

ATTACHMENT M7

ALTERNATIVES ANALYSIS

Alternatives Analysis

This alternatives analysis was performed to identify the least environmentally damaging practicable alternative (LEDPA) to meeting the Project Purpose and Need: The upgrade of an existing port facility on the New England coast of the United States to serve as a long-term regional wind turbine generator (WTG) port facility, while providing continued and enhanced support of other existing long-term operations and cargoes. This collateral objective of upgrading the State Pier for long-term efficient operations for a range of cargoes recognizes that the current conditions of the port are inadequate to sustain such uses into the future.

Offshore wind turbine components are exceptionally large and heavy. For comparison, general cargo items, such as steel coils and slabs, typically weigh in the range of five (5) to twenty-five (25) tons each and a standard 40-foot shipping container can weigh 30-40 tons. Accordingly, container ports typically have a standard uniform wharf capacity of approximately 1,000 pounds per square foot (psf). However, an offshore wind nacelle (i.e. the center hub where the tower and blades are connected) weighs up to 1,000 tons per unit and each of the 100' long tower sections can weigh nearly 350-tons per section (there are three of these sections per assembled WTG turbine unit). Multiple WTG components will be received, transported, and handled at a supporting facility at any given time. To accommodate these unique loads, a WTG support facility requires a heavy lift wharf capacity upwards of 5,000 PSF, or some five times that of the standard general / container cargo facility, as well as appropriately rated laydown areas.

As noted above, the unique size and weight of the WTG components require specialized handling, which includes purpose built vessels for transport, large upland areas to store and assemble the components and specialized wharf and berth characteristics that enable the WTG vessels to deliver and construct the turbines at offshore locations. A WTG port facility requires the following criteria:

- Transit distance from the port facility to the installation site should be no more than 40 to 100 nautical miles to enable cost-effective use of a variety of transport vessels;
- Direct access to deep water and navigation channels (>30') sufficient to accommodate a vessel with an overall length of 500', with a beam in excess of 150';
- Berthing depths of 30 - 40' or greater;
- Heavy loading criteria – WTG ports require a live load rating ranging between 2,000 and 5,000 psf;
- Minimum of 1,400 linear feet (LF) of berthing space to allow for simultaneous berthing of import/delivery and installation/construction vessels, with direct access to uplands;
- As close to 30 acres of adjacent, usable upland area as possible for assembly and storage of wind turbine components; and,
- Air draft clearances in excess of 300' from the WTG port to the open ocean.

In addition, certain design parameters are required to accommodate anticipated near-term and future facility uses of the State Pier facility. Specifically, the adjacent, improved upland area needs to be flexible in order to accommodate:

- The continued handling and storage of compatible general cargoes;
- Various WTG components to be handled onsite, also accounting for the anticipated future increases in wind turbine size and weight. These turbines are currently designed at 12 megawatts (MW) per unit, with forecasts for increases of 15 to 18 MW per unit;

- The planned sequential use of the facility by Gateway and various WTG operators, which will stage components in different manners due to alternative upland equipment each operator will select;
- The anticipated sourcing of WTG subcomponents and other general cargo domestically, thereby requiring rail service within close proximity of the heavy lift wharf capacity.

Regional Opportunities for Wind Turbine Generator Offshore Wind Port Facility

Using the identified criteria, extensive research was conducted to locate existing ports that could be used to support WTG activities off the coast of New England. Prospective ports were analyzed in order to establish candidate locations. This research confirmed that there are currently no existing port facilities that would meet the required criteria.

In some instances, identified candidate port facilities could be modified to satisfy some of the criteria. For example, measures such as dredging for a deeper draft or upgrading waterfront structures for heavier loads could be implemented. However, the physical location of the facility itself and its available footprint, including berthing space and adjacent upland area were often insufficient and proved to be limiting factors.

In addition to the State Pier New London Facility, there are several regional (Connecticut, Massachusetts, Rhode Island) facilities that could be considered for their potential to serve as a regional WTG offshore wind port. These facilities include the Port of Davisville, RI, the Port of Providence, RI and the Marine Commerce Terminal in New Bedford, MA. In addition, the Connecticut deepwater ports of New Haven and Bridgeport were also considered and are discussed below. Each of these terminals meet some of the serviceability criteria but none possess all the required criteria.

