Section 2.17 Construction Methodology

2.17.1 Construction Summary

As noted in section 2.3.2 Site Arrangement above, the F~~f~~acility will be constructed primarily on previously developed areas located at the port. The site is relatively flat and without natural vegetation or water features, resulting in limited preconstruction grading activities and modification or removal of vegetation. The only construction element that will include work within a sensitive area is the proposed modifications to berths 13 and 14 and other associated work within the shoreline area for the Marine Terminal (Area 400). For completeness this section addresses all construction elements.

Before any on-site ground disturbance, stormwater pollution prevention measures will be implemented in accordance with the project's SWPPP. Measures will include, but will not be limited to, installing stabilized construction entrances, wheel washes, and temporary stormwater collection and treatment facilities (hay bales, silt fences, other temporary measures), and temporary stormwater ponds.

Construction areas will be secured with temporary or permanent fences to control access to the construction sites. Primary construction access is expected to be established off the existing Gateway overpass; secondary access will be established at the west entrance to Terminal 5 and at Parcel 1A.

Construction on portions of Terminal 5 will involve impacts to areas of known residually impacted soils and protective caps that have been the subject of past remediation and containment activities. Work within these areas will comply with the restrictive covenants and consent decrees in place and the contaminated material management plan that will be developed for the project.

Prior to the construction of foundations and above-ground facilities, existing above-ground and underground utilities will be removed and if necessary reinstalled in a different location. The Applicant will coordinate with the owners and operators of these utilities before they are disconnected or moved. With the exception of rail loop adjustments, dock modifications and utility movements, no existing structures will be moved or removed from the site.

Construction laydown areas will be established for temporary construction trailers, storage of construction equipment and materials, and construction employee parking. The laydown areas will be on area<u>s</u> adjacent to the project site. Final configuration will be determined based on construction needs. In addition, areas adjacent to the proposed piping system alignment will be used to stage pipe prior to and during the process of constructing the piping system. Figure 2.17-1 illustrates the anticipated location of temporary construction boundaries and temporary laydown areas with respect to the Facility site boundary.

Conventional construction equipment – including bulldozers, front end loaders, trucks, tractor scrapers and graders – will be used to final grade the site. As described in further detail in the sections that follow, foundations will be constructed, and equipment and project facilities will be installed. Field toilets and temporary holding tanks will be installed for construction personnel. During construction, potable water will be provided in containers until permanent potable water service is established.

Cleanup of debris, final site stabilization and landscaping will complete construction activities.

