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MEMORANDUM

To:	Rob Holmlund (Humboldt Bay Harbor, Recreation, and Conservation District)
From:	Shane Phillips, Josh Singer, and Ashley Knipe
Date:	April 15, 2024
Subject:	Terminal Permitted and Future Operations
Project:	Redwood Marine Multipurpose Terminal Replacement Project
Location:	Humboldt Bay, California
M&N Job No.:	212991-03
Cc:	Michael Jokerst

Disclaimer: This draft technical memorandum is a work-in-progress and is intended to be an internal document for use by the Humboldt Bay Offshore Wind Heavy Lift Marine Terminal Project team as a part of the conceptual design process and the ongoing permitting process. This memorandum is meant to be read as a part of a comprehensive packet of technical analyses. It is not written to be a standalone document and it is assumed that the reader has substantial project knowledge and context to understand the memorandum's content. All aspects of this memorandum are subject to change and may become less accurate over time. To better understand the project, please review the more comprehensive and up to date documents posted to the Humboldt Bay Harbor District's website at https://humboldtbay.org/humboldt-bay-offshore-wind-heavy-lift-marine-terminal-project-3.

The purpose of this memorandum is to document Moffatt & Nichol's (M&N's) assumptions related to operations at the Redwood Marine Multipurpose Terminal (RMMT). This memorandum is organized as follows:

1. Introduction
2. Offshore Wind Development Background
3. Permitted Project Operations
4. Future Project Operations
5. Turbine Ballasting Regulations
6. Assumptions
7. Next Phase Considerations
8. References

Attachment A – Site Operations Data
Attachment B – Permitted Project Site Layout

1. INTRODUCTION

In multiple state and federal analyses, Humboldt Bay has been identified as one of the state's primary floating offshore wind (OSW) Staging & Integration (S&I) sites. This is primarily due to the bay's unrestricted air draft, direct open ocean access, and proximity to the California and Oregon OSW lease areas. The Redwood Marine Multipurpose Terminal Replacement Project (Project) is located in Humboldt Bay and will have a critical role in S&I and other port operations necessary for OSW development. This memo describes Project operations in the following two categories:

1. **Permitted Operations.** These operations will be analyzed at a detailed "project level" in the Project's California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) documents and will be included in permit applications that will be submitted in early 2024.
2. **Future Operations.** These operations will occur later than Permitted Operations and will be analyzed at a more general "program level" in the Project's CEQA and NEPA documents. Not enough detail regarding the Future Operations is currently known to include them in the initial permit applications. However, because these operations are likely to occur in the future it is important to consider them in the Project's CEQA and NEPA documentation.

For the Permitted Operations, the RMMT will have two S&I sites and one Floating Foundation Assembly Site. This combination of site usage will work to accommodate the State of California's OSW energy goals, create jobs and economic benefits for the area, and provide for efficient terminal operations.

Section 2 describes the state goals and port facilities required to meet them.

Section 3 describes the proposed Permitted Operations and assumptions, for which construction will be phased. The phasing will depend on market demand, site control, and funding availability. The infrastructure construction phasing will be detailed in a memo under separate cover.

Section 4 describes the Future Operations. The Future Operations are possible future site uses that will not be included in the initial permits. These uses will include Tier 1 and/or Tier 2 manufacturing that increase efficiencies when co-located with an S&I site.

Section 5 discusses the offshore wind operations within the port that will likely require ballasting and considers the potential regulations that could be applicable to those operations.

Section 6 lists the assumptions considered in developing the proposed Permitted and Future Operations site layouts.

Section 7 lists the critical items to consider in the continuation of the planning, analysis, and design work.

Section 8 lists documents that are referenced in this memo.

The port infrastructure requirements for the OSW facilities listed in this memo are based on the requirements stated in the *AB 525 Port Readiness Plan* and on M&N industry knowledge.

2. OFFSHORE WIND DEVELOPMENT BACKGROUND

2.1. State and Federal Activities

On August 1, 2022, the California Energy Commission (CEC) established a planning goal of 2 to 5 gigawatts (GW) of OSW energy by 2030 and 25 GW by 2045. It is anticipated that turbines installed off California's coast will have a capacity of at least 15 megawatts (MW). Components for a 15 MW turbine are so large that the only feasible way to transport them from one location to another is by waterborne transit; road and rail transit would not be possible. Therefore, port infrastructure is an essential part of achieving the OSW energy goals.

In December 2022, the Bureau of Ocean Energy Management (BOEM) held an OSW energy lease sale for five areas on the Outer Continental Shelf off central and northern California. The two northern California lease areas shown in **Figure 1**, OCS-P 0561 and 0562, are approximately 25 nautical miles off the coast of Humboldt Bay. RWE Offshore Wind Holdings, LLC won lease area OCS-P 0561, this lease area can accommodate approximately 1.6 GW of OSW power. California North Floating LLC (a subsidiary of Copenhagen Infrastructure Partners [CIP]) won lease area OCS-P 0562, this lease area can accommodate approximately 2 GW of OSW power. With the executed leases in hand, these OSW developers are planning the development of the areas. It is assumed both projects will use the future RMMT for their construction and operations phase. Additionally, the Project may support OSW construction and operations in central California and Oregon.