Port of Davisville, Rhode Island Alternative

The Port of Davisville (Quonset Point) has adequate uplands, access to deep water and sufficient berthing space. However, it is located upriver of the Jamestown and Pell Newport Bridges, which have air draft restrictions of 135' and 194' respectively. This air draft restriction will not allow a jack-up installation vessel to pass below with spuds (legs) in the elevated position and turbine towers stacked vertically on the deck. Both the vessel jack-up legs and the turbine towers require air draft clearances in excess of 300'.

Port of Providence, Rhode Island Alternative

The southernmost berth at the Port of Providence offers a deep enough draft and could potentially satisfy the berth length criteria. However, the total combined available upland area does not meet the 30-acre requirement. In addition, the available berthing space does not meet the required length criterion without further modifications. This port is also behind (located north/upstream of) the two bridges noted for the Port of Davisville, and thus also has the air draft constraint. Additionally, this facility is located approximately 26 nautical miles upriver from open water, which would add significant travel time and reduce the efficiency of the transport of turbine components from the port to the installation site.

Marine Commerce Facility, New Bedford, Massachusetts Alternative

The Marine Commerce Facility in New Bedford, MA is comprised of approximately 22 acres of usable upland area which is less than the required open upland space criteria. The available berthing space at this site is approximately 1,000 LF, which is 400 feet less than the required length for simultaneous berthing of a delivery and installation vessel. A designed dredge depth of -30' cannot be supported across the entire berth length, as there is a significant rock ledge at the mudline in the berth footprint. Dredging and rock removal would therefore come with significant costs and could potentially undermine the current bulkhead structure. While this location is not located behind/upriver from any bridges, it is located inshore of the USACE New Bedford Hurricane Protection Barrier. This structure has a horizontal clearance of just 150'. This width would prove to be extremely restrictive and would pose a navigational safety hazard for WTG installation vessels. The beam of anticipated installation vessels in a loaded condition is greater than 150'.

Connecticut Deepwater Port Facilities

Connecticut is home to three deep water ports that could be considered for the location of a WTG offshore wind port facility. These port locations are New Haven, Bridgeport and New London. CPA owns the State Pier facility in New London Harbor but does not own or control property in New Haven or Bridgeport Harbors.

New Haven Harbor Alternative

New Haven Harbor is primarily a liquid and dry bulk port which consists of seven privately owned and operated terminals. CPA is not currently a terminal owner or operator at New Haven Harbor, which further constrains the ability to meet the stated objectives. Additionally, the available uplands are insufficient in size to accommodate the onshore storage and assembly needs associated with a wind energy facility. Although the New Haven Harbor channel draft and approach conditions are suitable to accommodate the anticipated vessels, the existing piers are not heavy-lift capable and would need upgrading. As compared to New London Harbor, New Haven Harbor is located approximately 42 nautical miles further west from the open waters of the Atlantic Ocean, where wind projects will be located. This would add significant travel time and reduce the efficiency of the transport of turbine components from the port to the installation site and also would result in additional vessel emissions per installation site trip. Collectively, these circumstances preclude New Haven Harbor from serving as a viable WTG offshore wind port.

Bridgeport Harbor Alternative

Similar to New Haven, the Bridgeport, CT facility is privately owned. Although potentially available upland area exceeds 30 acres, the available berthing at this location is limited, with only approximately 1,000 LF of vessel berth. The bulkhead at this location is also in need of repair. The Bridgeport terminal is located down river from any bridges and has direct access to open water of Long Island Sound. However, this terminal does not meet the minimum requirements of a minimum of 1,400 LF of berthing for inbound delivery and installation vessels. In addition, the channel leading to this terminal has not been maintained since 1964. It is considered fully silted-in and would require significant dredging and disposal of dredge material to meet the minimum depth of 30 feet. The dredge material at this location are anticipated to be contaminated and the quantity could be up to hundreds of thousands of cubic yards. As compared to New London Harbor, Bridgeport is located approximately 56 nautical miles further west from the open waters of the Atlantic Ocean, where wind projects will be located. Again, this would add significant travel time and reduce the efficiency of the

transport of turbine components from the port to the installation site, and would also result in additional vessel emissions per installation site trip. For this reason, combined with the lack of required berthing length, as well as the significant siltation of the navigation channels, Bridgeport is not considered a viable. WTG wind port from the standpoint of the least environmentally damaging practicable alternative.