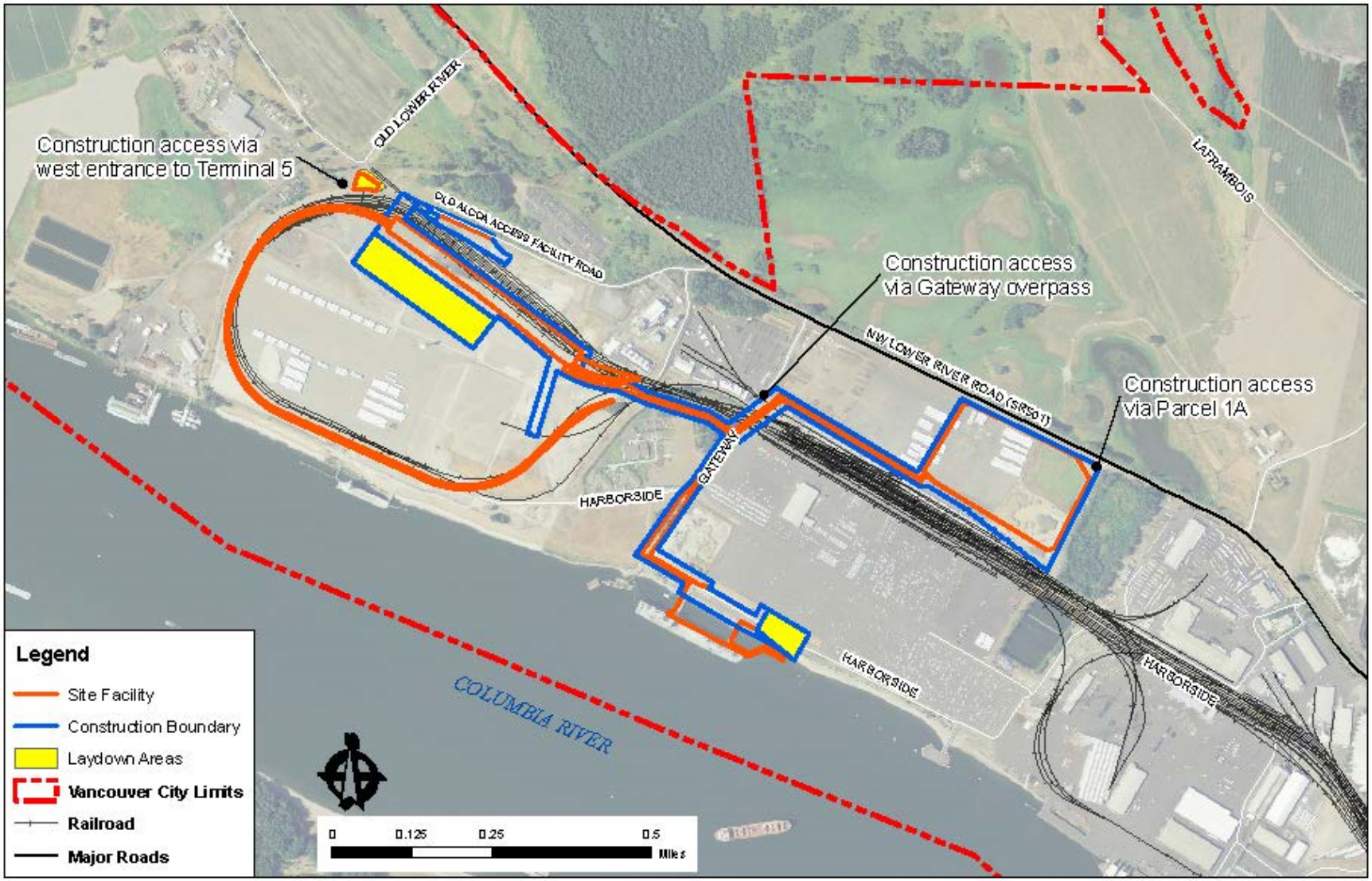

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Figure 2.17-1. Temporary Construction Boundary and Laydown Areas (Revised)

2.17.2 Site Preparation

During site preparation, the construction contractor will install stormwater pollution prevention measures and the permanent stormwater drainage system. This system is described in detail in the Preliminary SWPPP, Appendix C to this application. A Certified Erosion and Sediment Control Lead (CESCL) will be responsible for ensuring that stormwater pollution prevention measures are implemented and maintained according to the BMPs identified in the project SWPPP and selected in accordance with the Stormwater Manual.

2.17.3 Foundations

Foundations, ground improvements, buildings, storage tanks, and piping systems will be designed to the applicable seismic code, and will take into consideration site-specific soil stability, as described in more detail in Section 3.1.

The type of foundation chosen for the offloading building will depend on the results of the detailed site geotechnical investigation conducted prior to final site engineering and construction. It is anticipated that the foundation will consist of either drilled piers, with columns spaced 20 to 25 feet on center, or spread footings approximately 7 feet by 7 feet, placed 20 to 25 feet apart. The locations for piping trenches and pump basins will be excavated and the concrete for the trenches and pump basins poured. The storage tanks are anticipated to be constructed on a piling-supported ring wall foundation.

2.17.4 Storage Area

Following site grading and subsurface preparation, AST support piling will be installed and tank foundations will be poured. Sand and gravel material will be laid throughout the storage tank area, and the surrounding berm constructed. The berm around the storage tank area will be constructed from materials excavated from the loading facility area during the construction of the piping trench. The impervious membrane liner will then be placed covering the berm and storage area, and will either be tied into the AST foundations or will cover the entire containment area.

The storage tanks will be constructed on site from pre-fabricated sections of steel plate. A 100- to 150-ton crane will be brought to the site to move the tank sections into place. During the construction process, the various elements of the storage tank assembly will be tested according to API standards as indicated in section 2.10.3.2: Piping Installation.

Piping will be delivered to the site in prefabricated lengths. Pipe supports will be constructed on pile or stone column-supported concrete foundation designed to the applicable seismic code. Piping will be installed and field welded. Field welds will be inspected per applicable standards.

