3.0 ALTERNATIVES

In considering Sempra's applications, the FERC will review both the environmental and non-environmental record in deciding whether it is in the public convenience and necessity to issue any authorization for the project. The EIS addresses alternatives to the proposed actions before both the FERC and the Coast Guard. The proposed action before the FERC is to consider issuing to Sempra a section 3 authorization for the LNG import facilities and a section 7 Certificate for a new natural gas pipeline. The proposed action before the Coast Guard is to consider issuing Sempra an LOR finding the waterway suitable for LNG marine traffic, with certain conditions. These conditions are delineated, in part, in the Coast Guard's March 20, 2006, letter to FERC (attached as Appendix H). Specifically, these conditions may include requirements that all agencies that would be involved in navigation safety and maritime security aspects of LNG vessels transiting to and operating at the Port Arthur terminal be adequately staffed, equipped and funded to fully implement the safety and security measures. These measures may include, but are not limited to, security zones around the LNG carriers, a vessel traffic control plan, escorts by armed law enforcement vessels, a variety of waterway and shoreline surveillance measures, and multi-agency cooperation and communication. Specific details of these measures are further delineated in the Coast Guard's December 19, 2005, letter to FERC which has been designated Sensitive Security Information as defined in Title 49 CFR Part 1520. Because any unauthorized disclosure of these details could be employed to circumvent the proposed security measures, they are not releasable to the public.

In accordance with NEPA and Commission policy, we have evaluated a number of alternatives to the Port Arthur LNG Project to determine if any are reasonable and environmentally preferable to the proposed actions. Alternatives described in the following sections include no action or postponed action, system alternatives, LNG terminal site alternatives, and pipeline alternatives. Reasonable alternatives to the Coast Guard action of issuing an LOR include:

1) Issuance of a Coast Guard Letter of Recommendation finding the waterway suitable for LNG Marine Traffic without any conditions
2) Postponing the issuance of a Coast Guard Letter of Recommendation pending further analysis and study
3) Issuance of a Coast Guard Letter of Recommendation finding the waterway not suitable for LNG Marine traffic. (no action alternative).

The evaluation criteria for selecting potentially reasonable and environmentally preferable alternatives include whether they:

- are technically and economically feasible and practical;
- offer significant environmental advantage over the proposed Project or portions of it; and
- meet the Project objectives of:
  - allowing access to worldwide reserves of natural gas to diversify sources of natural gas, to meet increasing demand for natural gas in the U.S., and to replace declining natural gas production in the Gulf of Mexico[1]; thus, providing a new, stable source of between 1.5 and 3.0 Bcf/d of natural gas to supplement the diminishing supplies while utilizing, to the extent practical, the existing natural gas pipeline infrastructure within the Gulf of Mexico region of the U.S.; and

[1] The Department of Energy's EIA estimates that demand for natural gas in the U.S. could reach 35 trillion cubic feet annually by 2025 (EIA 2003a). This compares with an annual consumption of 22.2 trillion cubic feet in 2001 (EIA 2003b).

- providing a pipeline that would deliver natural gas to existing interstate pipeline systems that provide service to the Midwestern and Northeastern regions of the U.S.[2]

While we recognize that LNG could be imported to any number of locations along the U.S. shoreline as discussed in the following sections, our analysis of alternatives for this Project focused primarily on the Gulf of Mexico because this area has existing infrastructure which would allow Sempra to serve the widest market. Introducing the imported gas into this existing infrastructure also would serve to supplement the declining domestic production. Further, our analysis focused on those aspects of the proposed Project for which an alternative could minimize or avoid environmental impacts, such as wetlands.

3.1 NO ACTION OR POSTPONED ACTION

The FERC has three courses of action in processing an application. It may: 1) deny the proposal; 2) postpone action pending further study; or 3) authorize the proposal with or without conditions.

If the Commission denies the proposal (the No Action Alternative), the short- and long-term environmental impacts identified in chapter 4.0 of this EIS would not occur. If the Commission postpones action on the application, the environmental impacts identified in chapter 4.0 of this EIS would be delayed, or if the applicant decided not to pursue the Project, would not occur.

For the Coast Guard's proposed action, the no action alternative would be issuance of an LOR which finds the waterway not suitable for LNG vessel traffic.

If the Commission selects the No Action Alternative, however, the objectives of the proposed Project would not be met, and Sempra would not be able to provide the proposed import, storage, vaporization, and transportation services to its proposed shippers. If action is postponed, the objective of providing service before the 2008 winter heating season would probably not be reachable. It is purely speculative to predict the resulting actions that would be taken by the end users if the natural gas supplied by the Project were not available or the associated direct and indirect environmental impacts of these actions.

Because the demand for energy in the U.S. is predicted to increase and domestic natural gas supplies are declining (EIA 2003a), customers may have fewer and potentially more expensive options for obtaining natural gas supplies in the near future. It is possible that existing natural gas infrastructure supplying natural gas to the market area could be developed in other ways unforeseen at this point, including the further development of natural gas sources in North America and construction of associated pipeline projects. In some cases, potential customers of natural gas could select available energy alternatives such as oil or coal to compensate for the reduced availability of natural gas. Increased use of alternative fossil fuels such as oil or coal generally would result in higher emission rates of nitrogen oxides (NO_x) and sulfur dioxide (SO_2) than would be the case with natural gas. To comply with current air emission regulations, emission control technologies could be required that could limit the economic viability of projects using alternative fuels. Conversely, increased development of renewable sources of energy such as wind and solar could be developed, which would result in lower emission rates for NO_x and SO_2 than would be the case with alternative fuels.

[2] The natural gas pipeline infrastructure in this county was designed to transport gas from the production fields to the consumers. The flow of the interstate pipeline system in the eastern half of the country is for the most part west to east and south to north. This means that if an LNG terminal were constructed along the East Coast that gas could not be transported to the Midwest on the existing pipeline system without a major redesign of the system.

Alternatives to the Coast Guard Action

Similar to the no action alternative to the FERC proposed action, the no action alternative for the Coast Guard would avoid any project related environmental effects in the waterway; however, it would also prevent LNG vessels from delivering LNG to the proposed an import terminal and the project objectives would not be met.

If the Coast Guard postpones issuance of an LOR pending further analysis or study, the effect is expected to be similar to FERC postponing its action. That is, although it is speculative to predict the resulting effects, postponing issuance of an LOR may lead to Sempra deciding to delay its entire project.

A reasonable alternative to the Coast Guard action of issuing a LOR which finds the waterway suitable for LNG vessel traffic with certain conditions discussed on the previous page is to issue an LOR without any conditions. This would avoid the environmental effects related to any moving safety and/or moored vessel security zones, or other related LNG safety and security activities, which the Coast Guard would determine to be necessary prior to the commencement of LNG vessels transiting the waterway. We are unable to quantify the impacts at this time due to uncertainty in the scope, frequency, prevailing maritime security levels, and the number of resources that would be dedicated on a recurring or episodic basis; however, we do not anticipate any significant environmental impacts. The Coast Guard will ensure the appropriate NEPA environmental documentation for such actions is completed prior to the commencement of these activities. Also, the Coast Guard will cooperate in any required NEPA environmental analysis initiated by another agency for projects related to the introduction of LNG vessels such as any prerequisite channel deepening or dredging by the COE.

3.2 LNG TERMINAL FACILITY ALTERNATIVES

There are four existing onshore terminals in the continental U.S. (Everett, Cove Point, Elba Island, and Lake Charles) and one existing offshore project (Energy Bridge Gulf of Mexico). In addition, in the general project area (Louisiana and Texas), we are aware of 18 LNG projects. These projects include: two onshore terminals that are under construction (Sabine Pass and Freeport); seven approved but not yet constructed onshore and offshore LNG projects (Cameron, Port Pelican, Golden Pass, Vista del Sol, Ingleside, Gulf Landing, and Cheniere Corpus Christi); two expansions (Lake Charles and Freeport Phase II); and seven proposed onshore and offshore LNG projects, (including the proposed Project). **Table 3.2-1** provides a summary of the major environmental characteristics of these projects that are discussed further in the following sections. **Figure 3.2-1** shows the five existing terminals, and the other approved and planned projects in the Gulf of Mexico.

In addition to these existing, approved, and proposed LNG projects, one other planned LNG project has been announced for the Gulf Coast region. Preliminary information on this facility is provided below:

- In late September 2004, it was announced that the Port of Galveston approved a 3-year option on a 35-year lease agreement with British Petroleum Energy to develop an LNG terminal on about 185 acres of land and water at Pelican Island, Texas, about 5 miles from the center of Galveston. Known as the Bay Crossing Project, the facility would have a send-out capacity of 1.2 Bcf/d.

Because of limited information available on this LNG project, it has not been included in our analysis.

By connecting with Transco's Zone 3, the proposed Project would serve markets that are currently served by the pipeline infrastructure, which extends north and east from natural gas supplies in the Gulf of Mexico through Louisiana to the Northeast and Midwest. Transco's Zone 3 has interconnects with most of the major interstate pipelines that run from the Gulf of Mexico to markets in the Northeast and

TABLE 3.2-1

Summary of Environmental Characteristics of Planned or Approved Onshore and Offshore LNG Terminal Facilities in the Gulf of Mexico

	Property Size (acres)	Site Size (acres)	Existing Land Use	Adjacent Land Use[a]	Wetlands Temporarily Affected within LNG Terminal Site (acres)	Wetlands Permanently Affected within LNG Terminal Site (acres)	Dredging Required (million yd^3)	Associated Nonjurisdictional Facilities	Residences within 0.5 mile of Property Line (number)	Onshore Sendout Pipeline (miles)	Offshore Sendout Pipeline (miles)
ONSHORE LNG TERMINAL PROJECTS											
Sabine Pass, TX/LA:											
Sabine Pass	568	236.6	DMPA	DMPA, O	8.8	47.7	4.5	None	0	16	NA
Golden Pass	477	205	DMPA	DMPA, O	1.4	40.4	5.7	10 miles - power	17	122.5[b]	NA
Port Arthur	2,900	198	DMPA	DMPA, O	NA	82.5	6.7	23 miles – power 3 miles – highway relocation	0	73	NA
Calcasieu Lake, LA:											
Lake Charles	395	125	I	I, A, R	None	None	0.07	None	3	22.8	NA
Cameron	118.6	100.8	I	I, F, O	67.7	55	2.1	None	0	35.4	NA
Creole Trail	771.6	367.3	R, DMPA, I	I, O, F	8.5	2.5	4.1	10-inch-diameter water pipeline	0	123.6	NA
Quintana Island, TX:											
Freeport	188	120	O, C/I, P	O, C/I, R, P	22.5	46.9	2.2	2-4 miles - power	9	9.6	NA
Freeport Phase II[c]	38.3	25.1	I	I	0.5	8.2	0.7	Storage field and associated pipelines	9	0	NA
Corpus Christi, TX:											
Vista del Sol	311	288	A, I	I	24.7	24.7	5.8	0.08-mile- power	0	27	NA
Ingleside Energy	1196	82	I	I	0	4.5	3.7	None	0	26	NA
Cheniere Corpus Christi	772	366	I	I	12.4	10.7	4.4	1.6-mile- power 1.6-mile- water 0.7 mile – pipeline relocation	0	23	NA
Port LaVaca-Point Confort, TX:											
Calhoun	88.9	88.9	I	W, I	0	0	4.2	0.8-mile natural gas liquids pipeline 0.2-mile - power	0	27	N/A
OFFSHORE LNG TERMINAL PROJECTS											
Energy Bridge GOM	NA	0	W	W	NA	NA	NA	NA	NA	0	5.3
Port Pelican	NA	2[d]	W	W	NA	NA	NA	NA	NA	0	42.6

