt Hall, Ericka Lozon, Matt Shields, and Walter Musial. April 2022. *Assessment of Offshore Wind Energy Leasing Areas for Humboldt and Morro Bay Wind Energy Areas, California*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5000-82341. https://www.nrel.gov/docs/fy22osti/82341.pdf.

125 GridLab. May 2022. *Reliability reaching California's clean electricity targets: Stress testing an accelerated 2030 clean portfolio*. https://gridlab.org/wp-content/uploads/2022/05/GridLab_California-2030-Study-Technical-Report-5-9-22-Update1.pdf.

2045. Based on the CEC staff's assessment of existing information as presented and evaluated in this report, CEC staff recommends the preliminary MW planning goals summarized in **Table 3**. The information from the studies discussed in this report indicate that the range of MW planning goals are potentially feasible if significant investment is made toward the rapid deployment of the required transmission infrastructure and other related deployment infrastructure, such as ports. Moreover, these MW planning goals are within the range necessary to support and sustain employment and economic benefits to the state as discussed in Chapter 2. Finally, this range of MW planning goals are considered appropriate to receive additional study, assessment, and discussion in the strategic plan. These goals will be revised as appropriate based on findings in the strategic plan and learnings from early offshore wind projects. The goals do not represent procurement targets. The goals will facilitate the study of infrastructure needs and impacts to inform future procurement goals.

Table 3: Offshore Wind Megawatt Planning Goals for 2030 and 2045 for California Offshore Wind in Federal Waters

Objective	Approximate Nameplate Capacity
Maximum Feasible Capacity of California Offshore Wind in Federal Waters	*Maximum* feasible capacity to be determined in strategic plan, but nearly 21,800 MW (21.8 GW) of studied technical potential is the current reference point
Offshore wind planning goal for 2030	2,000 MW (2 GW) - 5,000 MW (5 GW)
Offshore wind planning goal for 2045	25,000 MW (25 GW)

Source: California Energy Commission

California Offshore Wind Planning Goal of 2,000 MW - 5,000 MW by 2030

For completing the strategic plan, the CEC recommends establishing a preliminary planning goal range of 2,000 MW–5,000 MW of offshore wind by 2030. This goal could come from a full build-out of Morro Bay Wind Energy Area or a combination of a partial build-out of each of the Morro Bay and Humboldt Wind Energy Areas, which the CEC will further explore when identifying suitable sea space for the 2030 MW planning goals. The lower end of that range reflects an understanding that achieving a 2030 online date will require a significant mobilization of effort and resources and timely infrastructure investments, among other factors. The CEC will work with state and federal partners to identify process steps and milestones that could allow for a 2030 online date for California's first offshore wind projects.

The ISO estimated transmission infrastructure for 1.6 GW from the Humboldt Wind Energy Area ranged from $2.1 billion to $4.0 billion and estimated that up to 5.3 GW of offshore wind from Central California could be deliverable through the existing transmission system without mitigation and minimal investment.[126] Realizing California-based economic benefits from the supply chain would also require in-state port modifications or improvements to support some level of fabrication or assembly of floating offshore wind components or both.

California Offshore Wind Planning Goal of 25,000 MW by 2045

For completing the strategic plan, the CEC recommends establishing a preliminary planning goal of 25,000 MW of offshore wind by 2045. These goals for 2030 and 2045 will be evaluated as part of the AB 525 strategic plan as more information becomes available from the analysis of suitable sea space and potential impacts on coastal resources, fisheries, Native American and Indigenous people, and national defense, as well as other topics addressed in the strategic plan.

These preliminary MW planning goals are designed to be potentially achievable but aspirational and are established at a level that can contribute significantly to achieving the climate goals. The planning goals reflect the best available data and science and evaluation of the 12 factors prescribed by AB 525, including the latest information presented in the series of public workshops discussed in Chapter 3. The information available supports the feasibility of at least 20 GW by 2045. However, the offshore wind industry, including floating turbine technology, continues to quickly evolve. The 25 GW target signals that the state sees a need for additional capacity and developing a threshold for creating the momentum necessary to unlock a robust offshore wind industry in California.

