would be mostly placed in the Corpus Christi New Work ODMDS. PA2 and nearshore berms B1 through B9 may also be applicable for use.

2.3 ALTERNATIVE 2: OFFSHORE SINGLE POINT MOORING

2.3.1 Background

The Offshore Single Point Mooring (SPM) Alternative is a multi-buoy single-point mooring system consisting of multiple sets in an array of SPM buoys (also known as Single Buoy Moorings). It would be located in the Gulf approximately 15 miles from the Gulf-side shoreline. Vessels would be loaded entirely offshore, eliminating the need to traverse the CCSC.

Based on offshore loading rates from various projects in Texas and globally, the loading rate per SPM when operated for multiple vessel loading can be expected to range from 40,000 to 60,000 barrels per hour (Bluewater Texas Terminal, 2019a; Texas Gulf Terminals, 2018; Trans-Balkan Pipeline B.V., 2009). A VLCC can carry approximately 1.9 to 2.2 million barrels. This volume could require approximately between 48 and 60 hours to load to full capacity.

VLCC loading operations are limited to periods of mild to moderate weather conditions and seas. Apart from filling time, the loading process requires time to approach and maneuver towards the SPM buoy, gather, tend, and connect SPM mooring lines (hawsers), floating hoses, and other connections to the vessel, operate valves, and similar disconnection procedures. There is also routine maintenance and inspection. Under this alternative filling, connection, and maintenance times may be more predictable. There are less predictable logistical and scheduling events, such as next vessel arrival (which itself is subject to individual vessel company scheduling), journey delays, shipment customer orders, and contract variability and delays. These factors affect the usage rate of a given offshore loading facility. Therefore, practical throughput is not solely a function of pumping rate, filling time, mooring/connection duration, and scheduled maintenance. Literature from other SPM project planning and offshore permitting documentation indicates that SPM facility planners expect a monthly usage rate of approximately eight VLCCs per month per SPM buoy (Bluewater Texas Terminal, 2019a;Texas Gulf Terminals, 2018; Trans-Balkan Pipeline B.V., 2009).

Factoring in weather, sea state, tendering/loading operations, administration, maintenance, and vessel logistics/scheduling, each SPM has the assumed capacity to load approximately eight VLCCs per month. For each two-SPM array, an average of 16 VLCCs could be loaded per month. This equates to approximately 32.8 million barrels per month, or approximately 1.1 million bpd. To meet a 4.5 million bpd demand, there would have to be eight individual SPM buoys or four sets in an array as described above.