TABLE 3.2-1

Summary of Environmental Characteristics of Planned or Approved Onshore and Offshore LNG Terminal Facilities in the Gulf of Mexico

	Property Size (acres)	Site Size (acres)	Existing Land Use	Adjacent Land Use[a]	Wetlands Temporarily Affected within LNG Terminal Site (acres)	Wetlands Permanently Affected within LNG Terminal Site (acres)	Dredging Required (million yd^3)	Associated Nonjurisdictional Facilities	Residences within 0.5 mile of Property Line (number)	Onshore Sendout Pipeline (miles)	Offshore Sendout Pipeline (miles)
Gulf Landing	NA	12.6[d]	W	W	NA	NA	NA	NA	NA		75.6
Compass Port	NA	31[d]	W	W	NA	NA	NA	NA	NA	5	27
Pearl Crossing	NA	4[d]	W	W	NA	NA	NA	NA	NA	65	106
Main Pass Energy	NA	0	W	W	NA	NA	NA	NA	NA	5.1	192
Beacon Port	NA	Unknown[d]	W	W	NA	NA	NA	NA	NA	0	46

(a) DMPA = Former Dredge Material Placement Area; O = Open; C = Commercial; I = Industrial; F = Forest; A = Agriculture, R = Residential; W = Water, P= Park
(b) Total includes 42.8 miles of looping.
(c) Acreages shown are for newly disturbed areas associated with Phase II; they do not include areas disturbed by the original project.
(d) Does not include land impacts associated with construction of the GBSs.
NA Not Applicable.

Non-Internet Public

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Figure 3.2-1

Public access for the above information is available only through the Public Reference Room, or by e-mail at public.referenceroom@ferc.gov.

Midwest. According to the EIA, the Gulf of Mexico has provided most of the natural gas consumed in the U.S. and accounted for 19 Bcf/d to these markets in 2001. As reserves decline in the Gulf of Mexico, this capacity would become available to transport LNG. Therefore, for this alternatives analysis, we did not consider proposed or planned projects in the Northeast or on the West Coast of the U.S., or projects outside of the U.S., because these projects would serve different regional (or niche) markets and could not make use of existing infrastructure that has been developed to transport natural gas from the Gulf to U.S. markets. Further, based on a recent study prepared by Louisiana State University (LSU) (LSU 2004), there is adequate market demand in Louisiana and the U.S. markets served by the existing Gulf infrastructure to support the proposed Project and other planned LNG projects in the Gulf of Mexico area, as well. So, with the exception of existing or planned LNG terminals, we had no compelling reason to evaluate alternative sites in other geographic areas.

3.2.1 Use of Other Existing, Approved, or Planned Onshore LNG Terminals

Since one of the purposes of the proposed Project is to provide facilities that would allow LNG from worldwide sources to be imported, stored, and delivered into the existing U.S. pipeline infrastructure, we considered expansion of the four existing onshore terminals and the existing deepwater port in the U.S. as well as those LNG projects that are approved or proposed along the Texas/Louisiana coastline of the Gulf of Mexico. Although expansion of these existing facilities or planned facilities could make it unnecessary to construct all or part of the Port Arthur LNG Project, significant modification of these existing facilities may be required that also would result in environmental impacts.

The Port Arthur LNG Project, including Phase I and Phase II, would ultimately provide facilities that would allow import of LNG from ships with capacities up to 250,000 m^3, storage capacity of 960,000 m^3, and transfer of 3.0 Bcf/d of vaporized natural gas for delivery via the proposed pipelines. Sempra estimates that its terminal would be capable of unloading 360 ships per year upon completion of Phase II.

Table 3.2.1-1 summarizes the current and planned send-out capacities of the four existing and eight approved onshore LNG import terminals that provide unloading, storage, and delivery services in the U.S. For any of these existing or approved facilities to meet the proposed Project objectives, the facility would need to have sufficient, uncommitted storage and send-out capacities to meet the requirements of Sempra's proposal.

The proposed Project location in the Gulf Coast region would take advantage of available existing pipeline infrastructure with access to the vast interstate and intrastate markets in the U.S. Historically, this infrastructure has provided up to 19 Bcf/d to Louisiana, and U.S. markets, including Chicago, New York, and Boston (EIA 2001). As shown in **table 3.2.1-1**, none of the existing or approved LNG import terminals have sufficient available capacity to accommodate the additional 3.0 Bcf/d ultimately proposed by Sempra without further expansion of their facilities. In addition, Elba Island, Cove Point, and Everett were built to mainly serve the local markets (southeast, mid-Atlantic, and New England, respectively). Because of their location and the existing infrastructure, any additional LNG delivered to these three existing import terminals could only serve a limited portion of the U.S. market. Also, the location and existing infrastructure would limit Weaver's Cove's service area to the northeast. However, seven of the eight remaining import terminals (Lake Charles, Cameron, Sabine Pass, Corpus Christi, Vista del Sol, Golden Pass, and Ingleside) are (or would be) connected to the existing interstate pipeline system in a location that could serve a much wider market. As such, these seven facilities would best meet the purpose of the Project. The eighth, Freeport, would be connected to the Texas intrastate pipeline system; however, it could be expanded to connect to the interstate market in a location that could serve a wide market. Therefore, we have eliminated Elba Island, Cove Point, Distrigas, and Weaver's Cove from further consideration. Lake Charles, Cameron, Freeport, Sabine Pass, Corpus Christi, Vista del Sol, Golden Pass, and Ingleside are discussed below.

TABLE 3.2.1-1

Existing and Approved Onshore LNG Facilities in the U.S.

Operator/LNG Import Terminal	County/Parish, State	Maximum Capacity (Bcf/d)	Percent Committed
Distrigas of Massachusetts Corp. – Everett	Middlesex, MA	1.1[a]	100
Dominion Cove Point LNG, LP – Cove Point	Calvert, MD	1.0[a]	100
Southern LNG, Inc. – Elba Island	Chatham, GA	1.0[a]	100
Trunkline LNG Company LLC – Lake Charles	Calcasieu, LA	1.3[a]	100
Cameron LNG LLC – Cameron[b]	Cameron, LA	1.5	Unknown
Freeport LNG Development LP – Freeport[b]	Brazoria, TX	4.0[a]	Unknown[c]
Cheniere LNG-Sabine Pass[b]	Cameron, LA	2.6	100
Corpus Christi LNG LP - Cheniere Corpus Christi[b]	San Patricio, TX	2.6	Unknown
Vista del Sol LNG Terminal LP – Vista del Sol[b]	San Patricio, TX	1.0	Unknown
Weaver's Cove Energy LLC – Weaver's Cove[b]	Bristol, MA	0.8	Unknown
Golden Pass LNG LP – Golden Pass[b]	Jefferson, TX	2.6	Unknown
Ingleside Energy Center LLC – Corpus Christi[b]	San Patricio, TX	1.0	Unknown

[a] Maximum capacity includes planned expansion.
[b] Recently approved LNG terminals.
[c] The original capacity (1.5 Bcf/d) is fully subscribed. It is unknown how much of the planned expansion is committed.

3.2.1.1 Lake Charles LNG Terminal

The Lake Charles LNG import terminal is the largest operating LNG import facility in the U.S. It is located approximately 45 miles northeast of the Project on the northeast side of the Calcasieu Lake in Calcasieu Parish, Louisiana, and is owned by Southern Union and operated by Trunkline LNG Company LLC. The Commission approved expansions of the Lake Charles Terminal on December 18, 2002, and March 18, 2003. These expansions were amended again and that amendment was approved by the Commission on October 27, 2003. The expansion, as amended, includes adding a second berth, a new 880,000-barrel LNG storage tank (in addition to the three existing 600,000 barrel storage tanks) and additional pumps, vaporizers, and appurtenant facilities. The terminal is capable of unloading about 175 LNG ships per year. In February 2004, applications were filed to further amend the expansion project to increase send out capacity. This would involve adding additional vaporizers and pumps, facilities to increase the capabilities to unload LNG vessels from the second dock, and a loop of the existing pipeline to increase the take-away capacity from the terminal.

After the expansion work is completed, the Lake Charles LNG terminal would not have adequate space within its 125-acre fenced site to accommodate the storage tanks and send-out facilities associated with the delivery volumes for the proposed Project. Because the terminal is 100 percent committed, further expansion outside the existing fence line would be needed. Expansion potential at this site is limited by existing or planned industrial facilities so the Lake Charles LNG terminal cannot be considered a practical alternative.

3.2.1.2 Cameron LNG Terminal

Cameron LNG LLC plans to construct and operate the Cameron LNG import terminal on the west side of the Calcasieu River ship channel, southwest of the Lake Charles LNG terminal near Hackberry, Cameron Parish, Louisiana. It will consist of a ship unloading slip with two berths, three 160,000 m^3 LNG storage tanks, pumps, vaporizers, appurtenant facilities, and a 35.4-mile-long, 36-inch-diameter natural gas send-out pipeline. The marine terminal will be capable of unloading 210 LNG ships per year. The proposed facilities will transport up to 1,500,000 dekatherms per day (approximately 1.5 Bcf/d) of imported natural gas to interstate pipeline markets. Although the terminal is not constructed, Cameron

LNG has recently proposed to add a fourth LNG storage tank that would increase the send-out from the terminal to 2.65 Bcf/d, if approved. However, since the output from the Port Arthur LNG terminal would be between 1.5 and 3.0 Bcf/d, the additional 1.1 Bcf/d potentially available at the expanded Cameron LNG terminal would be insufficient to meet the needs of the Port Arthur LNG Project and additional facilities would be required. For this reason, we have eliminated this alternative from further consideration.