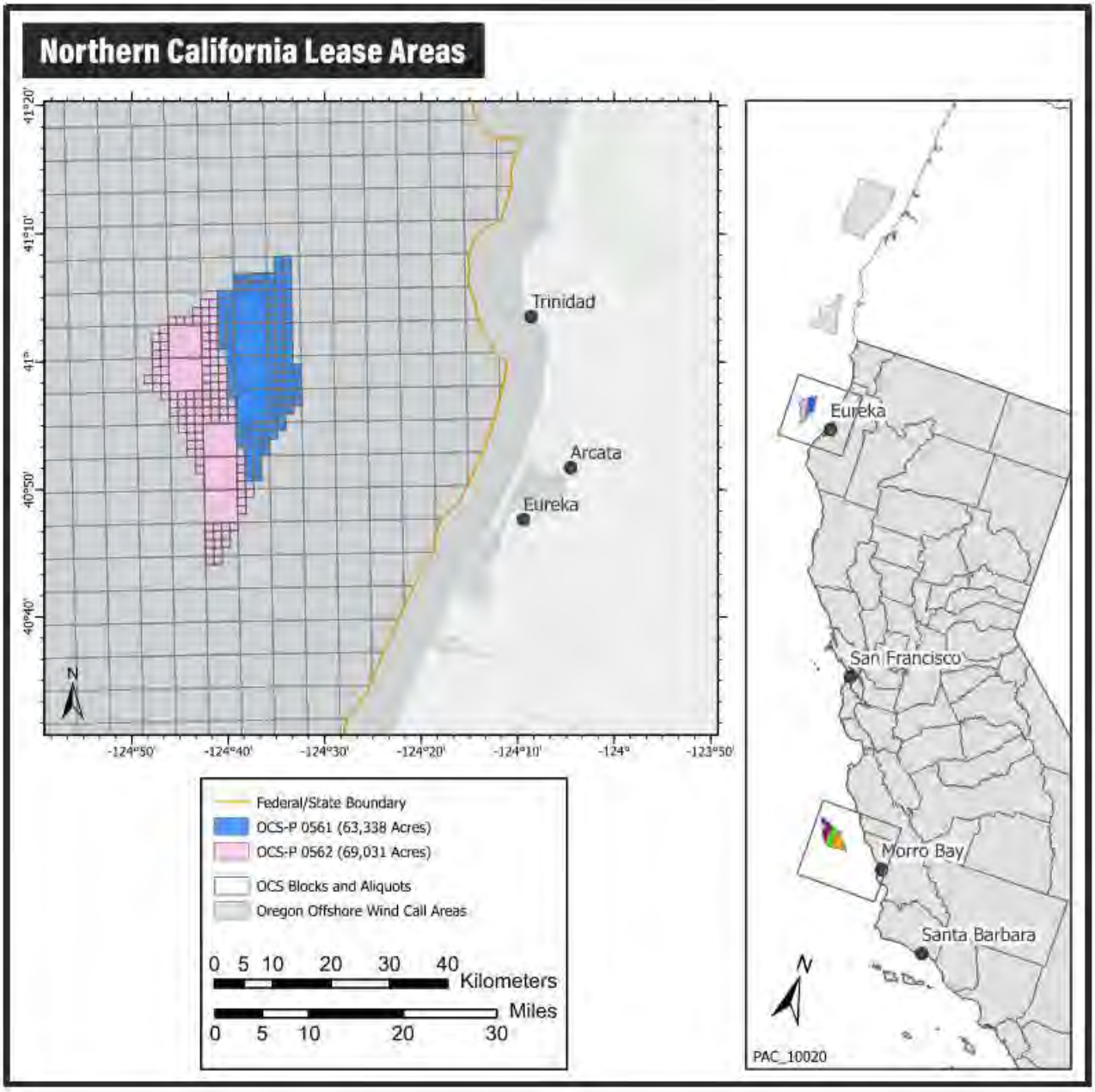


Figure 1 – Northern California lease areas

On October 7, 2023, California enacted Assembly Bill 1373. The legislation introduces a state level "central procurement" mechanism. Although the state does not have an exact timeline for procuring energy, this new law is intended to give OSW developers greater certainty regarding the timeline and procurement methodology. Once the developers have secured a power purchase agreement (or similar agreement) with the state, the projects will have a commercial operations date to initiate the delivery of OSW energy to the California power grid.

2.2. Timeline

To meet the planning goals of 2 to 5 GW of OSW energy by 2030 and 25 GW by 2045, the timeline for when OSW port sites become available for industry use is critical. The S&I sites are the most crucial as final turbine assembly occurs at these sites and there are only a few locations identified along the California

coast that can accommodate these activities. Additionally, all S&I site locations will require significant and costly upgrades before they can be utilized by the OSW industry. Based on the state goals timeline and typical timeframes for OSW energy procurement, port design and construction, it is essential that the process of preparing the northern California S&I port starts now and be completed by the late 2020s. This date will be refined as California developers start laying out project timelines.

If California intends to develop a domestic supply chain for OSW components, Foundation Assembly sites would also need to be available by late 2020s to mid-2030s.