2.3.2 Project Site and Components

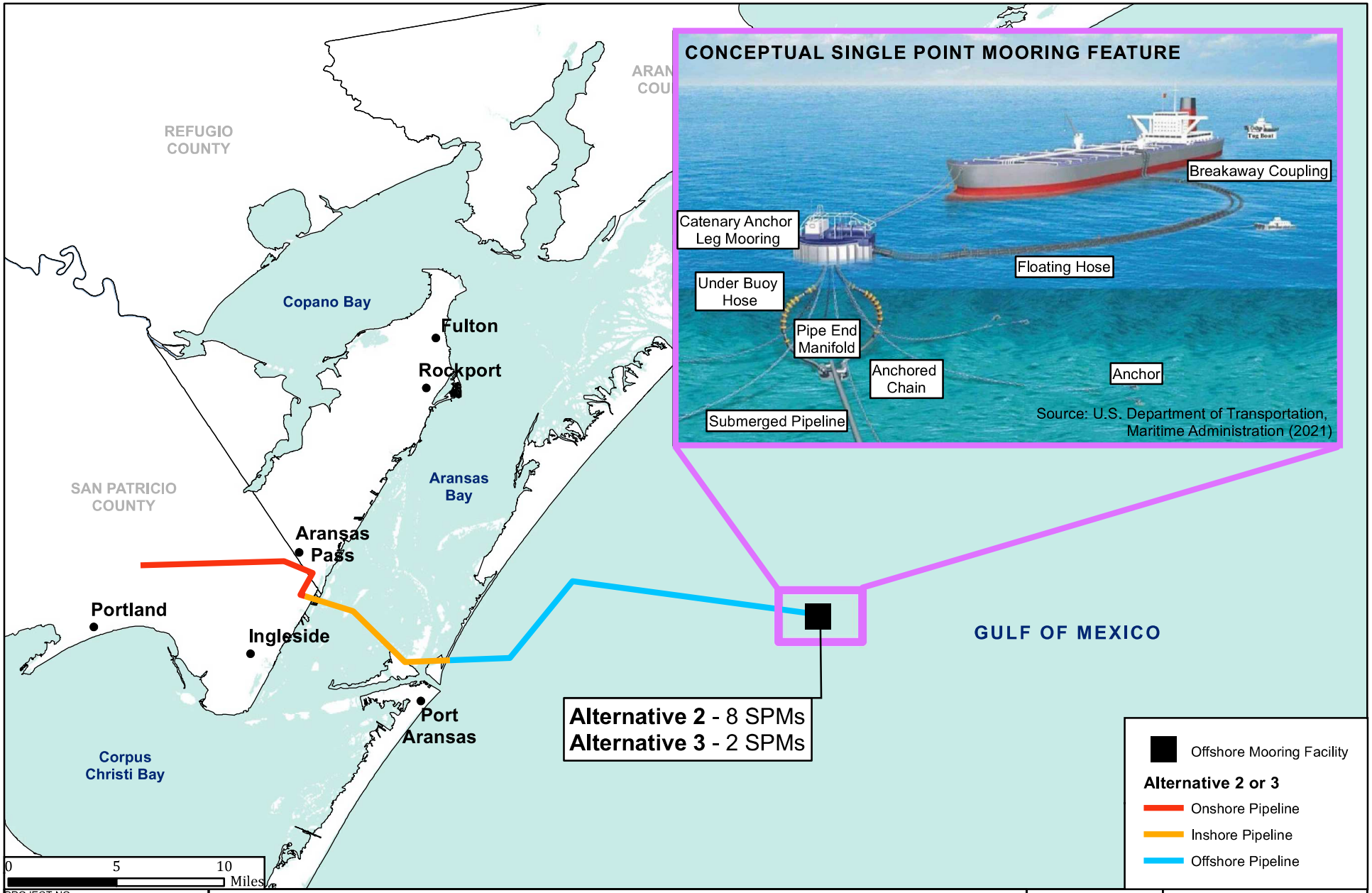
The Offshore SPM Alternative would include an array of SPM buoys located in the Gulf approximately 15 miles from the Gulf-side shoreline (Figure 2-2). Each set consists of two SPMs that would be serviced by either one or two pipelines from shore that would originate in Ingleside or Harbor Island facilities. The pipelines can be single, such as a 48-inch diameter pipe, or dual, such as two 30-inch diameter pipes, consistent with SPM offshore permit applications (Bluewater Texas Terminal, 2019a; Texas Gulf Terminals, 2018). Each SPM buoy would be in a water depth of approximately 90 feet and typically secured by a Catenary Anchor Leg Mooring configuration consisting of approximately six catenary anchor chains (legs). The chains or legs would be attached to seabed anchor points such as gravity-based anchors or piles (SBM Offshore, 2012). The number of SPM sets depends on the total daily throughput needed from the area serviced by the Offshore SPM Alternative. To meet a 4.5 million bpd demand indicated by the Applicant, there would have to be eight individual SPM buoys or four sets.

As aforementioned, the most common number proposed by individual entities for single projects is two SPMs. Locally, the Louisiana Offshore Oil Port, the largest U.S. offshore facility, hosts three SPMs (Louisiana Department of Transportation and Development, 2022). Larger numbers of loading points for single facilities either involve full loading platforms such as the four-berth Iraqi Al Basrah Oil Terminal, or intermediary pumping/metering platforms such as the six-SPM Saudi Arabian Ju'aymah Crude Terminal, both operated under more centralized and nationalized crude oil production (Office of the Special Inspector General for Iraq Reconstruction, 2007; Saudi Aramco, undated).

This alternative does not include any deepening of the CCSC and requires no inshore berthing (i.e., all VLCC vessels would be fully loaded offshore). Alternative 2 eliminates the need to traverse the CCSC and does not require reverse lightering. As is typical of SPMs, the buoy would not be equipped with vapor recovery or other loading emission controls other than what is achievable and practical for offshore loading systems. This typically consists of submerged filling and inert gas management plan to prevent unnecessary venting of volatile organic compound (VOC) vapors. Pipelines would originate inland and lead to the offshore SPM array.