3.2.1.3 Freeport LNG Terminal

On June 16, 2004, the Commission approved the Freeport LNG Project as proposed by Freeport LNG Development LP. The terminal is under construction at this time. The terminal will consist of a single LNG ship berth capable of unloading up to 200 ships per year, two LNG storage tanks, and 9.6 miles of 36-inch-diameter send-out pipeline with a nominal output of 1.5 Bcf/d. The LNG terminal will occupy about 120 acres of land within an approximate 188-acre site on Quintana Island near the City of Freeport, Brazoria County, Texas, and will disturb about 69.4 acres of coastal marsh. The project is presently 100 percent committed. On May 26, 2005, Freeport LNG filed an application to expand the terminal by adding a second berth and another LNG tank, increasing the capacity by 2.5 Bcf/d. A portion of this additional capacity is already committed.

We do not believe that the Freeport LNG Terminal is a viable alternative to the Port Arthur LNG Project. The Freeport LNG terminal was originally designed to only serve the Texas intrastate market, in the Freeport area. All of Freeport's authorized capacity is subscribed through binding agreements with customers. Thus, Freeport, as authorized, could not handle the additional volumes proposed for the Calhoun LNG Project. At this time it is unknown if the Freeport LNG terminal would have excess capacity as a result of proposed its expansion. However, since the proposed expansion is only 2.5 Bcf/d, a portion of which is already committed, there would not be sufficient excess capacity (up to 3 Bcf/d) to meet Sempra's proposed output. In addition, there is not sufficient space at the Freeport terminal site to construct an additional expansion to meet Sempra's requirements.

3.2.1.4 Sabine Pass LNG Terminal

The Sabine Pass LNG Project (Cheniere Energy, Inc.) was approved by the Commission on December 21, 2004. It is currently under construction. The terminal will be located to the east of Sabine Pass, Texas, on the eastern side of the Port Arthur Ship Canal in Cameron Parish, Louisiana. The project will consist of three single containment 160,000 m^3 LNG storage tanks with secondary containment provided by earthen berms. Two marine berths will be located off the Port Arthur Ship Canal and will be capable of accommodating LNG ships ranging in size from those currently in operation up to 250,000 m^3. The LNG unloading facilities at the berths will be capable of unloading two ships simultaneously (at a reduced rate from the single ship unloading rate of 12,000 m^3/hr). The terminal will have an average send-out capability of 2.6 Bcf/d. Submerged combustion vaporizers (SCV) are the proposed vaporization technology. Natural gas from the vaporized LNG will be sent out from the terminal by a 48-inch-diameter natural gas pipeline approximately 16 miles in length that will allow interconnections with up to seven interstate and intrastate natural gas pipeline systems.

The terminal facility will occupy approximately 236.6 acres of a 568-acre site on the eastern shore of the Sabine Pass Channel and east of the town of Sabine Pass, Texas. The Sabine Pass LNG Project is 100 percent committed. In addition, Cheniere has applied to expand the terminal by adding three additional tanks for an additional capacity of 1.4 Bcf/d. In order to meet its own output requirements, including the expansion, along with the additional output required by the Port Arthur LNG Project, Sabine Pass would have to be expanded by adding at least one more berth and additional LNG storage tanks. It is unlikely that the site could accommodate the additional berth and three to six LNG tanks that

would be needed to import and transport an additional 3.0 Bcf/d of natural gas. We analyzed alternative berth locations for the Sabine Pass LNG Project. The Sabine Pass pilots found one alternative berth location unsuitable because it could require the blocking of Sabine Pass Channel for longer periods and the second site encroached onto property that is not available for sale or lease. An alternative tank site we evaluated also would have been on the property that is not available. For these reasons, we eliminated this alternative from further consideration.

3.2.1.5 Corpus Christi LNG Terminal

The Cheniere Corpus Christi Project (Docket Nos. CP04-37, CP04-44, CP04-45, and CP04-46), as proposed by Corpus Christi LNG LP (an affiliate of Cheniere Energy, Inc.), was approved by the Commission on April 13, 2005. The project will consist of two LNG ship berths capable of unloading up to 300 ships per year, three LNG storage tanks, and 23 miles of 48-inch-diameter send-out pipeline with a nominal output of 2.6 Bcf/d. The LNG terminal will occupy about 366 acres of a total of approximately 722 acres of land and water at a site located east of Portland, San Patricio County, Texas, on La Quinta Channel on the northern shoreline of Corpus Christi Bay. The site is situated immediately west of the existing Sherwin Alumina Company plant.

While this terminal could be expanded by adding additional berths and LNG storage tanks, it is unlikely that the site could accommodate the additional two berths and six LNG tanks that would be needed to import and transport an additional 3.0 Bcf/d of natural gas. Further, an additional 180 to 360 LNG ships per year may be difficult for the La Quinta Channel and port to accommodate. Additionally, this site would not meet the Project objective of connecting to multiple interstate pipeline systems in Transco's Zone 3 and, as such, is not a viable system alternative to the Port Arthur LNG Project. For these reasons, we eliminated this alternative from further consideration.

3.2.1.6 Vista del Sol LNG Terminal

The Vista del Sol Project (Docket Nos. PF04-3, CP04-395-000, CP04-405-000, CP04-406-000, and CP04-407-000) as proposed by Vista del Sol LNG Terminal LP and Vista del Sol Pipeline LP (affiliates of ExxonMobil Corporation), was approved by the Commission on June 15, 2005. It will consist of two LNG ship berths, three LNG storage tanks, and approximately 25 miles of 36-inch-diameter send-out pipeline. The three LNG storage tanks will have a nominal output of 1 Bcf/d. The marine terminal will be capable of receiving up to 100 LNG ships per year, or the equivalent of about one LNG tanker visiting the terminal every 4 days. The LNG terminal will be located on approximately 288 acres within a 311-acre site between the communities of Ingleside and Gregory, San Patricio County, Texas, and adjacent to the Sherwin Alumina plant to the north and south, and the Oxy Generator/Oxy Chemical and DuPont plants to the east. The approved site is situated on La Quinta Channel on the northern shoreline of Corpus Christi Bay with the Cheniere Corpus Christi LNG Project to the west and the Ingleside Energy Center LNG Terminal Project to the east. The terminal will be designed to accommodate further expansion that would include an additional berth and two more LNG tanks. The expanded facility would be capable of unloading up to 200 LNG ships with a nominal send-out capacity of 2 Bcf/d and peak capacity of 2.7 Bcf/d. However, such expansion is not proposed at this time, and it would not be enough to accommodate the proposed final volumes of the proposed facility.

While this terminal could be expanded by adding additional berths and LNG storage tanks, it is unlikely that the site could accommodate the additional two berths and six LNG tanks that would be needed to import and transport an additional 3.0 Bcf/d of natural gas. Further, an additional 180 to 360 LNG ships per year may be difficult for the La Quinta Channel and port to accommodate. Also, like Cheniere's Corpus Christi Project, this site would not meet the Project objective of connecting to multiple interstate

pipeline systems in Transco's Zone 3 and, as such, is not a viable system alternative to the Port Arthur LNG Project. For these reasons, we eliminated this alternative from further consideration.

3.2.1.7 Golden Pass LNG Terminal

The Golden Pass LNG Project (Docket Nos. PF04-1, CP04-386-000, CP04-400-000, CP04-401-000, and CP04-402-000), as proposed by Golden Pass LNG LP and Golden Pass Pipeline LP (affiliates of ExxonMobil Corporation), was approved by the Commission on June 30, 2005. It will be constructed in two phases and will ultimately consist of two ship berths, five LNG storage tanks, two 36-inch-diameter send-out pipelines (one approximately 78 miles long and one approximately 43 miles long), and a 1.8-mile-long lateral. The first phase (three LNG storage tanks) will have a nominal output of 1 Bcf/d, increasing to up to 2.6 Bcf/d when all five storage tanks are in operation. One LNG tanker will visit the terminal every 4 days in the first phase, increasing to one tanker every 2 days in the second phase. The LNG terminal will be located on approximately 298 acres within a 477-acre site on the Port Arthur Ship Canal, about 2 miles northeast of Sabine, Jefferson County, Texas, and about 1.5 miles southeast of the terminal for the proposed Project. This project was issued a PF docket in our pre-filing environmental review process,[3] and the final EIS for this project was issued in June 2005.

The Golden Pass site is probably large enough to accommodate the additional LNG tanks and could probably accommodate the additional berths and LNG ships. However, this site would not allow for the Project objective of connecting to multiple interstate pipeline systems in Transco's Zone 3 and the takeaway capacity (looping pipeline or adding compression) would need to be increased because the proposed pipeline system is only designed for the Golden Pass Project's proposed send out volumes. For these reasons, we eliminated this alternative from further consideration.

3.2.1.8 Ingleside Energy Center LNG Terminal

The Ingleside Energy Center LNG Project (Docket No. PF04-9, CP05-13-000, CP05-11-000, CP05-12-000 and CP05-14-000), as proposed by Ingleside Energy Center LLC and San Patricio Pipeline, LLC (affiliates of Occidental Energy Ventures Corp.), was approved by the Commission on July 21, 2005. It will consist of one ship berth, two LNG storage tanks, a natural gas liquids extraction facility, and approximately 26 miles of 26-inch-diameter pipeline with interconnections to nine existing interstate and intrastate pipelines. Vaporization heat will be provided by waste heat from the adjacent chemical manufacturing process. The project will have an output of 1 Bcf/d and unload up to 140 LNG ships per year. The approved site is located on an 82-acre site adjacent to Occidental's chemical manufacturing facility west of Ingleside, San Patricio County, Texas, on LaQuinta Channel on the northern shoreline of Corpus Christi Bay.

While this terminal could be expanded by adding additional berths and LNG storage tanks, it is unlikely that the site could accommodate the additional two berths and six LNG tanks that would be needed to import and transport an additional 3.0 Bcf/d of natural gas. Further, an additional 180 to 360 LNG ships per year may be difficult for the La Quinta Channel and port to accommodate. Again, like the other two approved Corpus Christi projects, this site would not meet the Project objective of connecting to multiple interstate pipeline systems in Transco's Zone 3 and, as such, is not a viable system alternative to the Port Arthur LNG Project. For these reasons, we eliminated this alternative from further consideration.