New London Harbor: State Pier Facility (Selected Location)

Due to the above considerations, the State Pier Facility in New London emerged as the only viable facility to meet the CPA's Project goals. It is uniquely located with no air draft restrictions, has direct access to a federally maintained deep water channel, and also has the demonstrated capacity (via existing agreements) for over 35 acres of useable upland space with the proposed Project fill and adjacent parcel acquisition (railroad property lease). This is the sole facility in the region that can possess each of the essential characteristics. While upgrades to the existing uplands and marine infrastructure are required, as well as procurement of adjacent parcels, this facility's existing size, location and direct unimpeded access to open water, as well as proximity to multiple Bureau of Ocean Energy Management (BOEM) offshore wind sites make it an ideal candidate to serve as a long-term WTG port for the region.

While the State Pier Facility currently provides capabilities for importing, processing and distributing breakbulk cargo as discussed in the JPA's Purpose and Need section (DEEP Attachment III.3), upgrades to the facility are needed in order to accommodate the needs of a WTG port facility. Specifically, dredging in some locations to ensure adequate depths for the anticipated installation and transport vessels is required, approximately 7.4 acres of fill will need to be placed between the existing Admiral Shear State Pier and the CVRR Pier, and the facility will need to provide enhanced heavy lift capabilities for the anticipated offshore wind tenant, as well as future tenants and users. The proposed area of filling between the piers has been demonstrated to consist of low quality, disturbed aquatic habitat, and mitigation opportunities have been identified to offset these impacts.

These improvements will enable the facility's use to support offshore wind development by providing the needed draft for the transport and delivery vessels, providing the essential heavy lift capacity and the additional workspace for import, staging and pre-assembly of the wind turbine components. As noted herein, the upgrades will result in a facility enhancement for handling of various cargoes. The current conditions of the State Pier Facility are not adequate to sustain diverse cargo operations into the future. The condition of the piers immediately adjacent to the Long Dock Branch Channel (i.e. west face of the Admiral Shear State Pier and the east face of the CVRR Pier) are such that this area has not had the capacity to service arriving cargo vessel operations, beyond barge traffic, for some time. Draft depths and pier conditions within this channel are unsuitable for efficient operations, and will become obsolete in the future, given current trends in port operations and anticipated needs. At the current time, the State Pier Facility only has one fully functional berth (the east side of Admiral Shear pier), whereas under proposed conditions the improvements will result in a multi-berth facility equipped with heavy-lift capacity and sufficient dredge depths. Accordingly, the current conditions of the State Pier Facility, without filling the central wharf area, will not address the primary purpose and need (regional WTG support) with the collateral objective of upgrading the facility for long-term diverse cargo operations.

State Pier Facility – Construction Design Alternatives

As part of the alternatives analysis process, a variety of site configurations were considered for the State Pier Facility layout. These alternate onsite arrangements are outlined below. Ultimately the *Selected Alternative* best meets the Project needs and objectives and reduces the potential for navigational interference with adjacent stakeholders while minimizing environmental impacts.

State Pier Facility - No Action Alternative

The State Pier Facility Master Plan, developed in 2011, called for a number of improvements to the facility in order to accommodate future growth in the marine shipping market and to address the shortcomings of the existing State Pier Complex. The 2011 Master Plan recommended improvements including:

- Improved vehicular access and circulation;
- Restored and enhanced rail connectivity;
- Dredging and dredged material disposal;
- Enhanced vessel accommodations;
- Upland grading and surface improvements;
- Structural improvements to piers, bulkheads, and quay walls; and,
- Stormwater controls and treatment measures.

In 2018, CPA released a document entitled “Connecticut Maritime Strategy”. The document outlines CPA’s current strategic objectives, which includes capitalizing on Connecticut’s geographic location between New York and Boston by expanding and marketing the State Pier Facility’s capacity for break-bulk and other goods to attract more commercial traffic whether through imports, exports or domestic movements of goods.

CPA’s principal source of revenue is generated from its lease with the State Pier Facility’s operator. Accordingly, payments to CPA are calculated by combining monthly lease payments, as well as a percentage of the lessee’s assessable revenue. Therefore, it is in the best interests of CPA, as well as that of the overall Connecticut maritime commerce industry, to ensure that the State Pier Facility is designed to allow it to provide additional capability for existing uses, such as the handling of traditional break-bulk cargoes, while also accommodating new opportunities, such as the emerging offshore wind industry in the northeast United States.