Higher goals do not commit California to those deployment levels. Offshore wind resources will still need to go through siting and procurement processes, including environmental review, and stakeholder engagement will be critical to identifying new BOEM wind energy areas. However, these higher planning goals prepare the state for potential impacts due to the possible integration of significant offshore wind.

In consultation with state, local, federal agencies, a variety of stakeholders, and California Native American tribes, the CEC will use these MW planning goals to inform development of a strategic plan for offshore wind in federal waters off the California coast. In particular, the 2030 and 2045 MW planning goals are presented as a range to inform further analysis of the considerations that must be balanced when identifying suitable sea space, developing a plan to improve waterfront facilities, assessing transmission upgrades, identifying potential environmental impacts, and other related requirements of AB 525.

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126 California ISO. March 2022. *2021–2022 Transmission Plan.* http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf.

APPENDIX A: List of Acronyms

AB – Assembly Bill

ATB — Annual Technology Baseline

BOEM — Bureau of Ocean Energy Management

CEC — California Energy Commission

CNRA — California Natural Resources Agency

CPUC — California Public Utilities Commission

CZMA — Coastal Zone Management Act

DOE — U.S. Department of Energy

DOI — U.S. Department of the Interior

EPIC — Electric Program Investment Charge

GW — gigawatt

IRP — integrated resource planning

ISO — Independent System Operator

ITC — Investment Tax Credit

LCOE — levelized cost of energy

LSE — load-serving entities

MW — megawatt

nm — nautical miles

NREL — National Renewable Energy Laboratory

OCS — outer continental shelf

PSP — Preferred System Plan

SB — Senate Bill

TPP — transmission planning process

USC — University of Southern California

WEA — Wind Energy Area

APPENDIX B: Glossary of Terms

Distributed Energy Generation: A distributed generation system involves small amounts of generation located on a utility's distribution system for meeting local (substation level) peak loads or displacing the need to build additional (or upgrade) local distribution lines or both. Photovoltaics, fuel cells, and battery storage are some examples of distributed energy generation resources.

Energy-Only Resources Deliverability: A condition for a Large Generating Facility connected to the ISO Controlled Grid, meaning the facility cannot provide capacity to ensure resource adequacy.

Full Capacity Resource Deliverability: A status for a Large Generating Facility connected to the ISO Controlled Grid meaning the facility can supply and is eligible to sell capacity to ensure resource adequacy.

Gigawatt (GW): One thousand megawatts (1,000 MW) or, one million kilowatts (1,000,000 kW) or one billion watts (1,000,000,000 watts) of electricity. One GW is enough to supply the electric demand of about one million average California homes.

CPUC Integrated Resource Planning (IRP): A planning proceeding to consider all the CPUC's electric procurement policies and programs and ensure California has a safe, reliable, and cost-effective electricity supply. The integrated resource planning process ensures that load-serving entities (LSEs) detail the procured and planned resources in their portfolios that allow the electricity sector to contribute to California's economywide greenhouse gas emissions reductions goals.

Levelized Cost of Energy (LCOE): The average total cost of an energy generation project per unit of total electricity generated. Also referred to as the levelized cost of electricity or the levelized energy cost (LEC), LCOE is a measurement to assess and compare alternative methods of energy production. The LCOE of an energy-generating asset can be thought of as the average total cost of building and operating the asset per unit of total electricity generated over an assumed lifetime.

Maximum Feasible Capacity (AB 525/CEC definition): California Code of Regulations, Title 20, section 1201(h), defines "feasible" as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors." Maximum feasible capacity is the amount of offshore wind that California can expect to generate with realistic projections of what could be achieved by 2030 and 2045, considering the broad range of specified factors identified in AB 525.

Megawatt (MW): One thousand kilowatts (1,000 kW) or 1 million (1,000,000) watts. One MW is enough electrical capacity to power 1,000 average California homes. (Assuming a loading factor of 0.5 and an average California home having a 2 kilowatt peak capacity.)

Nameplate Capacity, Rated Capacity: The total manufacturer-rated capacities (or full-load sustained output) of equipment such as turbines, generators, condensers, transformers, and other system components.

Net Qualifying Capacity: The amount of capacity from each generation resource that can be counted toward meeting resource adequacy requirements.

Outer Continental Shelf (OCS): Includes the area between state jurisdiction to 200 nautical miles from shore.