[3] This process provides a PF docket number and allows for early stakeholder involvement by the applicant, FERC, regulatory agencies, and the public to allow for early issue identification and resolution, and a coordinated project design process.

3.2.1.9 Proposed Onshore LNG Terminals Under Review

We are currently aware of two other proposed onshore LNG terminal projects along the Texas and Louisiana Gulf of Mexico shorelines. These are summarized in **table 3.2.1.9-1** and described briefly below. Both of these projects would be capable of importing, storing, and vaporizing LNG for send-out to the existing natural gas pipeline system.

TABLE 3.2.1.9-1

Proposed Onshore LNG Facilities Under Review in Texas and Louisiana

Operator	Project	County, State	Capacity (Bcf/d)
Cheniere LNG	Creole Trail LNG	Cameron, LA	3.3
Gulf Coast LNG Partners	Calhoun LNG Project	Calhoun, TX	1.0

Cheniere Creole Trail Project

The Creole Trail Project (Docket Nos. CP05-357-000, CP05-358-000, CP05-359-000, CP05-360-000, CP05-357-001), as proposed by Creole Trail LNG, L.P. and Cheniere Creole Trail Pipeline Company, would consist of two marine berths, four LNG storage tanks, and a total of 123.6 miles of pipeline. The pipeline system includes: 25.3 miles of dual, parallel, and adjacent 42-inch-diameter pipeline; 91.5 miles of dual, parallel, and adjacent 42-inch-diameter pipeline; and 6.8 miles of 20-inch-diameter pipeline (Hackberry Lateral) that would extend across Cameron, Calcasieu, Beauregard, Allen, Jefferson Davis, and Acadia Parishes, Louisiana. The LNG terminal, designed to provide 3.3 Bcf/d of send-out capacity, would be located on a 1,463-tract of land in Cameron Parish, Louisiana, west of the Calcasieu Ship Channel and northwest of Monkey Island. This project was filed on May 23, 2005. A Draft EIS was issued for this project on December 16, 2005.

Calhoun LNG Project

The Calhoun LNG Project (Docket Nos. CP05-91-000 and CP05-380-000), as proposed by Calhoun LNG, L.P. (CLNG) (a wholly owned subsidiary of Gulf Coast LNG Partners, L.P.) and Point Comfort Pipeline Company, L.P. (an affiliate of CLNG), would consist of a single marine berth, two LNG storage tanks, and 27 miles of 30-inch-diameter send-out pipeline with a designed output capacity of 1.0 Bcf/d. The project also would include a 0.24-mile-long, 8-inch-diameter lateral and a 0.22-mile-long, 12-inch-diameter lateral. The LNG terminal would occupy about 98 acres of land and water at the Port of Port Lavaca – Point Comfort, Calhoun County, Texas, on man-made land created by dredged material placement. Applications were filed with FERC on March 8, 2005 for the terminal and June 10, 2005, for the pipeline.

3.2.1.10 Conclusions

Sempra is proposing a facility that would have the ability to unload, store, and deliver up to 3.0 Bcf/d of imported LNG directly into the interstate and intrastate pipeline network that exists in the Texas and Louisiana Gulf Coast region. None of the existing, approved, or proposed onshore LNG terminal facilities could handle the additional volumes proposed by Sempra without significant expansion and the associated environmental impact. This would include:

- adding one or possibly two ship berths;
- increasing the number of inbound and outbound ships by 180 to 360 ships per year;
- adding three to six LNG tanks; and

- increasing the capacity from the terminal to the interstate pipeline system by construction of additional send-out pipeline.

The Corpus Christi sites are likely too small to accommodate a third or fourth berth and an additional three to six LNG tanks. Further, an additional 180 to 360 LNG ships per year may be difficult for the La Quinta Channel and port to accommodate. Additionally, the Corpus Christi sites would not meet the Project objective of connecting to multiple interstate pipeline systems in Transco's Zone 3 and, as such, are not viable system alternatives to the Port Arthur LNG Project. The Port Arthur Ship Canal sites are probably large enough to accommodate the additional LNG tanks and could probably accommodate the additional berths and LNG ships. However, takeaway capacity would need to be increased because the proposed pipelines are only designed for the proposed send out volumes. The Creole Trail Project likely could accommodate the additional berths, tanks, and ships, but takeaway capacity would need to be increased because the proposed pipelines are only designed for the Creole Trail Project's proposed send out volumes. The Calhoun terminal site would be too small to accommodate the necessary additional facilities. In each case, environmental impacts at an alternative site would be similar to those at the proposed site. Therefore, we do not believe that any of these sites represent a viable system alternative or offer a significant environmental advantage over construction of the Project as proposed, and have eliminated all of them from further consideration.

3.2.2 Use of Other Approved or Planned Offshore LNG Facilities

There is only one existing offshore LNG facility in the U.S., the Energy Bridge Project. In addition, other companies have begun exploring methods of importing LNG into the U.S. through the use of deepwater ports that would avoid many of the perceived environmental and safety issues associated with onshore LNG facilities. As defined in the Deepwater Port Act of 1974, and as amended by the Maritime Transportation Security Act of 2002 to include natural gas, deepwater ports include a fixed or floating structure (other than a vessel) or a group of structures that are located off the coast of the U.S. and that are used as a port or terminal for the transportation, storage, and further handling of oil or natural gas. This legislation requires that the DOT (Maritime Administration) and the USCG regulate the licensing, siting, construction, and operation of deepwater ports for natural gas.

Although only one offshore LNG import facility has been built in the U.S., offshore LNG terminals have been proposed and are under review in the U.S., Australia, West Africa, Taiwan, and Italy. Because of the demand for natural gas and the potential advantages of offshore unloading and vaporization facilities, two other offshore LNG import terminals in the U.S. have been approved and an additional eight are under review (FERC July 2005). The four main offshore technologies under development include:

- regasification vessels where vaporization equipment is installed on LNG ships and the LNG ships are offloaded to a pipeline via a floating buoy and riser system;

- gravity based structures (GBS) where LNG storage tanks, offloading, and vaporization facilities are placed on platforms with foundations that are anchored directly to the seafloor;

- reuse of existing platforms for storage and vaporization facilities; and

- floating storage and regasification units (FSRU) where storage tanks, offloading, and vaporization facilities are placed on a floating structure (or ship) that is moored to the seafloor.

Our review of potential offshore LNG terminal facility locations in the Gulf of Mexico included offshore LNG facilities approved or currently proposed and under review by the USCG as listed in **table 3.2.2-1**

and shown on **figure 3.2-1**. No FSRUs are currently planned for the Gulf of Mexico. These offshore technologies and planned offshore projects are discussed in the following sections.

TABLE 3.2.2-1

Operational, Approved, and Proposed Offshore LNG Facilities Under Review in the Gulf of Mexico

Operator	Project	Type of Facility	Capacity (Bcf/d)	Status
Excelerate Energy LLC (formerly El Paso Energy Bridge Gulf of Mexico LLC)	Energy Bridge Gulf of Mexico Project	Regasification vessel	0.5	[a]
Port Pelican LLC	Port Pelican Project	GBS	1.6 to 2.0	[b]
Gulf Landing LLC	Gulf Landing Project	GBS	1.0 to 1.2	[b]
Compass Port LLC	Compass Port Project	GBS	1.0	[c]
Freeport-McMoRan Energy LLC	Main Pass Energy Hub Project	Platform reuse	2.5 to 3.1	[c]
ConocoPhillips	Beacon Port Clean Energy Terminal Project	GBS	1.5	[c]

[a] Operational.
[b] Approved.
[c] NEPA review in process.

3.2.2.1 LNG Regasification Vessels

Several companies are investigating the feasibility of installing vaporization equipment on conventional LNG ships. These ships would be able to dock at a floating unloading buoy and riser system where LNG could be vaporized onboard the LNG ship and injected directly into offshore pipelines that interconnect with onshore natural gas transmission systems. The vaporization equipment located on the ships would use technology that is similar to land-based LNG terminals. The Energy Bridge Gulf of Mexico Project is the only project of this type currently in existence or planned in the Gulf of Mexico.

Energy Bridge Gulf of Mexico

In December 2002, El Paso Energy Bridge Gulf of Mexico, LLC submitted an application (Docket No. 14294) for a Deepwater Port License to the USCG and the Administrator of the Maritime Administration to own, construct, and operate a deepwater port approximately 116 miles off the coast of Louisiana in the Gulf of Mexico. The USCGs final EIS for this project was issued in December 2003, and the final license was issued in April 2004. Excelerate Energy LLC acquired rights to the project in December 2003 and has begun manufacturing various components of the facility, including the construction of three regasification vessels. On March 17, 2005, the project received its first LNG delivery.

The Energy Bridge Gulf of Mexico system uses new specially designed LNG tankers (El Paso Energy Bridge Vessels or EPEBVs) with onboard regasification equipment to directly input natural gas into the pipeline grid. This system includes a submerged turret loading (STL) buoy, a flexible riser pipe to carry the natural gas from the STL buoy to a subsea manifold, a metering platform, and about 5.3 miles of undersea pipelines to connect to the existing Sea Robin and Bluewater offshore pipeline systems.

When an EPEBV reaches the buoy port, it will retrieve and connect to the STL buoy and the mooring system. When not in use, the STL buoy will remain submerged about 80 feet below the sea surface in about 298 feet of water. The STL buoy will be secured to the EPEBV and function as both the mooring system and the offloading mechanism for transferring the natural gas. After the connection procedures are completed, the LNG will be vaporized using the onboard regasification equipment and natural gas will

be transferred to the pipeline system through the STL buoy. It is anticipated that each EPEBV will have a transport capacity of about 138,000 m^3 of LNG. Under optimal operating conditions, each EPEBV will have the capability to regasify and unload a maximum of 0.69 Bcf/d of natural gas for an average natural gas delivery rate of about 0.5 Bcf/d.

Our review of the Energy Bridge Gulf of Mexico Project indicates that it would be unable to accommodate the additional 1.5 to 3.0 Bcf/d required to meet the throughput volumes proposed by Sempra without the addition of five or more STL buoy ports. Further, because there is no storage component to this system, a significant number of EPEBVs would be required to provide continuous service to the STL buoy ports to avoid any disruption in service. The EPEBVs are unique and the first of their kind. None of the existing LNG worldwide fleet can provide onboard vaporization capability, so increased use of this technology would require new ships. Three EPEBVs are under construction for this project alone. To provide comparable delivery volumes to replace the Port Arthur LNG Project, five or more new EPEBVs would need to be constructed.