2.3. Floating Offshore Wind Port Requirements

S&I and Foundation Assembly ports are essential to the construction of floating OSW farms but must meet the most rigorous port criteria. 20 MW wind turbine generator (WTG) components (i.e., blades, nacelles, and tower sections) were used for this analysis. Currently the U.S. marketplace is installing 11 to 15 MW turbines on fixed-bottom foundations. Floating wind installation is significantly more complex and expensive than fixed-bottom, so there is significant pressure to use the largest MW units possible. Units larger than 20 MW are proposed, however it is difficult to estimate the geometry and weights of these future units. There is some acknowledgement that the weight of the turbines cannot continue to grow linearly or exponentially as the nameplate capacity increases. There will be a practical limit to the size of the turbines and required foundations that can move in and out of OSW ports. The 20 MW unit is regarded as a reasonable capacity where the size and geometry can be estimated and accommodated at the ports. **Table 1** includes the general infrastructure criteria required for S&I and Foundation Assembly sites, as stated in the *AB 525 Port Readiness Plan*.

Table 1 – Floating OSW port infrastructure requirements

Floating OSW Turbine Criteria	Staging & Integration Sites	Floating Foundation Assembly Sites
Acreage	30 to 100 acres	30 to 100 acres
Minimum Wharf Length	1,500 ft	800 ft
Minimum Draft at Berth	38 ft	38 ft
Wharf Loading	6,000 psf	6,000 psf
Uplands Loading	2,000 to 3,000 psf	2,000 to 3,000 psf
Other Requirements	Air draft cannot be restricted	Minimum air draft: 100 ft

Further operations requirements, such as electrical demands, building sizes, etc., can be found in **Attachment A**.

Currently there are over 50 different types of proposed foundation technologies for the floating OSW market. In addition, each foundation type may prefer a specific type of buildout and launching methodology. The objective of the RMMT design is to provide uplands storage areas and wharf structures that can accommodate a large percentage of these technologies.

M&N has conducted industry outreach to gain a thorough understanding of the requirements for floating OSW foundations. Based on this effort, the RMMT design will provide level uplands with no internal obstructions and a straight wharf with a uniform berthing face. This design will allow for a wide variety of foundation MF/assembly and launching methodologies. It will also provide for the most functional terminal between wind projects as well as for future uses when OSW installation is complete.

2.4. Wet Storage

Wet storage is a key requirement at S&I and Foundation Assembly sites. The towing distance and transit time from the S&I site to the wind energy area (WEA) – or from an offsite Foundation Assembly site to the

S&I site – as well as weather risks could affect the project schedule. Wet storage allows production to continue until an adequate towing weather window is available.

Two types of wet storage may be required: assembled foundations and fully integrated turbine units. Assembled foundation wet storage is required so that foundations will always be available for integration independent of the Foundation Assembly site's output. If the Foundation Assembly site is located a significant distance from the S&I site, wet storage at the S&I site will also mitigate against poor ocean conditions. Fully integrated turbine wet storage is required to mitigate against slowdowns in the integration process and/or poor weather. Both the assembled foundations and fully integrated units can be towed to the S&I port and the installation site, respectively, when environmental conditions are below specified thresholds. If these conditions are above the threshold, the units can be towed to wet storage where it can wait for an acceptable weather window.

The number of foundations and integrated turbines required in wet storage is dependent upon the developer, their supply chain strategy, the required timeline to install the turbines offshore, and the size of the OSW project. The proximity of the Foundation Assembly site to the S&I port will increase efficiency and may reduce the area required for wet storage. For a description of the wet storage anchoring system options – fixed mooring structures vs. seabed anchoring – see the Wet Storage Capacity Analysis memo.

2.5. Sinking Basin

One of the major challenges the OSW industry has identified is the transfer of completed floating foundations from the Foundation Assembly wharf to the water. Each developer may prefer a different option; however, the most common approach is the use of a semi-submersible barge or semi-submersible heavy lift vessel and a sinking basin. Additionally, if assembled floating foundations are to be delivered to the terminal from a separate location in the U.S., Europe, or Asia via semi-submersible heavy lift vessel, a sinking basin would be required to float off the foundations.

Based on discussions with developers, operators, and OEMs, a semi-submersible barge – shown in **Figure 2** – will need a minimum water depth of approximately 60 ft, while a semi-submersible heavy lift vessel – shown in **Figure 3** – will need a minimum water depth of approximately 80 – 100 ft due to its deeper hull depth.

Figure 2 – Semi-submersible barge

Figure 3 – Semi-submersible heavy lift vessel

It is recommended to permit a minimum water depth of 60 ft for the sinking basin. Based on the assumed size of the foundations, the size of the sinking basin should be approximately 400 ft x 400 ft, minimum. It is not feasible to develop a deeper sinking basin in the project area.

It is important to note that the current terminal design has the sinking basin located *within* the North Wet Storage Area. If assembled foundations or fully integrated turbines are utilizing the North Wet Storage Area when a semi-submersible barge/vessel needs to utilize the sinking basin, this will impact operations as the semi-submersible barge/vessel will not be able to float off the foundation, thus slowing down production at the Foundation Assembly site.