The redesign and substantial upgrading of the State Pier Facility will allow for the accommodation of a wider range of cargo opportunities and is consistent with CPA’s updated 2018 strategies. Through this Project, it is the goal of CPA to create infrastructure in Connecticut that can support the long-term requirements of a regional WTG port facility as well as provide enhanced capabilities for current breakbulk cargo operations. As described above, the current conditions of the State Pier are inadequate to sustain such long-term diverse cargo operations.

If the proposed upgrades are not implemented, the State Pier Facility will not meet the required

criteria to serve as a WTG port facility for the following reasons:

Limited Berthing Space – Currently only the east side of the State Pier is available for vessel berthing. The northeast bulkhead requires significant dredging to accommodate the deeper drafts of the anticipated WTG transport and installation vessels. The central wharf area has both insufficient drafts and inadequate structural capacity for efficient berthing.

Limited Live Load Capacity – The CVRR Pier is currently rated in poor condition and cannot meet the required loading levels. The Admiral Shear State Pier is rated in satisfactory condition. However, the Admiral Shear State Pier's load rating is 1,000 psf, which is well short of the required WTG loading levels. Neither existing pier currently has heavy-lift capabilities required for a WTG support facility.

Uplands – Approximately 30 acres of open, level land is required in support of WTG operations. More specifically, in terms of the need to have substantial open, level land in close proximity to the berthing spaces, the size of the WTG components (e.g., 265-foot long blades) warrants such conditions adjacent to the installation vessel berth, and this can only be achieved by filling the central wharf area. Filling of this area is also critical to achieving successful efficient long-term cargo operations at the State Pier. Currently, approximately 25% of the footprint of the site is composed of a hillside of sandy soils. This hillside is located approximately 20 feet higher than the adjacent site grades. The current topography would interfere with the movement and storage of large wind turbine components. Additionally, the location of various existing buildings, electrical infrastructure, and high mast lights would likewise interfere with the movement and storage of large components. Additional level upland acreage is required for the staging and preassembly of the large components. The current two pier configuration does not provide adequate waterfront working space. As outlined above, the *State Pier Facility - No Action Alternative* does not meet the Project goals. Therefore, this alternative is not viable and will not be pursued.

State Pier Facility – Alternate Onsite Uplands Configuration

In order to gain the required upland work area requirements for this Facility, CPA has entered into a lease agreement with the adjacent railroad owner, as noted in Attachment B. In addition to CPA-owned and controlled parcels, this lease agreement will provide an approximately 5 additional acres of useable uplands to the Project.

Initial investigations indicate that the acquisition of other adjacent upland parcels, either through purchase or tenancy lease agreements, would not be of practical benefit to the Project. Potential expansion to the west is limited by the existing regional rail tracks. Project activities west of these tracks would be incompatible with WTG self-propelled modular transporter (SPMT) movements which are explained in more detail below and would require significant track crossing upgrades. In addition, the remaining upland space in this immediate vicinity (west of the tracks and south of the Amtrak rail) is already occupied by an existing active office and warehouse space (Carwild / Medsorb Corporation).

Potential Facility expansion further to the north would be limited by the size of the underpasses beneath the existing State Pier Road and the Amtrak railroad tracks. Specifically, the width of these existing bridge abutments would likely prohibit the movements of large WTG components such as blades, precluding the areas north of the tracks from WTG storage uses.

To the extent practicable, the existing Facility layout is maximizing the use of existing and proposed

adjacent upland areas in support of the Project; however, the approximately 7.4 acres of proposed Central Wharf area fill remains required in order to meet Project WTG port support facility needs. As described above, the strategic location of the filled central wharf area adjacent to the east berth (as well as the south berth) is critical for the WTG operations and also for the long-term success of the State Pier at servicing diverse cargo operations. The infrastructure improvements planned for the Facility will enhance its capabilities for conventional cargos as well as meeting the requirements to serve as a regional WTG port.

State Pier Facility - Pile Supported Platform Alternative

The State Pier Facility's *Central Wharf Southern Loadout Alignment* and *East Berth Loadout Alignment (Selected Alternative)* are described in more detail below. These alternatives, which propose different installation vessel berthing locations, were advanced as the proposed Project footprint in the May 2019 JPA and in the enclosed Revised JPA, respectively.