3.2.2.2 Gravity Based Structures

The use of GBS would be limited to areas with suitable substrates and where water depths range from 55 to 85 feet. Safety zones surrounding these types of offshore LNG facilities would exclude certain ship traffic from operating in the vicinity and the GBS would need to be located outside of shipping lanes. Although designs would vary depending on site-specific circumstances, offshore GBS facilities could be built to store between 290,000 and 400,000 m^3 of LNG with send-out capacities ranging between 0.8 and 2.8 Bcf/d.

In addition, because a GBS is fabricated in a graving dock (or dry dock) at an onshore location, the GBS design is not completely devoid of adverse onshore impacts, such as impacts to wetlands and other sensitive land uses. The onshore graving dock must be of sufficient size and depth to fabricate the GBS, and in an area with access to a 45- to 50-foot-deep channel to float the GBS. This requires that the graving dock area be large enough to accommodate the GBS and be excavated deep enough to allow the GBS to be floated out after construction is completed. One side of the graving dock must be directly adjacent to a waterbody, and that side must be removable to flood the dock and float the GBS so that it may be towed from the dock to its final destination. GBS units for the currently proposed projects range from 210 to 248 feet wide by 500 to 1,110 feet long. The fabrication site for the GBS would require between 50 and 100 acres, and availability of adequate infrastructure to facilitate construction.

Currently, there are two approved and three proposed projects that would use the GBS technology in the Gulf of Mexico.

<u>Port Pelican Project</u>

Port Pelican, LLC (an affiliate of the ChevronTexaco Corporation) received approval in November 2003 and a license in January 2004 from the U.S. Maritime Administration (Docket No. 14134) for its Port Pelican Project, an LNG unloading, storage, and vaporization terminal that would be located about 37 miles offshore from Vermillion Parish, Louisiana, and about 95 miles southeast of the Project. The vaporized natural gas will be transported into the interstate natural gas pipeline system at Henry Hub by constructing a new 42.6-mile-long, 42-inch-diameter pipeline to the existing Tiger Shoal "A" platform, then using the existing pipeline infrastructure to Henry Hub. The Port Pelican Project will have the capability of vaporizing and transporting up to 2.0 Bcf/d of natural gas to U.S. markets.

The Port Pelican Project will use two GBSs for the offshore terminal that will be anchored to the sea bottom in 83 feet of water. Each GBS will consist of a large concrete structure that will be specially

designed and fabricated to provide a safe and secure foundation for the LNG tanks, and a supportive deck for vaporization equipment and crew quarters. Berthing facilities (mooring and breasting dolphins and unloading platforms) will be able to accommodate two LNG ships, one on either side of the terminal. In June 2004, the USCG announced its intent to prepare an Environmental Assessment for the fabrication of the GBSs and consideration of two alternative onshore sites for fabrication: a preferred site in Port Aransas (174 acres) or an alternate site on Pelican Island in Galveston (67 acres). Because of the scope of this project, an EIS is now under preparation.

As approved, the Port Pelican Project will require two GBSs to provide unloading, storage, and vaporization facilities for 2.0 Bcf/d. An additional two to three GBSs would be required to accommodate the additional 1.5 to 3.0 Bcf/d proposed by Sempra, affecting an additional 150 to 300 acres of shoreline for construction. In addition, while the existing infrastructure (as enhanced by the new 42.6-mile-long Port Pelican pipeline) can accommodate the output from the Port Pelican terminal, it would not be able to accommodate an additional 1.5 to 3.0 Bcf/d at that location. New pipeline requirements could include construction of 45 to 50 miles of onshore and offshore pipeline. Overall, the environmental impact associated with construction of the GBSs on land, combined with construction of additional new offshore and onshore pipelines, likely would be equal to or greater than impacts associated with construction of the proposed Project.

Gulf Landing Project

Gulf Landing LLC (part of the Royal Dutch/Shell Group of Companies) received approval from the USCG in February 2005 for its Gulf Landing Project (Docket No. 16860), an LNG unloading, storage, and vaporization terminal that would be located about 38 miles offshore of Cameron, Louisiana, and about 50 miles from the Port Arthur LNG Project site. The vaporized natural gas would be transported from the proposed facility into the existing interstate natural gas pipeline system through 5 segments of 16- to 36-inch-diameter offshore pipeline totaling about 75.6 miles. The Gulf Landing Project would have the capability of storing up to 180,000 m^3 of natural gas, and vaporizing and transporting up to 1.2 Bcf/d of natural gas to U.S. markets.

The Gulf Landing Project would use 2 GBSs, each approximately 1,100 feet by 248 feet, for the offshore terminal that would be anchored to the sea bottom in about 55 feet of water. Each GBS would consist of a large concrete structure designed and fabricated to provide a secure foundation for the LNG tanks, and a supportive deck for accommodating all of the regasification equipment, utilities, and other related facilities (living quarters, metering, workshops, helicopter access, etc.). Berthing facilities (mooring and breasting dolphins and unloading platforms) would be able to accommodate up to 135 LNG ships per year, ranging in size from 125,000 m^3 to 165,000 m^3. The GBSs would be initially built onshore, towed to the site, and installed on the seabed.

For this project to accommodate the volumes proposed by Sempra, an additional two to three GBSs would be required, affecting between 150 and 300 acres of shoreline for the graving docks. In addition, 75 or more miles of pipelines may be required both onshore and offshore to provide takeaway capacity for the added volumes. As with the Port Pelican Project, the environmental impact associated with construction of the GBSs on land, combined with construction of additional new offshore and onshore pipelines, likely would be equal to or greater than the impacts associated with construction of the proposed Project.

Compass Port Project

In March 2004, Compass Port LLC (a wholly owned subsidiary of ConocoPhillips Company) filed an application (Docket No. 17659) with the USCG for a Deepwater Port License for its Compass Port

Project in the Gulf of Mexico. The project would consist of 2 GBSs, with docking facilities for 1 LNG ship, 2 LNG storage tanks and regasification facilities, located in 70 feet of water, approximately 11 miles south of Dauphin Island and about 15 miles off the coast of Alabama. The project also would involve construction of approximately 27 miles of offshore and 5 miles of onshore[4] 36-inch-diameter send-out pipeline to connect the deepwater port with existing natural gas pipelines near Coden, Alabama. The application was determined to be complete in May 2004. The draft EIS was issued in February 2005, and meetings to take comments on the EIS were conducted in early March 2005.

The generalized dimensions of the entire terminal facility (including the GBSs; regasification, unloading, and living quarters platforms; mooring, berthing, and support structures; and flare tower) would be 1,350 feet by 1,000 feet (31 acres) and anchored in water depth of 70 feet. However, facility structures would occupy only about 6.2 acres. Construction of the two GBSs would require approximately 70 acres of land adjacent to a navigable channel with a minimum depth of 50 feet. Construction is expected to take about 42 months.

To accommodate the volumes proposed by Sempra, this project would require an additional two to three GBSs for the three to six LNG storage tanks and potentially two large diameter pipelines (each 27 miles long) to move the natural gas to shore and interconnects with the existing natural gas pipeline system. Additional environmental impacts associated with an expanded Compass Port facility would include up to 140 acres of land for construction of the GBSs, an offshore facility footprint that would be nearly triple of that proposed (or about 90 acres), and a subsea construction disturbance of approximately 1,300 acres for two 27-mile-long pipelines based on a 200-foot-wide construction right-of-way. Thus, the environmental impact associated with expansion of the Compass Port Project would be similar, if not greater, than the impacts associated with construction of the proposed Project.

Beacon Port Clean Energy Terminal Project

In January 2005, ConocoPhillips announced that Beacon Port LLC (a wholly owned subsidiary of ConocoPhillips) had submitted an application for a Deepwater Port License to the USCG for the construction of a new offshore LNG import, storage, and regasification facility in the Gulf of Mexico. The proposed Beacon Port would be located approximately 56 miles south-southwest of Johnson's Bayou, Louisiana in Minerals Management Service (MMS) Lease Block High Island Area 27. The terminal would consist of two gravity-based structures containing LNG storage tanks, a regasification platform, an offloading platform, docking structures, a flare tower and a personnel living quarters platform. The Port also would consist of a 46-mile pipeline to a proposed riser platform in West Cameron 167 (approximately 29 miles south-southeast of Johnson's Bayou) and three smaller distribution pipelines that would tap into existing offshore pipelines to transport gas to shore. The facility would support an average throughput capacity of 1.5 Bcf/d.

To accommodate the volumes proposed by Sempra, the capacity of this project would need to be approximately doubled, resulting in a minimum of one to two more GBSs in the Gulf of Mexico, and an additional 46 miles of offshore pipeline and roughly 80 miles of onshore pipeline. Environmental impacts would be similar to and, more likely, greater than, those of the proposed Project.

3.2.2.3 Reuse of Existing Oil/Gas/Mining Platforms

This concept involves the conversion of abandoned platforms and associated infrastructure that exist in the Gulf of Mexico for reuse as LNG import, storage, and vaporization terminals. On a conceptual level,

[4] On April 16, 2004, Compass Pass Pipeline LLC filed an application with the FERC (Docket Nos. CP04-114 and CP04-115) to construct and operate 5 miles of onshore pipeline near Coden, Alabama.

reuse of any of these platforms for an LNG receiving and vaporization terminal would require decommissioning of the existing production facilities, installation of mooring and LNG vaporization facilities, and construction of new underwater, pressurized natural gas pipelines with interconnections to existing onshore pipelines. Currently, there is one such project proposed in the Gulf of Mexico.

Main Pass Energy Hub Project

In February 2004, Freeport-McMoRan Energy LLC (a division of McMoRan Exploration Company) (Freeport McMoRan) filed an application (Docket No. 17696) with the USCG for a Deepwater Port License for its Main Pass Energy Hub, an LNG unloading, storage, and vaporization facility that would be located about 37 miles off the coast of Venice, Louisiana, and more than 300 miles from the proposed Port Arthur LNG Project site. The Main Pass Energy Hub Project would make use of existing platforms and other infrastructure in the Gulf of Mexico, including a nearby salt dome for underground storage of up to 28 Bcf/d of natural gas and would have the capability of a peak deliverable volume of 3.1 Bcf/d of natural gas to U.S. markets. The existing offshore platform facility was constructed in 1992 and would be reconfigured to consist of an LNG berth, LNG surface storage of up to 145,000 m^3, vaporization and compression facilities, living quarters, and associated facilities. Approximately 192 miles of offshore[5] pipeline and 5.1 miles of onshore pipeline would be constructed to connect the terminal to the existing pipeline infrastructure. The USCG has begun its environmental review of the project.