2.6. Floating Offshore Wind Manufacturing

The tiers of manufacturing required to produce the many different floating OSW turbine components are defined as follows:

- **Tier 1 – Finished Components:** These are the major products such as blades, tower sections, assembled foundations, etc.
- **Tier 2 – Subassemblies:** These products have a specific function for a Tier 1 component such as the pitch system for blades or the struts and cans for foundations.
- **Tier 3 – Subcomponents:** These products are commonly available items that are combined into Tier 2 subassemblies such as motors, belts, and gears.
- **Tier 4 – Raw Materials:** These materials, such as steel, copper, concrete, etc., are directly processed into Tier 2 or Tier 3 components.

To prioritize the RMMT as a primary construction hub for floating OSW, it is assumed that Tier 1 and/or Tier 2 facilities could be installed at the terminal based on market demand. For manufacturing (MF) sites, the terminal will need to provide acreage to accommodate manufacturing factories, any storage/assembly racks, and transport of components using self-propelled modular trailers (SPMTs). The WTG components (i.e., blades, nacelles, and tower sections) would be produced on-site within the manufacturing building and can either be transported within the terminal to the laydown area for later integration or be loaded onto vessels/barges for transport to other port locations.

It is important to note that MF sites have the same port requirements as Foundation Assembly sites, however MF sites have no air draft restrictions.

For Permitted Operations, the RMMT will have one MF site – Floating Foundation Assembly (Tier 1 manufacturing) – as the focus of the OSW operations will initially be on S&I activities. Future Operations will likely convert one of the S&I sites into a second MF site, for a total of two MF sites (specific manufacturing activities to be determined in the future) and one S&I site on the terminal.

2.7. Benefits of Co-Location

When multiple floating OSW activities occur in the same location, efficiencies and synergies are created. For example, a delivery wharf can be shared between WTG deliveries and foundation subcomponent deliveries to maximize the use of the infrastructure investment without affecting operations. Additionally, when components or foundations do not require lengthy transit between facilities (reducing vulnerability to shipping delays and supply chain issues), supply chain risk is reduced, and costly project delays are less likely.

Co-location of MF and S&I facilities will also translate to lower production and transportation costs which will allow the manufacturer to offer a more competitive price to OSW developers. This, in turn, will lead to a more viable and robust domestic OSW supply chain.

3. PERMITTED PROJECT OPERATIONS

3.1. Overview

The full site at the RMMT is approximately 180 acres. The requirements listed in the *AB 525 Port Readiness Plan* state that an S&I site should be between 30 to 100 acres. Based on the size of the terminal and number of port sites required to meet the state goals, it is likely that two S&I sites will need to be constructed at the RMMT. This will allow for the simultaneous construction of two OSW projects out of the RMMT.

It is assumed that the two S&I sites in the RMMT will each have the following infrastructure: 60 acres of uplands space and one 1,200 to 1,600-ft heavy lift wharf for delivery vessels, turbine integration, and possibly an additional berth slot that could be utilized for integration or pre-commissioning activities.

In addition to the two S&I sites, a Foundation Assembly site is included in the remaining 60 acres. This will provide significant economic benefits and job creation as well as operational efficiencies at the RMMT. In addition to the 60 acres of uplands space, the Foundation Assembly site will have 400 ft of dedicated berth space for foundation launching, and access to a shared berth for delivery of subcomponents.

Both site types will likely require wet storage space. For a description of the wet storage anchoring system options – fixed mooring structures vs. seabed anchoring – see the Wet Storage Capacity Analysis memo.

The infrastructure shown in the Permitted Operations Site Layout – see **Attachment B** – is based on the assumption that one S&I site can install a 1-GW project in one year. It is assumed the Foundation Assembly site can provide foundations for one S&I site each year (completion of one foundation per week). The operations at each terminal are described below. A portion of the wharf length can be shared. This will maintain operational efficiencies while also reducing capital costs.

3.2. Staging & Integration Site #1 - Infrastructure

- 1,600-ft heavy lift wharf:
    - (1) 400-ft integration berth
    - (1) 400-ft pre-commissioning berth
    - (1) 800-ft delivery berth
    - (1) quayside crane
    - Load rating = 6,000 psf
- 60-acre uplands:
    - (1) 20,000 sqft office building
    - (1) 50,000 sqft storage / assembly building
    - (1) 90,000 sqft parking area
    - Laydown area for WTG components
    - Load rating = 3,000 psf

3.3. Staging & Integration Site #2 - Infrastructure

- 1,100-ft heavy lift wharf:
    - (1) 400-ft integration berth
    - (1) 700-ft delivery berth (shared with adjacent Foundation Assembly site)
    - (1) quayside crane
    - Load rating = 6,000 psf
- 60-acre uplands:
    - (1) 20,000 sqft office building
    - (1) 50,000 sqft storage / assembly building
    - (1) 90,000 sqft parking area
    - Laydown area for WTG components
    - Load rating = 3,000 psf

3.4. Staging & Integration – Operations

<u>Wet Storage</u>

- Wet storage is required for both assembled foundations and integrated turbines associated with S&I Site #1.
- For a description of the wet storage anchoring system options – fixed mooring structures vs. seabed anchoring – see the Wet Storage Capacity Analysis memo.
- Two potential wet storage areas have been identified: North Wet Storage and South Wet Storage.