In addition to these vessel berthing alternatives, installation of a *Pile Supported Platform Alternative* - in lieu of placing fill between the two piers - was examined as an alternative way to provide the Project's Central Wharf area. This platform would consist of driven steel pipe piles, concrete pile caps and a concrete deck. This alternative was ruled out due to the excessive cost, constraints to future facility flexibility, lack of significant environmental benefit and extended construction time frame required.

Assumptions

A live load requirement of 4,000 psf was used for the analysis. An additional 300 psf of dead load was also added to account for the concrete deck. The piles were placed in a 10' x 12' pile grid. This loading and pile configuration places a load demand of approximately 258 tons (516 tons ultimate driven capacity) on each pile and requires approximately 2,361 piles.

The site substrate between the two piers is underlain by a relatively shallow rock ledge. The depth of this ledge below the mudline ranges from approximately 33' at the northern (inshore) end to 65' at the southern (out shore) end. Due to the high load demand on each pile it was assumed that the piles would be driven to the underlying rock ledge. It was also assumed that the inshore half of the piles (1,181 piles) would require rock socketing into the bedrock layer. These rock sockets would likely be required to laterally support the pile tip due to the lack of soil overburden.

Facility Design and Flexibility

The new Central Wharf area proposed at the State Pier Facility is being designed to handle offshore wind components and other bulk or oversized cargo that will require a uniform live load rating of 3,000 psf and 5,000 psf for the heavy lift areas. The first use of the retrofitted State Pier Facility and Central Wharf improvements will be as a marshalling port for WTG components, which will be used in offshore wind (OSW) projects. This intended usage requires an upland area that can accommodate a variety of WTG component staging configuration. The staging and transit routes/corridors of WTG components throughout the facility, and specifically in the new Central Wharf area, will vary significantly within OSW campaigns (i.e. from one installation project to the next) and during non-OSW operations and therefore facility flexibility is key to the success of the design.

The significant upgrades of the terminal will also allow for future uses such as container, bulk and oversized cargo handling. The programming for these cargo types will be determined between OSW

projects and/or after OSW use of the terminal is complete. The facility design needs to account for maximum flexibility to accommodate for these future programs and operation of the port. The placement of confined fill between the piers (i.e. the options described below) allows for maximum flexibility with regards to the placement of the currently known and future OSW loading areas as well as for other types of cargo.

In addition, the retained fill will allow for rail track installation on the new Central Wharf at a future date. CPA and Gateway Terminals are currently assessing options for near-term reconfigurations of onsite rail service, with a focus on the Central Wharf area. The final rail alignment and number of rail spurs and configuration has not yet been determined, and therefore there is a need for flexibility in design for the future rail alignment to be responsive to the cargo requirement. A pile-supported deck does not provide the necessary flexibility for rail track placement that will be generated from the solid compacted earth fill.

CPA understands that the Electric Boat (EB) project, which is currently in progress across the river, while similar, does have significant differences from the State Pier Project. Though not confirmed, the EB facility may require similar load ratings as the State Pier; however, the operational program at EB is a well-defined, assembly-line type function, therefore defined component loadings can be supported on a specific foundation type and alignment. That is, the location of the drilled shafts supporting the deck at this site could be customized to handle very heavy and concentrated component loadings such as gantry crane legs and rail transfers of submarine modules to and from a floating asset. The known operational parameters, layout of equipment, product movement and assembly-line type of operation have a specific defined purpose and sole user program at the EB facility. As such, the design allowed for the optimization of a pile-supported structure.

In contrast, and as noted above, the State Pier Facility's operational program requires maximum flexibility in order to handle a variety of different cargo types, the associated cargo transit paths (i.e. transportation corridors are purposefully left undefined at this time) and to accommodate multiple end-users both now and in the future. Construction of the Central Wharf Area using solid fill, rather than a pile-supported deck provides this operational flexibility. As such, fill placement between the piers was determined to be the most favorable option from an operational perspective.

Environmental Concerns

As noted in the *State Pier Facility – No Action* and the *State Pier Facility – Alternate Onsite Uplands Configuration* alternatives described above, insufficient space is available under the current facility configuration to adequately support the proposed project purpose. Approximately 30 acres of open area, with sufficient loading capacity and direct connection to the heavy lift platforms, are required in support of WTG support facilities, thus necessitating the expansion of the Central Wharf area. As described herein, the project examined creating this Central Wharf area by both earth fill and pile-supported structure.