As proposed, the Main Pass Energy Hub Project would utilize an existing offshore platform and salt cavern to provide unloading, vaporization, and storage facilities for LNG shipments. This project could accommodate storage of the Port Arthur LNG Project Phase I natural gas volumes (480,000 m^3), but not the proposed Phase II volumes (960,000 m^3), and it may be unable to accommodate the proposed number of LNG ships (up to 360 ships per year) without additional berths, and possibly additional platform construction, or the proposed send-out (1.5 to 3.0 Bcf/d) without construction of additional, or larger, takeaway pipelines.

3.2.2.4 Offshore Site Alternative

It is possible that an offshore LNG terminal with a EPEBV, a FSRU, or a gravity-based design (similar to the Port Pelican, Gulf Landing, or Beacon Port projects) could provide an import service similar to the Port Arthur LNG Project and that suitable sites could be located and developed in the offshore in the Gulf of Mexico. By constructing an LNG terminal offshore, some of the environmental impacts associated with the proposed Port Arthur LNG Project may be avoided (e.g., permanent fill of wetlands and additional ship traffic in the Sabine Pass and Port Arthur Channels). For an offshore site alternative, we considered the technologies using a FSRU or a GBS. The regasification vessel (EPEBV) would not provide LNG storage, which is provided by the LNG tanks for onshore projects, and therefore would not meet the storage requirement objective of the proposed Project. The EPEBV, as well as the FSRU, would need to be located in deeper water to accommodate the STL buoy, thus significantly increasing the length of offshore send-out pipeline and associated environmental impacts. Reuse of existing platforms would involve identifying decommissioned production facilities and determining whether these facilities were appropriate for conversion to import LNG, both of which are beyond the scope of this analysis. Therefore, our consideration of an offshore site alternative for the Project was limited to use of the GBS offshore technology since this technology can be applied in the shallower waters of the Gulf of Mexico, thus requiring fewer miles of connecting pipeline.

[5] On February 27, 2004, Freeport McMoRan filed an application with the FERC (Docket Nos. CP04-68 and CP04-69) to construct and operate 5.1 miles of onshore pipeline near Coden, Alabama.

To determine a reasonable length of offshore and onshore pipeline that would be required, we assumed that an alternative offshore site could be located within water depths from 60 to 80 feet. In the vicinity of Jefferson County, Texas, the 60-foot water depth contour is approximately 35 miles offshore and the 80-foot contour approximately 62 miles offshore (see **figure 3.2.2-1**).

Since the offshore portion of the pipeline would be located in water depths less than 200 feet, the pipeline would need to be buried, using either trenching, jetting, or subsea plowing methods to achieve the required depth of cover. Offshore pipeline construction would be expected to result in various, but temporary, levels of localized turbidity and short-term disruption of benthic habitats during construction.

Once onshore, the pipeline could be routed approximately 5.1 miles directly north to the NGPL pipeline following an existing pipeline corridor across 3 miles of coastal marsh wetlands and 2.1 miles of uplands. It could interconnect with NGPL at that location and then follow the NGPL pipeline corridor 0.8 mile westward through 0.8 mile of coastal marsh wetlands to the SH 87 right-of-way, following the highway 87 right-of-way north-northeastward approximately 2.4 miles, across the Keith Lake Cut, to the currently proposed crossing location of the Port Arthur Ship Canal. From that point, it could follow the proposed route on to the proposed terminus at Transco's Compressor Station 45. Consequently, in order to serve the same markets as Sempra's proposal, the send-out pipeline from an offshore LNG storage and vaporization facility would be about 39 to 66 miles longer (for the 60- and 80-foot depth sites, respectively) than the proposed 73 miles of pipeline.

Although it may be possible to construct an offshore LNG storage and vaporization facility as an alternative to the Port Arthur LNG Project, we do not believe that it is a reasonable alternative. Construction of an offshore alternative would involve a longer pipeline with more overall environmental impact than the proposed pipelines, and, for the GBS technology, it also would require the construction of a graving dock that would impact the shoreline and a permanent onshore facility for terminal support activities. In addition, the evaluation of an offshore facility as an alternative to the Port Arthur LNG Project cannot merely transpose the onshore facility to an offshore location. Rather, it represents a complete redesign of the entire facility such that the feasibility of meeting the operational and economic objectives of the proposal is highly questionable.

3.2.2.5 Discussion of Offshore Alternatives

There are both operational and environmental tradeoffs associated with offshore LNG terminal technology. Offshore LNG terminals need to be located in areas that are away from shipping fairways and operating oil or gas platforms. In addition, a safety zone would be established that would preclude commercial or recreational fishing within a range of between 1,640 and 3,280 feet of an offshore terminal. An offshore terminal must be self-contained, providing its own power, water, communications, and other utilities. This would translate to additional construction and operational costs associated with provision of these utilities; transportation by boat or helicopter of materials, supplies, and workers; and permanent onshore facilities for these terminal support activities. Although specific numbers are not available, preliminary estimates indicate that the construction and operational costs for an offshore terminal are noticeably higher than a typical onshore facility. For a GBS, the tanks are an internal component of the GBS and form the foundation of the offshore structure. These structures, and consequently the tanks, would be designed to withstand the greater natural forces associated with the offshore location and terminal operation. As a result, the capital expenditures for the GBS would be

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Figure 3.2.2-1

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about double the cost of the onshore Port Arthur LNG terminal. In addition, permanent staffing and personnel requirements for the proposed Port Arthur LNG terminal would be about one-fourth that needed for an offshore facility.

An LNG import terminal that is located in an offshore setting would be exposed to the effects of meteorological and oceanographic forces such as high winds, waves, and currents. A key technical issue for the successful operation of an LNG terminal in this environment includes designing the LNG transfer system (i.e., unloading arms) to compensate for the relative motion between the terminal and LNG ship during unloading operations. Although storage and unloading technologies similar to those that would be used with an offshore LNG terminal have been applied for many years at onshore LNG terminals and at offshore petroleum product facilities (LNG Express 2002), the technologies needed to transfer a cryogenic liquid under the harsher conditions in an offshore setting have not been demonstrated. This may be particularly problematic for offloading to a FSRU where the stresses on a transfer system could be even greater than what would be experienced at a stationary GBS or an existing platform. For a GBS, an artificial breakwater must be constructed to protect the docked LNG vessel as well as the terminal itself. This breakwater could be combined with the GBS; however, the GBS must then be much larger to withstand the physical forces of wind, waves, and water currents at the terminal location. This protective function is more easily and economically achieved in a protected harbor onshore.

In general, the offshore terminals would vaporize the LNG using open rack vaporization, where water is withdrawn from the Gulf, used to transfer heat to the LNG, and then discharged back at a lower temperature. This would decrease the water temperature, increase turbidity, and increase dissolved oxygen content in marine waters within about 300 feet of the terminal. Although a GBS terminal could serve as an artificial reef, potentially resulting in some beneficial impacts on the populations of commercial and recreational fish species, the intake structures would impinge or entrain fish eggs or larvae that are floating in nearby waters. However, the EISs prepared for the Energy Bridge Gulf of Mexico and Port Pelican Projects do not anticipate these impacts on fish or fish habitats would result in population-level effects or changes to the biomass of the stocks of any species. Sempra proposes to use shell and tube vaporizers (STVs), which avoid the need for continuous large volume water withdrawal as well as eliminating the need for discharging condensate, as would be required with SCVs.

In addition to considering the potential technical issues and environmental impacts associated with construction and operation of an offshore LNG storage and vaporization facility, we also considered the relative impacts associated with the need to construct an additional send-out pipeline from an offshore site to allow for market deliveries. An offshore alternative to the proposed Project would need to be located a minimum of 35 miles offshore to allow for safe berthing of the LNG ships. Ideally, the costs and environmental impacts associated with constructing a send-out pipeline between an offshore terminal and the interstate pipeline system could be avoided or reduced by connecting to and using existing offshore pipelines that have excess capacity and could transport the gas from offshore waters to interconnection sites onshore in Texas or Louisiana. However, our analysis indicates that it is likely that no one pipeline system could accommodate all of the 1.5 to 3.0 Bcf/d proposed by Sempra and that new pipeline would need to be constructed to multiple interconnects. With the exception of the Energy Bridge Gulf of Mexico Project, which would only deliver up to 0.5 Bcf/d, the other proposed offshore projects would require between 43 and 192 miles of new offshore pipeline. This could be slightly less to significantly more than the 73 miles of onshore pipeline proposed by Sempra.

One of the tradeoffs for the regasification vessel technology is that it requires a dedicated LNG fleet with vaporization equipment on all of the vessels. This fleet does not exist, although at least one ship does and two other EPEBVs are on order for the Energy Bridge Gulf of Mexico Project. Additionally, it would take up to 6 days to unload a ship at a maximum design rate of about 0.5 Bcf/d, and no fixed LNG storage would be provided. Further, since the STL buoy must be located in waters between 130 to 490 feet deep,

this could significantly increase the length of offshore pipeline and associated environmental impacts. Finally, to maintain continuous send-out, two buoys likely would be required to transition between successive ships. With a one STL buoy system, the first ship would have decreased send-out as the cargo tanks are emptied, the ship disconnects, the buoy is lowered, and the ship releases its moorings and departs. The incoming ship then would reverse this procedure before being able to reestablish full natural gas send-out. A two STL buoy system would avoid this disruption.

One of the more significant tradeoffs for the GBS technology is the potential for environmental impacts associated with fabrication of the GBS within a graving dock. The final EIS for the Port Pelican Project indicated that each of the project's two GBS units would be 210 feet wide by 500 feet long. The Gulf Landing Project GBS units are about twice as large. Fabrication of the GBSs would require between 50 and 100 acres of land and adequate infrastructure to move materials and workers to the site. The graving dock also must be located along the shoreline so that, when construction is complete, the GBS can be floated (in water about 45 feet deep) and towed to its final destination. While the level of impact would depend on whether the graving dock is located in an undisturbed or disturbed area, dredging probably would be required because many of the western Gulf Coast channels are 42 feet deep or less, and wetlands may be dredged or filled because the Texas/Louisiana shoreline in the Project area is mostly wetland. There are no existing graving dock facilities in the U.S. of the size needed for a GBS. Fabrication of the GBS outside of the western Gulf Coast area and floating it into the offshore Louisiana/Texas area would increase costs and could potentially interfere with shipping.