- Due to proximity to the bridge, the northern area can be used for wet storage of assembled foundations only.
- The southern area will be used for wet storage of fully integrated turbines.
- Based on limited available space, it is assumed that a fixed mooring system will be utilized. This will limit the travel of foundations when at anchorage.

WTG Components

- Delivery at delivery berth (S&I Site #2 shares delivery berth with Foundation Assembly Site)
    - Assumptions include:
        - WTG components manufactured overseas (Europe or Asia) and delivered to terminal on a bulk cargo vessel such as the BoldWind (initial assumption prior to establishment of U.S. west coast domestic supply chain).
        - WTG components delivered from a U.S. MF site on a 400 ft x 100 ft barge (future assumption after domestic supply chain has been established).
        - Timing of domestic supply chain origination will be market driven. This timing may also be influenced by guidelines of California OSW solicitation. This solicitation could require the establishment of OSW MF sites in California.
        - There are currently no domestic west coast OSW MF sites. The 5 projects (including two Humboldt Lease Area projects) that were awarded in December 2022 will need to import all WTG components from overseas, until a domestic supply chain is established.
- Storage in uplands
    - Assumptions include:
        - Maximum number of sets of 20 MW components onsite at once is still to be determined
        - Blades will be stacked in sets of three
        - Towers can be stored horizontally or vertically
        - Nacelles require a power source for hub rotation and diagnostics

Foundations

- Multiple scenarios can be utilized:
    - Scenario 1: Foundations sourced from the onsite Foundation Assembly site and launched with semi-submersible barge. A sinking basin approximately 60 ft deep would be required. The foundations would be assembled in the uplands, moved across the quay onto a semi-submersible barge with SPMTs, then the barge is moved to the sinking basin using tugs and submerged, the foundation then floats off the barge and is towed to wet storage with tugs.
    - Scenario 2: Foundations are fabricated at a separate location in the U.S. and towed to Humboldt Bay using tugs. Foundations are then placed in wet storage.
        - OR: Foundations are fabricated in Europe or Asia and delivered to a separate location in the U.S. via a semi-submersible heavy lift vessel, floated off the heavy lift vessel, and then towed to Humboldt Bay by tugs and placed in wet storage. No sinking basin would be required at the RMMT.
    - Scenario 3: Foundations are fabricated in Europe or Asia or at a separate location in the U.S. and delivered to Humboldt Bay on a semi-submersible heavy lift vessel, floated off the heavy lift vessel, and then placed in wet storage using tugs. A sinking basin approximately 80 – 100 ft deep would be required.

- **The project will likely be built in phases with the northern most S&I site constructed first. The Foundation Assembly site will likely follow at a later date. This precludes use of Scenario 1 for the first projects completed at the RMMT. These first projects will likely use Scenario 2. This scenario was considered in the design criteria.**
- **Once the Foundation Assembly site is constructed it will likely supply one of the two S&I sites. For this reason, Scenario 1 was also considered in the design criteria.**
- It is not feasible to construct a sinking basin with the depth required for Scenario 3 in the project area, therefore this scenario was not considered.

Integration

- Foundations, from wet storage, will be brought to the integration berth by tugs.
- WTG components will be moved from uplands storage to the quayside pre-assembly area by SPMTs and integrated onto the foundation by a quayside crane.
- Once fully assembled, the integrated turbine will move to the pre-commissioning berth for pre-commissioning activities.
- After pre-commissioning is completed, depending on weather and towing conditions, the turbine will be towed directly to the offshore installation site (good weather window) or towed to integrated wet storage (impermissible weather window).

3.5. Floating Foundation Assembly Site – Infrastructure and Operations

Infrastructure

- 500-ft heavy lift wharf
  - (1) 500-ft load-out berth
  - (1) 700-ft delivery berth (shared with adjacent S&I Site #2)
  - Load rating = 6,000 psf
- 60-acre uplands:
  - (1) 20,000 sqft office building
  - (1) 50,000 sqft parking area
  - Laydown area for foundation subcomponents
  - (2) assembly lines – moving from the back of the site towards the wharf – for foundation assembly (exact method of assembly, quantity, and orientation of production lines will differ depending on foundation technology being utilized).
  - Load rating = 3,000 psf

Wet Storage

- Completed foundations will be moved to the northern wet storge area by tugs.

Foundation Subcomponents

- Delivery at 700-ft delivery berth (shared with adjacent S&I Site #2)
  - Assumption scenarios include:
    - Scenario 1 – Subcomponents sourced from Europe or Asia and delivered to Humboldt Bay on a bulk cargo vessel such as the BoldWind (initial assumption)
    - Scenario 2 – Subcomponents sourced from a MF site at a separate location in the U.S. and delivered to Humboldt Bay on a 400 ft x 100 ft barge (future assumption)
    - Scenario 3 – Subcomponents sourced from onsite MF site and transported to the Foundation Assembly site via SPMTs (future assumption)

  - **It is assumed the facility will be designed for Scenario 1, which requires the most onsite infrastructure** and is the most likely to occur for the first two OSW projects.

- Storage in uplands
  - Assumptions include:
    - Quantity of subcomponents, storage configuration, and storage location will differ depending on foundation technology being utilized.
    - Steel semi-submersible foundation type is shown in permit drawings. Concrete foundations are also a possibility. Tension leg platform foundations are also a possibility.