If the Central Wharf area were to be constructed utilizing a pile structure, an extensive network of driven and rock-socketed piles would be required. Specifically, over 2,361 piles would be needed within the Central Wharf expansion area located between the Admiral Shear State Pier and the CVRR Pier. This amount of material installed in the Central Wharf area – with piles approximately 10 feet on center – would act similarly to a solid fill option from an aquatic habitat perspective. While some existing (low quality, previously disturbed) substrates would be left unaltered, the decking required for a pile supported option would provide substantial shading to the remaining habitat within this 7.4 acre expanded Central Wharf area. Limited habitat value would be maintained by retaining

this substrate and some additional available habitat would be provided on the new piles; however, it is anticipated that these would be significantly offset by shading over the full Central Wharf area.

Cost, Schedule and Constructability

A preliminary cost estimate and schedule for this alternative was also undertaken. Installation rates of 3 driven piles per day were used for the outshore (non-rock socketed) piles and 3 driving rigs was assumed. For the inshore piles, an installation rate of 1.5 rock socketed piles per day was used and 3 drilling rigs was assumed. Table 1 below shows the approximate schedule and cost of this alternative.

Table 1. Pile-supported Platform Alternative Approximate Schedule and Cost.

Item	Unit Cost	Unit	Quantity	Total Cost	Installation rate (piles per day)	Required time to install (weeks)
Driven pile	\$21,000	ea.	1,181	\$24,794,000	9	26.2
Rock Socketed pile	\$29,000	ea.	1,181	\$34,240,000	4.5	52.5

The total cost to provide the pile foundation for the pile supported platform alternative was calculated to be approximately \$60,000,000. This cost does not include the installation of any required pile caps and a concrete deck or onsite pier rehabilitation work. These elements will be required to provide the working surface between the CVRR and State Piers. The time to drive and rock socket the piles was estimated to be approximately 79 weeks.

A cost estimate and Project schedule was also created for the selected alternative where fill is placed between the two piers. The cost to install and compact the fill between the two piers, install a steel sheet pile bulkhead as southern closure (between the CVRR and State Piers) and rehabilitate the CVRR pier to provide lateral support to the installed fill in the selected alternative was calculated (during initial alternatives costing analyses) to be approximately \$30,000,000. The required time frame to complete these activities was estimated to be approximately 50 weeks. The required schedule to complete the fill option was estimated to provide time savings of approximately 29 weeks (+/-37%).

The cost for the pile supported option, even without the concrete pile caps and deck was calculated to be approximately twice the cost of placing fill between the two piers and securing with a steel sheet pile bulkhead. It should be noted that the estimated \$30,000,000 price for the fill option offers a complete solution to achieve a heavy load capable work area between the two piers. The estimated \$60,000,000 for the pile supported platform option only includes the foundation elements. This platform option would incur significant additional costs for the beam and deck elements, as well as pier rehabilitation work. The magnitude of this cost differential is sufficient to render the pile supported option infeasible, and it would convey only very minimal environmental advantage, given the extensive shading of habitat associated with a pile supported deck and extensive network of support structures required in a pile-supported option.

As the Central Wharf area is proposed under both the *State Pier Facility - Central Wharf Southern Loadout Alignment (Initial JPA Footprint)* and the *State Pier Facility – East Berth Loadout Alignment (Selected Alternative)*, the additional costs associated with this pile supported option (rather than fill construction) would increase the construction costs associated with any of the berthing layout options discussed below.

Additionally, from a practical construction standpoint, it should be noted that the proposed work at the General Dynamics EB facility across the Thames River involves the installation of hundreds of in-water drilled shafts to support the new South Yard Assembly Building. The equipment required for the installation of these drilled shafts is the same equipment required to rock socket the piles of the pile supported platform option at the State Pier site. The construction timeframe of these two projects may overlap and there was concern that the pile supported platform option could be significantly resource restrained.

As a final constructability consideration, the pile supported option would preclude the possibility of utilizing both the on-site upland hill soils and the dredge sediment from the State Pier Facility dredging as fill material. As a result, materials dredged under a pile-supported option would need to be disposed of at an offsite upland facility at a higher project cost and without the beneficial reuse for fill materials, as provided by the proposed project design.