2.17.5 Rail Improvements

As noted above in section 2.3.3.2, two additional, approximately 8,000-foot-long rail loops will be constructed to accommodate unit trains. Construction of these rail loops will follow typical industry standards. The track alignment and construction limits ~~would~~ will be established by field survey. Minor grading of the rail alignment will consider the existing relatively flat ground level at Terminal 5. Soils will be compacted in consideration of subsurface conditions to ensure ground stability. Approximately 12 inches of finely graded compacted granular material (sub-ballast) will be placed as necessary.

After the sub-ballast has been placed, specialized construction equipment will be used to construct the track. The track will consist of railroad ballast (rock), 115-pound hardened steel continuously-welded rails, mounted on either 8-foot-6-inch or 8-foot-3-inch crossties, and other miscellaneous materials. Crossties will be concrete for the most part, except at crossings where timber will be used. A stockpile for the track material will be located at one of the proposed laydown areas. The material will be distributed by truck to the final location and the rails will be spiked or clipped to the proper gauge on the crossties. Railroad ballast will be dumped using construction equipment mounted on rails. A specialized piece of construction equipment, called a tamper, will be used to raise the track through the ballast, and the ballast will be compacted under the crossties. The track surface will be smoothed to a tolerance of 1/16th of an inch. The ballast will then be shaped to form a typical uniform ballast section.

2.17.6 Utilities

Natural Gas

Natural gas service will be obtained from ~~either~~ Northwest Natural Gas ~~or Williams Pipeline~~. Existing 2 inch service lines are in place for service to the Area 300 Boiler Building and the Area 600 West Boiler Building. The existing service line to the Jail Work Center ~~would~~ will be extended further south towards berths 13 and 14 to provide assist gas for the MVCU. A meter ~~would~~ will be placed on the F~~f~~acility-side of each of these connections.

Water

The City's existing water distribution facilities are adjacent to or located on the site. The Facility's water service will be connected to the City's existing distribution network in accordance with the City's water design and construction requirements. Necessary water metering and cross-connection control will be installed at each of the connection locations between the on-site water facilities and the public water distribution system. Multiple water service connections will be constructed because of the multiple discontinuous areas that are part of the project.

Electrical

The Facility will obtain electrical service from Clark Public Utilities.

2.17.7 Dock Improvements

Dock Improvements will include in and overwater construction ~~as follows~~:

- ~~Remove two mooring dolphins, and two breasting dolphins including forty-seven 18-inch steel pipe piles, eight 12-3/4-inch steel fender piles and approximately 1,330 square feet of existing concrete pile cap.~~
- ~~Remove approximately 3,250 square feet of grated walkway associated with existing breasting dolphins to be removed. One existing 18-inch steel pipe pile supporting the walkways will also be removed.~~
- ~~Install four new 27-foot-diameter mooring dolphins (approximately 2,140 square feet combined new, solid overwater coverage), including forty 36-inch steel pipe piles.~~
- ~~Add four 24-inch steel pipe piles to Berth 13 dock platform.~~
- ~~Add sixteen 24-inch steel pipe piles (all below OHWM) to existing bents at Berth 13 access trestle.~~

- ~~Add six to twelve 36-inch steel pipe piles at the existing trestle abutment at Berth 13, all above OHWM, including pile cap modifications resulting in an additional 192 square feet of overwater coverage.~~
- ~~Install structural connection framing consisting of two 24 to 36-inch-diameter steel pipes between the Berth 13 platform and the adjacent upstream and downstream breasting dolphins totaling 920 square feet. Grated walkways will be installed above one of the steel pipes adding approximately 690 square feet of new grated walkways. Two 24-inch steel pipe piles will be installed to support the structural framing system.~~
- ~~Add approximately 2,880 square feet of grated walkways between mooring and breasting dolphins with four 24-inch steel piles to support the walkways. Grated walkways will mostly be reused portions of existing walkway that was removed.~~

Construction Equipment

In water construction will be completed with typical waterborne construction equipment. The contractor will likely conduct most of the work from construction barges. The anticipated equipment includes, but is not limited to:

- Crane and material barge(s) (typical dimensions of 150 feet x 60 feet)
- Cranes
- Work skiff(s)
- Tug(s)
- Impact pile driver (anticipated size of 165,000 to 212,000 ft-lbs)
- Vibratory pile driver
- Concrete pumps or buckets
- Air compressors and generators
- Typical hand held equipment
  - Concrete saws
  - Welding and cutting torches
  - Saws, chainsaws and drilling equipment
  - ~~Impact hammer~~
  - Underwater chainsaw
- Dump truck or wheeled excavator (for material removal on dock)
- Emergency response and safety equipment