Foundation Load-Out

- Load-out at 500-ft load-out berth
  - Assumption options include:
    - Option 1 – Semi-Submersible Barge: SPMTs load the foundation onto a semi-submersible barge at the quay, the barge then moves to the sinking basin and ballasts down until the foundation is floated off, then the foundation is towed by tugs over to the integration berth or to foundation wet storage. A sinking basin approximately 60 ft deep would be required.
    - Option 2 – Direct Transfer with Crane: Quayside crane lifts assembled foundation from quayside into water. Tugs attach to the foundation in the water and tow it to integration berth or to foundation wet storage.
  - **For the Permitted Operations, Option 1 is assumed based on feedback from industry.** Due to the significant size and weight of the foundations, Option 2 is infeasible for the majority of foundation designs.

4. FUTURE PROJECT OPERATIONS

As the U.S. West Coast OSW industry matures, the domestic supply chain will begin to build out. The programmatic project options allow for the construction of Tier 1 and 2 manufacturing on the RMMT. This co-location of MF with S&I reduces both logistics complexities and costs for the industry. WTG components can be transferred directly across the terminal from the MF yard to the S&I storage area. The exact facility that may choose to come to the RMMT is unknown and will be market driven. Options include:

- Blade Manufacturing Facility
- Nacelle Subcomponent Manufacturing Facility
- Nacelle Assembly Facility
- Tower Manufacturing Facility
- Electrical Cable Manufacturing Facility
- Mooring Line and Anchor Manufacturing Facility

For a comparison of the different site activities, including quantity, type, and size of buildings, number of workers per 8-hour shift, delivery vessel rates, etc., see **Attachment A**.

5. TURBINE BALLASTING REGULATIONS

To level and stabilize WTGs both during offloading of the WTG floating foundations and during vertical integration, ballasting with supply water will be required. It is anticipated that bay water will be used for ballasting. This can be done by either flooding foundation compartments (by gravity) or by the use of pumps. Ballasting of floating dry docks and during loading of cargo vessels are common practice at vessel berths and marine facilities which come under vessel related regulations. Ballasting regulations need further investigation as it relates to the proposed project because the WTG foundations are a new type of floating structure and current regulations may not directly apply.

Ballasting regulations may be dependent on the origin of the foundations. Following are potential ballasting operations:

- WTG floating foundation manufactured in a U.S. Port such as the Port of San Diego or Port of Long Beach. These foundations may be directly towed to the project site or delivered with a semi-submersible vessel.
- WTG floating foundation manufactured overseas (for example in Asia). These foundations would be delivered with a semi-submersible vessel.
- WTG floating foundation assembled at RMMT.

Foundation ballasting may be required for the following circumstances.

- WTG Vertical Integration: flooding of compartments of floating foundation while tower sections, nacelle, and blades are installed.
- WTG Tow-Out Preparation: flooding of compartments of floating foundation as preparation for tow out.
- WTG Tow-In Operations: this would be for future maintenance of the WTGs which would require towing them back to port for heavy lift service or tow-in delivery from another port. There may need to be reversed ballasting operations depending on navigation requirements and what work is done on the WTG (such as nacelle vs. blades). This would be analogous to deep draft vessels coming to port.

Applicable regulations could vary depending on the operational activities, location, and origin of the vessel. This will require research from a specialty consultant (possibly a maritime lawyer), development of a ballasting strategy, and engagement with the appropriate Federal and State agencies.

6. ASSUMPTIONS

- The RMMT Foundation Assembly site can supply a single commercial scale project. Therefore, the foundations for one of the S&I sites will need to be towed from another foundation assembly/MF site on the U.S. west coast.
- No med-mooring (stern-in) berthing will be designed due to quay proximity to the federal channel.
- Each of the three sites will require independent storage/assembly buildings, office buildings, and parking. This allows for independent work areas with no employee crossover. This is typical at many OSW ports in Europe. This is also more conservative for the permitting phase.
- 20,000 sqft was used for the size of the office buildings based on similar office buildings at fixed marshalling ports in Europe. There are no S&I sites currently built to compare to. The footprint of the building could also be reduced, but still have the same amount of square footage, by adding additional stories.
    - It is recommended to keep the office and storage/assembly buildings separate, as combining them could lead to noise issues for the office tenants since there will likely be heavy equipment moving things in/out of the building.
- In the Permitted Operations Site Layout, **Attachment B**, the storage/assembly buildings are placed so that laydown space can be maximized and operations can be as efficient as possible. Sharp turns with the extremely large and heavy components on SPMTs from the delivery berth into the building should be avoided as much as possible.
    - Further modeling and analysis is required to determine the best layout arrangement for the components and storage/assembly buildings.
- Also in the Permitted Operations Site Layout, the solid black line between S&I Site #1 and S&I Site #2 is the official property line, while the dashed black line is the preferred site boundary as this

would allow for a more efficient component laydown configuration on both sites and would help prevent restrictions to the transportation corridor.

  - To move the property line to the preferred site boundary, an access easement or lease is needed.

7. NEXT PHASE CONSIDERATIONS

At the start of the next phase of work, the following are critical items to consider in the continuation of the planning, analysis, and design work.