3.2.2.6 Conclusions on Offshore Technology

In summary, we conclude that, although offshore technologies provide an alternative means for the import of LNG, the proposed offshore technologies would not provide the same capability as the proposed Port Arthur LNG Project and would likely result in a similar level of (although different) environmental impacts. The proposed Project would provide berthing for LNG ships of up to 250,000 m^3, storage for approximately 480,000 m^3 to 960,000 m^3 of natural gas, a send-out capacity of 1.5 to 3.0 Bcf/d, and 73 miles of pipeline to connect to the existing natural gas infrastructure. In comparison:

- Use of the new specially designed regasification vessels (or EPEBVs) with transport capacities of 138,000 m^3 would provide less delivery capacity, lack LNG storage, and may be less reliable due to transitioning between incoming and outgoing EPEBVs.

- While the GBS terminal is a proven technology for offshore petroleum production, with existing offshore petroleum facilities along the east coast of Canada and in the North Sea, it is not yet a proven technology for the storage and vaporization of LNG. Although an offshore GBS terminal can provide similar storage and send-out capabilities, environmental impacts associated with the graving dock and offshore pipeline (minimum of 35 miles) likely would be similar if not greater than those associated with the proposed Project.

- While a graving dock would not be required for the FSRU, the FSRU would need to be moored in deeper waters (greater than 160 feet) to accommodate a flexible pipeline connection between the FSRU and the send-out pipeline, thus potentially increasing the length of the offshore pipeline. Since it makes use of a floating platform, it typically provides less storage and send-out capacity than a GBS. Depending on the unloading system configuration, the relative motion of two vessels at sea could increase difficulty of cargo transfers, thus affecting overall reliability.

The reuse of existing platforms is limited by the availability of abandoned platforms that can be adapted to accommodate the LNG storage and vaporization facilities and crew quarters, as well as being at sufficient depth to allow for berthing of LNG ships (e.g., over 40 feet).

3.3 ONSHORE LNG TERMINAL SITE ALTERNATIVES

The examination of alternative sites for an LNG terminal typically involves a comprehensive process that considers environmental, engineering, construction, economic, safety, and regulatory factors. The first step includes identification of the most suitable regional area within the U.S. for an LNG terminal based on natural gas demand, existing infrastructure, and other market factors. The second step includes identification of specific ports within the identified region, and the evaluation of these ports to determine if they could accommodate LNG ships while meeting project objectives. The third and fourth steps involve a preliminary assessment of suitable sites within those ports and an evaluation of the most suitable sites to identify the preferred site.

3.3.1 Regional Alternatives

In conducting its site selection review Sempra used siting criteria that incorporated the most important requirements needed for delivery of LNG to the greatest number of regional markets. Sempra's focus was upon existing deepwater ports in order to minimize environmental impacts associated with the development and operation of a new LNG terminal in an undeveloped non-industrialized area. Sempra evaluated multiple ports along the Atlantic and Gulf coasts. Ultimately, Sempra focused its search on three areas: Port Arthur, Texas, and Port Plaquemines and Lake Charles, Louisiana (**figure 3.3.1-1**).

Sempra focused its site selection efforts on these areas because:

- the areas have deep water ports (channel depth 40 feet or greater);
- the ports are near the interstate natural gas pipeline systems;
- the existing pipeline systems have access to multiple regional markets; and
- the areas have low population densities.

We have reviewed Sempra's initial screening process, including criteria, and find that although there are likely developable sites for the import of LNG at the other two areas they evaluated (**figure 3.3.1-1**); none appear to provide a significant environmental advantage over the proposed site. We also conducted our own initial screening of a broader range of regional alternatives east of the proposed site, shown on **figure 3.3.1-2,** summarized in **table 3.3.1-1**, and discussed below.

Potential sites in Florida at Panama City and Pensacola or in Mississippi at Gulfport/Biloxi are in areas where channel depths are less than 40 feet, which is the minimum required for LNG ships (see section 3.3.2). In these areas, additional dredging would be required to increase the depth of the shipping channel, as well as to create the LNG ship berths and maneuvering area. The third site in Florida (Tampa/St. Petersburg) does not have enough takeaway capacity. All three areas in Florida have an additional problem. Since Florida produces only a minor amount of natural gas and is one of the largest consumers of natural gas, the existing pipeline infrastructure in the state was designed to transport natural gas into the state from the Louisiana/Alabama Gulf region, not into the interstate market. If ports in Florida were to be used, either a major new pipeline would be required or the existing system would need to be redesigned to allow the flow of gas out of the state. Therefore, the three areas in Florida and one area in Mississippi (Gulfport/Biloxi) were eliminated from further consideration.

Potential sites at Mobile Bay (Alabama) or Pascagoula (Mississippi) offer less total available takeaway capacity than the proposed site because there are fewer existing interstate pipelines in the Gulf area that flow gas to the Northeast and Midwest. For example, in Alabama, the primary interstate pipeline serving

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TABLE 3.3.1-1

Initial Screening Analysis of Gulf Coast Sites East of the Project Area

Description	Screening Criteria[a]	Florida - Tampa Bay/St. Petersburg`	Florida - Panama City	Florida - Pensacola	Alabama - Mobile Bay	Mississippi - Pascagoula	Mississippi - Gulfport/Biloxi	Louisiana - Mississippi River - Baton Rouge to Venice	Louisiana - Lake Charles (Calcasieu Pass)
Marine									
Channel Access, including need for dredging	40 feet MLLW	40 feet MLW	32 feet MLW	33 feet MLW	45 feet MLW	45 feet MLW	36 feet MLW	45 feet MLW	40 feet MLW
Maneuvering area	Available	May need to develop	None	None	Can develop	Can develop	None	Can develop	Can develop
Existing volume of marine traffic	Moderate	Moderate	Unknown	Unknown	Moderate	Moderate	Unknown	High	Moderate
Siting									
Existing land use	Industrial or commercial port	Commercial port	Commercial port	Commercial port	Industrial port	Industrial port	Commercial port	Industrial port	Industrial port
Present zoning of the site	Industrial	Industrial	Recreational	Recreational	Industrial	Industrial	Commercial	Commercial and industrial	Industrial
Distance to nearest residences	More than 1 mile	Unknown	Unknown	Unknown	More than 1 mile	More than 1 mile	Unknown	More than 1 mile	More than 1 mile
Distance to nearest public interest area	More than 2,000 feet	Unknown	Unknown	Unknown	More than 1 mile	More than 1 mile	Unknown	More than 1 mile	More than 1 mile
Availability of land	Sites available with at least 200 acres	Available	Unknown	Unknown	Available	Available	Unknown	Available	Available
Existing infrastructure	Available	Available	Available	Available	Available	Available	Available	Available	Available
Probable community support	Neutral or positive	Strongly negative	Strongly negative	Strongly negative	Mixed	Positive	Neutral	Neutral	Positive
Sendout Pipeline									
Distance to existing interstate pipeline system	Less than 50 miles	Less than 50 miles	Less than 50 miles	Less than 50 miles	Less than 50 miles	Less than 50 miles	Less than 50 miles	Less than 50 miles	Less than 50 miles
Availability of takeaway capacity	2.0 Bcf or more	Not sufficient	2.0 Bcf or more	2.0 Bcf or more	2.0 Bcf or more	2.0 Bcf or more	2.0 Bcf or more	2.0 Bcf or more	2.0 Bcf or more

[a] Screening criteria include those attributes that would be considered minimum requirements for siting of an LNG terminal.

northern markets is Transco. In Mississippi, the primary interstate pipelines that move gas north from the Gulf of Mexico are the BP Pipeline (formerly Destin) and Tennessee pipelines. West-east pipelines, which do not serve the northern markets, include the Florida Gas Transmission Company and Gulf South Pipeline Company (Gulf South) pipelines. Takeaway capacity within 70 miles of the proposed site includes two 30-inch-diameter, two 24-inch-diameter, one 16-inch-diameter, and smaller diameter pipelines, with the larger pipelines operated by NGPL, Transco, and Tennessee. Although it is reasonable to assume that, if more takeaway capacity is indeed needed in Alabama or Mississippi, the market would allocate the existing takeaway capacity or the owners of takeaway capacity would be motivated to expand their facilities. However, it also is reasonable to conclude that there is more limited takeaway capacity in these two areas in comparison to the proposed Project, so these two areas were eliminated from further consideration. We note that there are two LNG terminals proposed for the Pascagoula area, Casotte Landing and Gulf LNG Energy. Together these two terminals would have less send-out (2.3 Bcf/d) than is proposed by Sempra (3 Bcf/d). In addition, we note that there was public opposition when ExxonMobil announced plans to site an LNG facility south of the Mobile city limits in 2003. In response to these concerns, the Governor of Alabama commented that he would block the sale of state-owned land outside of Mobile for use as an LNG terminal unless an independent, site-specific study of potential hazards to the public was conducted.

Potential sites along the Mississippi River (Venice to Baton Rouge) offer greater takeaway capacity and include the existing pipeline systems of Southern Natural Gas Company, Texas Eastern Transmission Corp., Gulf South, and Transco. However, access to any potential sites between Venice (near New Orleans) and Baton Rouge would be along the Mississippi River. This would require LNG ships to travel about 20 miles from Main Pass in the Gulf of Mexico to Venice and up to 200 river miles from Venice to Baton Rouge. By comparison, LNG ships would travel about 10.5 miles along the Sabine Pass Channel from the Gulf of Mexico, into the Port Arthur Ship Canal, to the proposed Project site. Because of the distance the LNG ships would need to travel along the Mississippi River and the potential for operational impact on existing shipping traffic along the river, potential sites along the Mississippi River were eliminated from further consideration.

The Lake Charles, Calcasieu Pass area offers ample takeaway capacity and relatively easy access from the Gulf of Mexico. However, development of potential sites along the Calcasieu Ship Channel in this area of Cameron or Calcasieu Parish would likely have considerable wetland impacts because of the extensive wetlands in this part of southern Louisiana. For example, construction and operation of the Cameron LNG terminal will result in the permanent loss of 55 acres of previously undisturbed wetlands. By comparison, the proposed Project would result in the permanent loss of 82.5 acres of wetlands, all of which are in a previously disturbed area used for dredge material placement. Overall, the magnitude of environmental impacts likely would be similar (if not greater) for potential sites in the Lake Charles, Calcasieu Pass area. Because there would be no significant environmental advantage with development of sites along Calcasieu Pass, this area was eliminated from further consideration.