Renewables Portfolio Standard: One of California's key programs for advancing renewable energy. The program sets continuously escalating renewable energy procurement requirements for the state's load-serving entities.

Technical Potential (for floating offshore wind): Areas offshore that can generate electricity using offshore wind and meet certain technical requirements for the deployment of floating offshore wind technology. Technical requirements include waters that are greater than 60 meters and less than 1,300 meters in depth, have an annual average windspeed of seven meters per second or greater, and can be commercially developed using available technology.

The ISO Transmission Planning Process (TPP): Annual stakeholder process that provides a comprehensive evaluation of the ISO transmission grid to identify upgrades needed to maintain reliability, successfully meet public policy goals, and identify transmission projects that can bring economic benefits to consumers.

Utility-Scale Energy Generation: A utility-scale generation system involves large energy facilities that are designed to generate large amounts of electricity to be place directly onto the regional transmission grid.

Resolution No: 22-0810-02

STATE OF CALIFORNIA
ENERGY RESOURCES CONSERVATION
AND DEVELOPMENT COMMISSION

In the Matter of:	Docket No.17-MISC-01
CALIFORNIA OFFSHORE RENEWABLE ENERGY	Adoption of the AB 525 Offshore Wind Report Including the Maximum *Feasible Capacity and Megawatt Planning Goals for 2030 and 2045*

WHEREAS, the legislature has found and declared that offshore wind energy can contribute to a diverse, secure, reliable, and affordable renewable energy resource portfolio to serve the electricity needs of California ratepayers and improve air quality, particularly in disadvantaged communities; and

WHEREAS, the California Energy Commission (CEC) has actively participated in the Intergovernmental Renewable Energy Task Force, established in 2016 with representatives from federal, state, local, and tribal governments working together to identify opportunities for renewable energy leasing and development off the coast of California; and

WHEREAS, through coordination with the Task Force and an extensive stakeholder outreach and engagement process, the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM), who is responsible for overseeing renewable energy development in federal waters of the Outer Continental Shelf, is moving forward with further environmental review for leasing two areas, one off the north coast and one off the central coast, for additional evaluation of floating offshore wind development and the CEC has been working closely with BOEM on these activities; and

WHEREAS, Assembly Bill 525 (AB 525, Chiu, Chapter 231, Statutes of 2021) directs that on or before June 1, 2022, the CEC shall "evaluate and quantify the maximum feasible capacity of offshore wind to achieve reliability, ratepayer, employment, and decarbonization benefits and shall establish megawatt offshore wind planning goals for 2030 and 2045;" and

WHEREAS, AB 525 outlined twelve factors the CEC was required to consider in establishing these goals and the CEC did so consider those factors; and

WHEREAS, in May 2021 Governor Gavin Newsom signed an agreement on behalf of California with the U.S. Department of the Interior and the U.S. Department of Defense opening the West Coast for offshore wind energy development for the first time in its history

WHEREAS, the CEC conducted workshops on March 3, 2022, May 18, 2022, and June 27, 2022, to solicit input from stakeholders on this report; and

WHEREAS, Governor Gavin Newsom on July 22, 2022, sent a letter to the Chair of the California Air Resources Board, urging bold actions to address the urgency of the climate crisis by outlining new targets to accelerate progress on California's 2030 climate goals and reaching climate neutrality no later than 2045. In the letter, among other requested actions, the Governor asks the CEC to establish an offshore wind planning goal of at least 20 GW by 2045; and

WHEREAS, the CEC published the draft report on May 9, 2022 for public review and comment and, after considering all comments received and recently released studies that were not available during the development of the May draft version, published the proposed final version on August 1, 2022.

THEREFORE BE IT RESOLVED, the CEC hereby accepts, approves, and adopts the final report *Offshore Wind Energy Development off the California Coast: Maximum Feasible Capacity and Megawatt Planning Goals for 2030 and 2045,* incorporating any changes presented and adopted today along with any non-substantive changes such as typographical corrections, and directs CEC staff to make the document accessible to state, local, and federal entities, the public, and the Legislature.

CERTIFICATION

The undersigned Secretariat to the CEC does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the CEC held on August 10, 2022.

AYE:
NAY:
ABSENT:
ABSTAIN:

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Liza Lopez
Secretariat
California Energy Commission

Dated: August 10, 2022