- Other possible foundation load-out methods
- Mooring methodology for:
  - Foundation at integration berths
  - Semi-submersible barge at Foundation Assembly load-out berth
  - Delivery vessel at delivery berths
- Construction and operations noise levels (mitigation options, if necessary)
- Access easement or lease for preferred site boundary between S&I Site #1 and S&I Site #2

8. REFERENCES

- AB 525 Port Readiness Plan (Moffatt & Nichol) https://efiling.energy.ca.gov/GetDocument.aspx?tn=251089&DocumentContentId=86043
- Wet Storage Capacity Analysis Memo (Moffatt & Nichol)

ATTACHMENT A – SITE OPERATIONS DATA

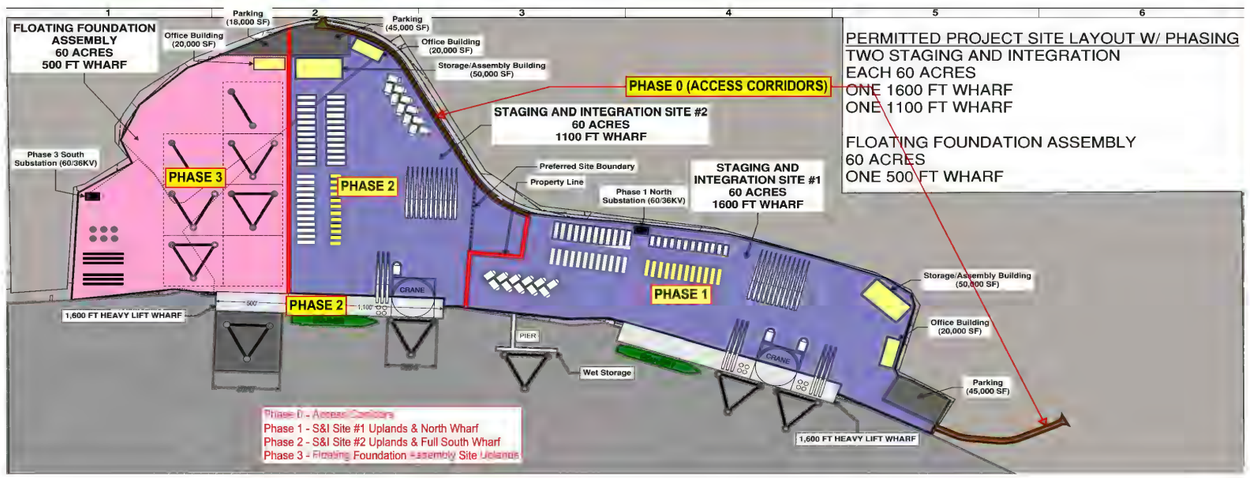
DRAFT

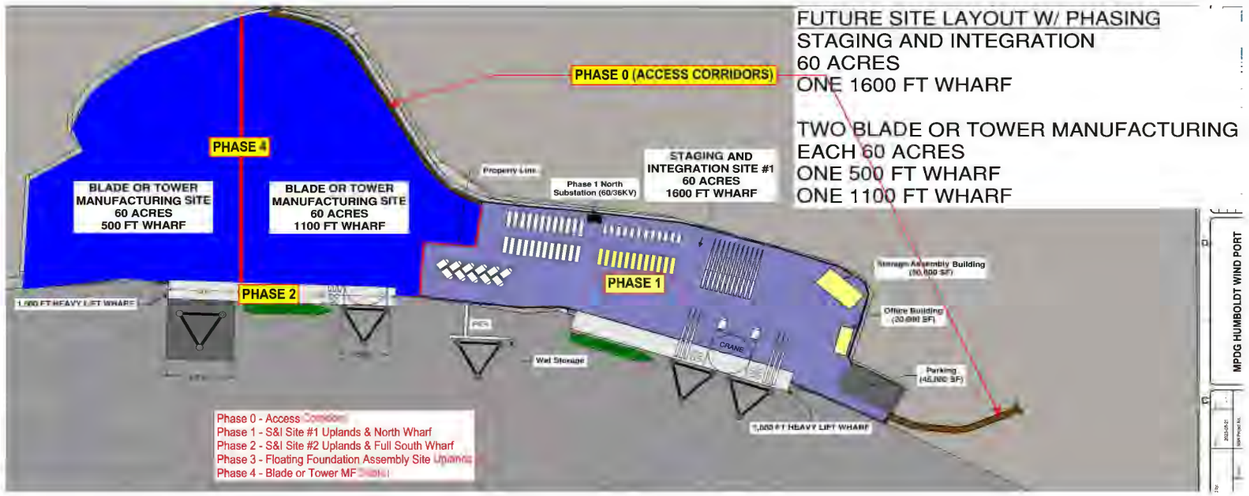
NOTE: Table values are preliminary and will be updated as more information is acquired during the design process.