Pile Supported Summary

For the reasons outlined above, the creation of the Central Wharf area through pile-supported means, rather than placement of earth fill, was determined to not meet the criteria for a “least environmentally damaging practicable alternative”. Consequently, the concept was eliminated from future consideration. As noted, higher costs are anticipated for a pile supported deck, a solution which does not provide the required operational flexibility and offers only minimal environmental benefit.

State Pier Facility – Location of Vessel Berth Alternatives

In order to provide for efficient terminal operations for both the WTG and more conventional port operations, two distinct vessel berths (import and loadout berths) are required. The facility’s import berth is used to receive the WTG components (towers, turbines and blades) from the manufacturer. The import vessel is moored at this berth and the WTG components are offloaded via shipboard cranes and/or land-based cranes. The components are then moved into the upland yard/laydown area via self-propelled modular transporter (SPMT) where they are stored. The loadout berth is used for component preassembly (tower up-righting and assembly) and for the loadout of these WTG components onto the installation vessel.

As further detailed below, the Project was initially proposed utilizing an installation and delivery vessel layout described in the *Central Wharf Southern Loadout Alignment (Initial JPA Footprint)* section. Based on abutters' and stakeholders' comments and concerns voiced during the ongoing design process, it became apparent that the proposed location for the loadout (installation) vessel was problematic under the initially advanced Project design. Therefore, alternate facility designs have been considered to address these navigational concerns. As described below, the Project has been redesigned and a revised berthing footprint, the *Admiral Shear East Berth Loadout Alignment Alternative (Selected Alternative)*, is currently being advanced.

State Pier Facility - Central Wharf Southern Loadout Alignment (Initial JPA Footprint)

The *Central Wharf Southern Loadout Alignment* was described in detail as the proposed SPII configuration, as outlined in the Project's initial May 2019 Joint Permit Application. The original configuration of the terminal had the import vessel berth located at the Northeast Bulkhead and the loadout berth (installation vessel berth) located at the Central Wharf Southern Bulkhead. This site layout was selected following significant study conducted by the state of CT Port Authority and offshore wind developers. This study included (but was not limited to) vessel maneuvering and berthing requirements, movement of bulk components through the terminal, dredge spoils disposal locations, existing loading capacities vs proposed loading requirements and cost and schedule to complete the required terminal upgrades.

The key criteria in the vessel berthing analysis of the terminal was the development of a flexible facility that would allow for the handling of a variety of cargos while maintaining and enhancing the existing capabilities. The design using the NE Bulkhead for the import vessel and the Central Wharf Southern Berth for the loadout vessel satisfied both short- to midterm-needs of the offshore wind industry, as well as the long-term needs of the state of Connecticut. In addition, this *Central Wharf Southern Loadout* configuration allowed for other bulk cargo operations to be performed in the short and mid-term between potential gaps in offshore wind installation activities. Based on abutters' and stakeholders' comments and concerns voiced during the ongoing design process, it became apparent that the *Central Wharf Southern Loadout Alignment (Initial JPA Footprint)* loadout vessel location had the potential to adversely impact local navigational patterns. These concerns were focused on the large footprint of the loadout vessel. The southern end of the State Pier Facility has not typically received vessels and the location of the loadout vessel at the facility's southern terminus would force other existing commercial vessels - including the adjacent CSF operations - to alter their typical transit patterns.

As such, the CPA and Project team considered alternate onsite arrangements that would minimize the potential navigational impacts to abutters. These potential alternate arrangements that were reviewed are outlined below.

State Pier Facility – Import and Loadout Berth Swap

This alternative examined moving the delivery berth to the Central Wharf South Berth and the WTG assembly and load out berth to the Northeast Bulkhead. This alternative was rejected for the following reasons:

- If the delivery vessel operations were moved to the Central Wharf South Berth, this would significantly increase the vessel activity adjacent to the existing CSF marine based

operations in or near Winthrop Cove (monthly import vessel deliveries would be more frequent than the installation vessel trips during times of active wind campaigns).

- The delivery vessels typically have a greater length than the installation vessels; accordingly, the delivery vessel could require a larger berthing area, further impacting operations in and adjacent to Winthrop Cove.
- The load out of WTG components requires a large and open heavy lift area for the staging and assembly of WTG components. The area adjacent to the Northeast bulkhead was analyzed to determine if it could support WTG assembly and loadout activities. This analysis determined that the area adjacent to the Northeast Bulkhead does not have the space required to conduct preassembly and load out activities and would result in further operational congestion on the site.