~~Mobilization~~

~~During this task, the contractor will mobilize labor and equipment to the site. Materials and equipment will arrive at the site via land and water.~~

~~Demolition~~

~~Following mobilization, demolition activities would commence. In-water and overwater demolition will consist of removal of the two existing mooring dolphins, two existing breasting dolphins, and associated walkways. Demolition will generally proceed by removing existing concrete caps, and then removing the associated piles for each structure. Pile removal at the Terminal 5 dock and at Port Terminal 2 for habitat mitigation will also likely proceed at this time. Approximately 250 piles will be removed from below the OHWM of the Columbia River. Piles will be removed by vibratory extraction or by pulling them directly with a crane mounted~~

on a barge. If a pile breaks above or below the mudline, it will be cut off consistent with agency-approved BMPs. Any voids left in the river bottom following pile removal are expected to collapse and fill in rapidly due to the sandy/silty nature of the substrates at the site and natural sediment transport activities in the river. The removed piles will be stored temporarily on a barge before being sent to an approved recycling center or disposal in a landfill. All activities conducted below the OHWM will be conducted within the in-water work window.

Pile Installation

The project requires the installation of approximately 76, 24- to 36-inch steel piles (66 planned and 10 contingency) below the OHWM of the Columbia River. The diameter of the piles is based on structural and geotechnical design considerations. Pile installation activities will occur via a combination of impact and vibratory methods and will only be conducted during the in-water work window established for the project.

The in-water piles will most likely be installed by a crane located on a derrick barge with piles and materials stored on a supply barge; a tugboat will also likely be required. Shoreline piles at the Berth 13 abutment are expected to be installed from shore by land-based equipment.

To the greatest extent possible, piles will be driven using a vibratory hammer; however, piles will be driven to final tip elevations with an impact hammer. Temporary piles are expected to be used to support the guides that will position and align the permanent piles and for the concrete formwork. It is estimated that up to approximately 40 temporary piles may be required. These temporary piles will be 18- to 24-inch-diameter open-ended steel pipe or H-piles and will be installed with a vibratory hammer.

The vibratory hammer method is a common technique used to drive piles where the type of sediment allows it. This process begins by placing a choker around the pile and lifting it into vertical position with the crane. The pile is then lowered into position and set in place at the mudline. The pile is held steady while the vibratory hammer drives it to the required tip elevation. For this project, it is expected that the vibratory hammer will be used to drive all of the permanent structural piles to the extent practicable as well as all of the approximately 40 temporary piles.

Following vibratory driving to refusal (the point at which the pile will no longer advance with the vibratory hammer), an impact hammer will be used to drive piles to their final tip elevations. An impact hammer will also be needed to proof the structural piles. Proofing is the process of striking piles with an impact hammer to verify their load-bearing capacity.

An impact hammer is a large steel device that works with a hydraulic or diesel piston. Impact hammers have guides (called a lead) that hold the hammer in alignment with the pile while the heavy piston moves up and down, striking the top of the pile and driving it into the substrate from the downward force of the hammer on the top of the pile. Where the impact hammer is used, a bubble curtain or other similar noise attenuation method (such as sound attenuation pile caps, increased hammer size, etc.) will be employed.

Temporary piles may be necessary to support concrete forms or for pile driving templates during pile driving. These will be installed with a vibratory hammer to the greatest extent possible.

The overwater construction portions of the project will generally proceed immediately after pile installation operations. Concrete pile caps will be formed and constructed, and walkways and access trestle decking will be installed. Other overwater portions of the project will include

~~installation of associated on deck infrastructure such as the hanging fendering system, bollards, handrails, etc.~~

~~Overwater activities would be conducted according to the BMPs established for the project, which will minimize any potential for impacts to water quality such as inadvertent releases or release of construction debris into the waters at the site. Overwater construction would not be limited to the in-water work window.~~

~~Piping, jib cranes, a moveable gangway, an observation and control platform, dock safety unit, pipe trays, and lighting will be installed on the existing berth 13 trestle and dock. The two 24- to 36-inch pipelines from the tank storage will be located on the trestle where they will connect with a manifold on the dock. High velocity hoses will be connected to the manifold and used to transfer the crude oil from the piping system to the marine vessel being loaded. The high velocity hoses will be supported by a pulley or crane system and connected to the grounding grid to protect from the buildup of static electricity. The loading system will incorporate automatic shutoff valves with a maximum 30-second shutoff time.~~

Mobilization

The contractor will mobilize labor and equipment to the site. Laydown areas for materials and equipment will be located landward of the OHWM.