2.3.3 Construction

The primary infrastructure that would need to be constructed includes the pipeline and the SPM facility. The pipeline would likely be constructed in a similar manner that is proposed for the Axis Midstream Harbor Island Terminal (SWG-2018-00789) or Bluewater Terminal (USACE, 2020; U.S. Department of Transportation, 2021), where the pipeline would likely be installed via horizontal directional drill (HDD) across Redfish Bay to minimize impacts. Construction of the Offshore SPM would include the SPM buoy(s) secured by a Catenary Anchor Leg Mooring configuration with approximately six catenary anchor chains (legs) attached to gravity-based anchors or piles (SBM Offshore, 2012).



PROJECT NO.	PCA20166
DATE CREATED	Date: 2/8/2022
DATUM & COORDINATE SYSTEM	NAD83 State Plane (feet) Texas South Centra
FILE NAME	Name: Fig_2_2_Alternatives 2 and 3 Conceptual Features
PREPARED BY	KLC

Port of Corpus Christi Authority
Corpus Christi Ship Channel Deepening Project

Alternatives 2 and 3 Conceptual Features

N W E S

FIGURE 2-2

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2.3.4 Operations and Maintenance

Like the proposed Bluewater Texas Terminal (Bluewater Texas Terminal, 2019a; U.S. Department of Transportation, 2021), it is assumed that 24/7 monitoring would take place on Harbor Island. Operations would also include an on-site support vessel while loading. For spill preventions, there would be spill and fire response equipment and personnel, and the pipeline route would include shut-off valves and auto shut-off hoses. In addition to maintenance of the Offshore SPM facility itself, it is also assumed that maintenance dredging would be the same as the No-Action Alternative. Alternative 2 would not induce future maintenance dredged material volumes in excess of the No-Action Alternative as maintenance cycles and placement would be associated with the –54-foot MLLW CCSCIP that is currently underway. Most maintenance material would be placed in the ODMDS.

2.4 ALTERNATIVE 3: INSHORE/OFFSHORE COMBINATION

2.4.1 Background

Like the Offshore SMP Alternative, the Inshore/Offshore Combination Alternative is a SPM buoy located in the Gulf approximately 15 miles from the Gulf-side shoreline. The SPM buoy is located in a water depth of approximately 90 feet and is typically secured by a Catenary Anchor Leg Mooring configuration consisting of approximately six catenary anchor chains (legs) secured to seabed with anchor points such as gravity-based anchors or piles (SBM Offshore, 2012). Vessels are partially loaded inshore then traverse the CCSC offshore to the SPM to fully load.

Like the Offshore SPM Alternative, this alternative does not consist of deepening the CCSC and does not require reverse lightering. Some inshore berthing would be required at Harbor Island and Ingleside to partially fill half-laden VLCCs. The half-laden VLCCs would be fully loaded at the SPM.

2.4.2 Project Site and Components

The project site is the same as the Offshore SPM Alternative (see Figure 2-2). It would include an array of SPM buoys located in the Gulf approximately 15 miles from the Gulf-side shoreline. Each set consists of two SPMs that would be serviced by either one or two pipelines from shore that would originate in Ingleside or Harbor Island facilities.

2.4.3 Construction

Construction of this alternative would be like the Offshore SPM Alternative. The primary infrastructure that would need to be constructed includes the pipeline and the SPM facility. The pipeline would likely be constructed in a similar manner that is proposed for the Axis Midstream Harbor Island Terminal (SWG-2018-00789) or Bluewater Terminal (USACE, 2020; U.S. Department of Transportation, 2021), where the pipeline would likely be installed via HDD across Redfish Bay to minimize impacts. Construction of the

Offshore SPM would include the SPM buoy(s) secured by a Catenary Anchor Leg Mooring configuration with approximately six catenary anchor chains (legs) attached to gravity-based anchors or piles (SBM Offshore, 2012). This alternative also assumes that facilities would be constructed on Harbor Island through other USACE authorizations.

2.4.4 Operations and Maintenance

During operations of this alternative, inshore berthing of VLCCs would still occur at LaQuinta or Harbor Island for partial filling (i.e., half laden). These VLCCs would then fully fill at the Offshore SPM facility. Like the Offshore SPM alternative, it is assumed that 24/7 monitoring would take place on Harbor Island and that a support vessel would always be on-site while loading. For spill preventions, there would be spill and fire response equipment and personnel, and the pipeline route would include shut-off valves and auto shut-off hoses. Similar to the Offshore SPM Alternative, this alternative would not induce future maintenance dredged material volumes in excess of the No-Action Alternative. Most maintenance material would be placed in the ODMDS.