				Sources: *M&N industry knowledge*		*M&N industry knowledge* *Crowley*	*M&N Electrical Team*	*Estimated based on M&N industry knowledge*		*Back-calculated from AB 525 Workforce Readiness Plan*	*M&N industry knowledge*	*Estimated based on # of workers per shift*	*Calculated based on M&N industry knowledge*		
	Development Phase	**Description**	**Number of Buildings**	**Size of Buildings**			**Total Electrical Demand**	**Estimated Domestic Water Demand** (25 gpd / worker)	**Estimated Sanitary Waste Water Demand** (20 gpd / worker)	**Estimated Number of Workers per Day**	**Shifts per Day**	**Estimated Parking Square Footage**	**Typical Delivery Vessel Frequency (trips per year)**	**Typical Install / Export Vessel Frequency (trips per year)**	**Notes**
				Dimensions		**Approx. Square Footage**									
PERMITTED	0 & 1	Access Corridor, North Wharf, and S&I Site #1 Uplands	(1) Office building	120' x 48' Height = 30'		20,000 sf	9,808 kVA*	6,875 gpd	5,500 gpd	275 workers	3	45,000 sf	95	50	Vessel Rate Assumptions: - A vessel call includes the vessel entering Humboldt Bay and then leaving Humboldt Bay. - Total vessel calls per year are shown. Seasonality may increase frequency during certain times of year. This is to be further studied. - Assumes second S&I site imports foundations via tug until Foundation Assembly site is up and running. - Assumes Programmatic manufacturing sites (Phase 4) produce components for two projects per year and one of those projects is exported to another S&I site.
			(1) Storage / Assembly Building	250' x 250' Height = 30'		50,000 sf									
	2	South Wharf and S&I Site #2 Uplands	(1) Office building	120' x 48' Height = 30'		20,000 sf	11,077 kVA**	6,875 gpd	5,500 gpd	275 workers	3	45,000 sf	50	50	
			(1) Storage / Assembly Building	250' x 250' Height = 30'		50,000 sf									
	3	Floating Foundation Assembly Site Uplands	(1) Office building	120' x 48' Height = 30'		20,000 sf	5,861 kVA**	2,500 gpd	2,000 gpd	100 workers	3	18,000 sf	50	0	
FUTURE	4 (REPLACE FOUNDATION ASSEMBLY SITE WITH MF SITE)	Blade Manufacturing Site Uplands	(1) Office building	120' x 48' Height = 30'		20,000 sf	25,224 kVA**	8,750 gpd	7,000 gpd	350 workers	3	54,000 sf	25	25	
			(1) Blade MF building	1000' x 1000' Height = 60'		500,000 sf									
		Tower Manufacturing Site Uplands	(1) Office building	120' x 48' Height = 30'		20,000 sf	25,629 kVA**	8,750 gpd	7,000 gpd	350 workers	3	54,000 sf	25	50	
			(1) Tower MF building	1600' x 400' Height = 50'		500,000 sf									

* 30% electrical demand contingency

** 50% electrical demand contingency





ATTACHMENT B – PERMITTED PROJECT SITE LAYOUT

PERMITTED PROJECT SITE LAYOUT

TWO STAGING AND INTEGRATION
EACH 60 ACRES
ONE 1600 FT WHARF
ONE 1100 FT WHARF

FLOATING FOUNDATION ASSEMBLY
60 ACRES
ONE 500 FT WHARF

N

FLOATING FOUNDATION ASSEMBLY
60 ACRES
500 FT WHARF

Parking (18,000 SF)
Parking (45,000 SF)
Office Building (20,000 SF)
Office Building (20,000 SF)
Storage/Assembly Building (50,000 SF)
STAGING AND INTEGRATION SITE #2
60 ACRES
1100 FT WHARF
Phase 3 South Substation (60/36KV)
Preferred Site Boundary
Property Line
Phase 1 North Substation (60/36KV)
STAGING AND INTEGRATION SITE #1
60 ACRES
1600 FT WHARF
Storage/Assembly Building (50,000 SF)
Office Building (20,000 SF)
Parking (45,000 SF)
1,600 FT HEAVY LIFT WHARF
CRANE
500'
1,100'
DELIVERY
PIER
350'-0"
470'-0"
Wet Storage
DELIVERY
CRANE
1,600 FT HEAVY LIFT WHARF

Fully Integrated WTG
Wet Storage

Sinking Basin
(Depth: 60 ft)

Floating Foundation
Wet Storage

300' 0' 300' 600'
SCALE: 1"=300'

FOR CONCEPTUAL DESIGN
ISSUED: 2023-12-17
NOT TO BE USED FOR CONSTRUCTION

DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING

HUMBOLDT BAY HARBOR RECREATION & CONSERVATION DISTRICT

Mark	Description	Date	Appr

REDWOOD MULTIPURPOSE MARINE TERMINAL REPLACEMENT PROJECT

WATER SITE PLAN

Designed by: DSGN	Drawn by: DRFT	Checked by: CHKR	Reviewed by: REVR
Date: DATE	M&N Project No.: 212991-03	Drawing scale:	Drawing Scale: Plot scale: 1:1 (D SHEET)
Rev: REVNO			

Submitted by: SUBMITTER'S NAME
MOFFATT & NICHOL

1300 CLAY STREET, SUITE 350
OAKLAND, CA 94612
moffatt & nichol

INSERT SUB-CONSULTANT OR CLIENT LOGO AND INFO HERE

DRAFT

SEAL

Sheet Reference No.
CW100
INDEX: 22 OF 2

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