State Pier Facility – Installation Vessel Shift to the East End of Central Wharf’s South Berth

This alternative analyzed the potential operational impacts associated with mooring the installation vessel further to the east at the Central Wharf South Berth. This option was considered in an effort to avoid potential conflicts with adjacent stakeholder vessels. Specifically, this shift was designed to minimize potential maneuvering impacts on vessels transiting to and from the northernmost CSF berths. This alternative was rejected for the following reasons:

- As stated above, the installation vessel loads WTG components (nacelles, tower and blades) from the load out and assembly area. The nacelles and assembled towers require a heavy lift platform or area (typically rated at 5,000 psf), while blades require an area with a rating of 1,000 psf. The installation vessel crane capacity governs the positioning of the vessel relative to the WTG assembly and load out area.
- An installation vessel crane is typically located around one of the vessel’s jack-up legs and has a defined capacity at a given radius. The combination of WTG assembly and load out area and vessel crane radius govern the mooring position of the installation vessel. Typical installation vessel design requires that the nacelles and assembled towers are loaded onto the center section of the vessel with the vessel main crane with the blades loaded onto the stern of the vessel, commonly with a combination of a land crane and a vessel auxiliary crane.
- The prior and current Project design aligns the vessel crane radius with the Heavy Lift Central Wharf assembly and load out area, allowing for the ongoing assembly and load out of the nacelles and towers. The Project, as previously designed, uses the Admiral Shear pier with its existing live load capacity of 1,000 psf for the loading of blades.
- Shifting the installation vessel as described here would move the center line of the vessel crane to the southeast end of the Admiral Shear pier and would limit the crane’s ability to reach the WTG assembly and load out areas. In addition, this shift would also limit the loading of blades from the Admiral Shear pier. In order to ensure the facility and installation vessel could operate efficiently, the heavy lift area would have to be expanded into the southern portion of the Admiral Shear State Pier.
- The Admiral Shear State Pier is currently designed with a load rating of 1,000 psf, not the 5,000 psf required for WTG assembly and load out. To meet the heavy lift requirements, approximately 300 ft (longitudinal) of the southern portion of the pier would have to be demolished and rebuilt.

- The impact of this additional work includes an additional cost of \$20 to \$30 million (as calculated during the initial Project design and planning stage) and a schedule extension beyond the required facility delivery date.

This revised Project footprint described under this alternative is potentially viable as an alternate design; however, the utilization of Project space isn't optimized under this scenario. Further, the following alternative better addresses the concerns raised by adjacent stakeholders by further reducing potential interferences with CSF vessel navigation.

State Pier Facility – Admiral Shear East Berth Loadout Alignment Alternative (Selected Alternative)

In order to accommodate the above-noted navigational concerns, the currently proposed installation/loadout vessel berthing location has been moved to the east face of the Admiral Shear State Pier, as depicted in Attachment I. This location services the large bulk carriers that currently call on the State Pier Facility and will therefore not require other local waterway users to substantially alter their existing transit patterns.

As the entire Admiral Shear State Pier is currently designed for a loading capacity of 1,000 psf, a new Heavy Lift platform will be required. In order to meet the requirements for WTG assembly and load out, a portion of the East Berth will be upgraded to a capacity of 5,000 psf. To accomplish this, approximately 400 LF (longitudinal) of the Admiral Shear State Pier will be demolished and rebuilt.

Placing Central Wharf area fill between the two piers would still be required under this alternative, in order to satisfy the minimum overall useable uplands square footage requirements of the WTG support facility, including pre-assembly and load-out space to meet operational logistics and worker safety requirements.

It is estimated that the construction of this alternative would add approximately \$30 to \$50 million to the cost of the project (as calculated during the initial Project design and planning stage).

This location for the loadout area poses some logistical challenges for the loadout of offshore wind components; however, after additional study it has been deemed a workable solution. In addition, this change in loadout vessel location will not limit the future use of the terminal for other bulk cargos.

Summary

Overall, considering both off-site and on-site alternatives and based upon extensive assessment, it is the CPA's position that the proposed plan is the least environmentally damaging practicable alternative to meet the Project's Purpose and Need. Through analysis of multiple design alternatives, the selection of the *Admiral Shear East Berth Loadout Alignment Alternative* has been selected and this new design addresses the navigational concerns of abutting stakeholders.