Demolition

In-water and overwater demolition will consist of removal of the existing breasting dolphin and associated walkways and removal of the existing deck and pile caps from those areas of the structure requiring seismic work. Demolition will generally proceed by removing existing concrete caps, and then removing the associated piles for each structure. Piles will be removed by vibratory extraction or by pulling them directly with a crane mounted on a barge. If a pile is unable to be extracted with the above methods it will be cut off consistent with agency-approved BMPs. Any voids left in the river bottom following pile removal are expected to collapse and fill in rapidly due to the sandy/silty nature of the substrates at the site and natural sediment transport activities in the river. The removed piles will be stored temporarily on a barge before being sent to a recycling center. All pile removal activities below the OHWM will be conducted within the published in-water work window. Demolition may be conducted using land- and/or barge-based equipment.

Pile Strengthening

Prior to strengthening, the inside of the piles will be inspected for substrate that must be removed, if necessary. The piles were installed with partially closed ends and significant substrate is not anticipated to be present. The end of the pile will be opened with a drill to allow installation of the ground anchor. The ground anchor will likely consist of a steel threaded rod that will be inserted into a hole drilled into the substrate and secured with grout. A new steel pile will then be placed inside the existing pile and concrete grout pumped into the piles to complete the pile work. This may be conducted using land- and/or barge-based equipment.

Overwater Construction

New concrete pile caps will be formed using water-tight forms. The superstructure will be constructed with steel framing with a steel grid deck and a poured in place concrete topping slab. Walkways and trusses will be manufactured off site and brought to the site for installation. Temporary piles (up to 40) may be used for the concrete formwork. Temporary piles will be 18- to 24-inch-diameter open-ended steel pipe or H-piles and will be installed with a vibratory hammer.

Other overwater portions of the project will include installation of associated on deck infrastructure such as the hanging fendering system, bollards, handrails, etc.

Overwater construction may be conducted using land- and/or barge-based equipment.

Overwater activities would be conducted according to the BMPs established for the project, which will minimize any potential for impacts to water quality such as inadvertent releases or release of construction debris into the waters at the site. Overwater construction would not be limited to the in-water work window.

Upland Access Trestle Improvements

The project will install ground improvements at the upland end of the access trestle and along the shoreline. A series of drilled shafts will be installed at the Berth 13 Trestle abutment. Ground improvements, if required, will consist of vibro-compaction, stone columns or other similar method that results in the establishment of an area of denser soils through compaction and the placement of additional materials. 6 24-inch steel pipe piles will also support the access trestle. Pipe pile installation will require use on an impact pile driver. This work would not be limited to the in-water work window.

2.17.8 Commissioning

During commissioning all systems and components, all systems and components of the F~~f~~acility will be checked, inspected and tested to verify that every operational component of the F~~f~~acility is functioning properly.

Hydrostatic Testing

Prior to commissioning the project, the piping systems and storage tanks will be hydrostatically tested to ensure they are free of leaks in accordance with industry standards. Hydrostatic testing water will be obtained from the City or Port municipal supply. The piping systems will be filled with water and then pressurized to check for leaks. Water used to test the piping systems will then be pumped to the first storage tank, which will be filled with additional water and then pressurized. Once the testing process for the first tank has been completed, the water will be drained into the next storage tank, and so forth until all of the tanks have been tested. At the completion of the testing process, the hydrostatic test water will be discharged to the stormwater system. Nothing will be added to the testing water. Upon the completion of testing, the water will be analyzed and treated as necessary before its discharge in compliance with wastewater permits issued by EFSEC. Leaks identified during the testing process will be repaired before final commissioning.

~~Equipment Commissioning~~

2.17.9 Project Construction Cleanup

During this final stage all temporary construction features, equipment and excess materials will be removed. Some temporary stormwater BMPs may remain on site until the site is fully stabilized.