3.3.2 Port Alternatives

The next step in the process was to identify suitable port areas along the western Gulf Coast (Louisiana and Texas) and involved the application of more refined screening criteria that incorporated the basic requirements needed for delivery of LNG to the market. The initial focus was on existing ship channels and ports with deepwater access that are near interstate pipelines with sufficient takeaway capacity. Seventeen ports were identified as shown on **figure 3.3.2-1**. The three main criteria used to review and evaluate these 17 ports were channel depth (greater than 40 feet), air draft (greater than 180 feet), and proximity to natural gas pipeline systems (see **table 3.3.2-1**).

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Figure 3.3.2-1

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TABLE 3.3.2-1 Screening Criteria for Potential Port Alternatives Along the Western Gulf Coast				
Port	**County, State**	**Depth**	**Air Draft**	**Close to Natural Gas Pipeline Systems**
Port of Brownsville	Cameron, TX	Yes	Yes	Yes
Port of Isabel/San Benito Navigation District	Cameron, TX	No	Yes	Yes
Port of Harlingen	Cameron, TX	No	Yes	Yes
Port Mansfield/Willacy County Navigation District	Willacy, TX	No	Yes	Yes
Port of Corpus Christi Authority	San Patricio, TX	Yes	Yes	Yes
Port Aransas	Aransas, TX	Yes	Yes	Yes
Port of Port Lavaca-Point Comfort – Calhoun County Navigation District	Calhoun, TX	No	Yes	Yes
Port of Palacios	Matagorda, TX	No	Yes	Yes
Port of Freeport – Brazos River Harbor Navigation District	Brazoria, TX	Yes	Yes	Yes
Port of Galveston	Galveston, TX	Yes	Yes	Yes
Port of Texas City	Galveston, TX	Yes	Yes	Yes
Port of Houston Authority	Harris, TX	Yes	Yes	Yes
Port of Sabine Pass	Jefferson, TX	Yes	Yes	Yes
Port of Port Arthur Navigation District	Jefferson, TX	Yes	Yes	Yes
Sabine Pass	Cameron, LA	Yes	Yes	Yes
Port of Beaumont	Jefferson, TX	No	No	Yes
Port of Orange/Orange County Navigation Port District	Orange, TX	No	Yes	Yes

3.3.2.1 Channel Depths

Ships that are currently used to transport LNG have capacities that range from 125,000 m^3 to 140,000 m^3, and future ships may be sized to transport up to 250,000 m^3 of LNG. The larger ships range from 950 to over 1,000 feet long, with typical laden drafts of 38 to 40 feet. To ensure that the LNG ships do not easily or frequently run aground, an additional 2 feet of water is required under the keel. This means that LNG tankers require sea-going access and berthing facilities within waterbodies containing depths of a minimum of 40 feet. Although dredging in shallow water areas could provide access for LNG ships, the costs and environmental impacts of significant dredging requirements could be prohibitive.

3.3.2.2 Air Draft

Air draft (the space between the water and an overhead stationary object that the ship would be required to pass under, such as a bridge) for an LNG ship must be greater than 180 feet. Consequently, LNG terminal alternative sites that were outside of existing deepwater ports, in areas with depths less than 40 feet, and/or an air draft of less than 180 feet were excluded from further analysis.

3.3.2.3 Proximity to Natural Gas Pipeline Systems

Essential to the development of an LNG import facility as proposed by Sempra is having access to its market, in this case the national interstate pipeline market. The ability to replace declining natural gas

production in the gulf region with vaporized LNG and send it throughout the U.S. via the interstate pipeline system is critical for the development and long-term viability of the Port Arthur LNG Project.

Consequently, the proximity of pipelines with sufficient capacity and access to the national market is critical as a siting criterion. Construction of a send-out pipeline to connect to the interstate market would involve both construction and operational costs, as well as environmental impacts. To minimize these impacts and costs, only those ports posing no significant routing impediments from the LNG terminal site to the interstate pipeline system are viable as potential LNG terminal sites. The western Gulf Coast has extensive pipeline infrastructure to move gas from the coast to all significant markets, thus all of the 17 identified ports met this screening criterion. As shown in **table 3.3.2-1**, only 11 of the 17 identified ports met all of these screening criteria.

3.3.3 Preliminary Site Selection

The next step in the evaluation of alternative sites consisted of developing a comprehensive list of potential LNG terminal sites in each of the 11 ports that met all of the screening criteria and then evaluating each of these sites through the application of preliminary technical, commercial, and environmental criteria. Seventeen potential sites were identified in the five general port regions. These sites are identified on **figure 3.3.3-1** and summarized in **table 3.3.3-1**.

The following criteria were used to evaluate each of these 17 potential sites to identify the best alternative sites:

Channel Access – Availability of a channel with enough depth, width, and air draft for the operation of a typical LNG carrier, which is in the range of 950 feet long by 150 feet wide, and requires a channel depth of 40 feet and an air draft larger than 180 feet.

Zoning/Isolation – One of the objectives of the Project is to avoid or minimize adverse impacts to the environment due to site development. To accomplish this, the sites must be located in an area zoned for industrial development. In addition, avoidance of populated areas would help to ensure compliance with DOT siting criteria (49 CFR Part 193) and enable a smoother permitting process by minimizing the public perception of safety issues often associated with LNG terminals.

Availability of Land – Enough area must be available to accommodate the proposed facilities, the safety features required by 49 CFR Part 193 and NFPA 59A, and the area for berthing facilities for 950-foot-long vessels. In addition, area for a pipeline right-of-way may be required for the installation of the send-out pipeline to connect to the existing pipeline infrastructure.

The results of the application of the above criteria to the 17 potential terminal sites are summarized in **table 3.3.3-2**. Only the sites that met all three criteria were considered for a detailed evaluation.

Of the 17 potential port sites, 15 port sites were dropped from consideration based on the screening results listed in **table 3.3.3-2.** Of these 15 sites, 10 sites met the criteria, but were unavailable because they were being developed by others (see **table 3.2.1-2** and section 3.2.1.3). The other five port sites were eliminated for other factors or combination of factors. Only two port sites (Port Arthur Ship Canal No. 1 and Port of Brownsville), were forwarded to the next step of the alternative site evaluation process, the selection of a preferred site location.

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Figure 3.3.3-1

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TABLE 3.3.3-1

Potential LNG Terminal Sites within the Selected Port Regions

Site No.	Site Name	Description
Sabine Pass/Port Arthur		
S1	Port Arthur Ship Canal No. 1, TX	A parcel on the canal, located directly on a turning basin.
S2	Port Arthur Ship Canal No. 2, TX	Property located across from Mesquite Point.
S3	Sabine Pass Ship Channel No. 1, TX	West side of Sabine River near Sabine Pass in Jefferson County, Texas.
S4	Sabine Pass Ship Channel No. 2, LA	East side of Sabine River and Ship Channel in Cameron Parish, Louisiana.
Galveston/Houston/Freeport		
S5	Pelican Island	Island located to the north of Galveston and accessible via a bridge from Galveston.
S6	Texas City	Available parcel of land in the Port of Texas City.
S7	Morgan's Point	Property to the south of Barbours Cut.
S8	La Porte	Property owned by the Port of Houston Authority at La Porte.
S9	Houston Point	800 acres on the coastline east of the Houston Ship Channel across from Texas City.
S10	Freeport	Property controlled by the Port Authority of Freeport, approximately 500 feet from the eastern end of Quintana Island.
Corpus Christi/Aransas		
S11	Corpus Christi – Port Aransas	Property near the entrance to the Corpus Christi Ship Channel.
S12	La Quinta – Ingleside	Property in La Quinta Branch in the Ingleside area east of Corpus Christi.
S13	La Quinta – Gregory	Property in La Quinta Branch in the Gregory area east of Corpus Christi.
S14	Bay Construction Property	Property owned by Bay Construction Ltd, near the end of the Corpus Christi Ship Channel.
S15	Koch Property	Property owned by Koch Refining Co, and adjacent to Bay Construction Ltd.
Brownsville		
S16	Port of Brownsville	Undeveloped property in the Port of Brownsville.
Port Lavaca-Point Comfort		
S17	Port Lavaca-Point Comfort	Undeveloped manmade site south of the port's basin.

TABLE 3.3.3-2

Potential LNG Terminal Sites – Screening Results

Site No.	Site Name	Criteria[a]			Passed Screening	Comments
		CA	Z/I	AL		
Sabine Pass/Port Arthur						
S1	Port Arthur Ship Canal No. 1, TX	✓	✓	✓	Yes	Satisfied criteria. Proposed Project.
S2	Port Arthur Ship Canal No. 2, TX	✓	✓		No	Satisfied most criteria. Land not available. Site approved for the Golden Pass LNG Project.
S3	Sabine Pass Ship Channel No. 1, TX	✓	✓		No	Satisfied most criteria. Land not available.
S4	Sabine Pass Ship Channel No. 2, LA	✓	✓		No	Satisfied most criteria. Land not available. Site approved for the Sabine Pass Project.
Galveston/Houston/Freeport						
S5	Pelican Island	✓			No	Land not available. Site under development by British Petroleum Energy.
S6	Texas City	✓			No	Available property too small for facility.
S7	Morgan's Point	✓	✓		No	Land not available.
S8	La Porte	✓	✓		No	Land not available.
S9	Houston Point		✓	✓	No	No access to Houston Ship Channel.
S10	Freeport	✓	✓		No	Land is not available. Site approved for the Freeport LNG Project.
Corpus Christi/Aransas						
S11	Corpus Christi – Port Aransas	✓	✓		No	Pipeline right-of-way would impact bay, town of Aransas Pass, and sensitive marshland.
S12	Corpus Christi/La Quinta – Ingleside	✓	✓		No	Land not available. Sites approved and being developed as the Vista del Sol LNG and Ingleside Energy LNG Projects, respectively.
S13	Corpus Christi/La Quinta – Gregory	✓	✓		No	Land not available. Site being developed as the Cheniere Corpus Christi LNG Project.
S14	Corpus Christi – Bay Construction Property		✓	✓	No	Bridges block tanker passage.
S15	Corpus Christi – Koch Property		✓	✓	No	Bridges block tanker passage.
Brownsville						
S16	Port of Brownsville	✓	✓	✓	Yes	Satisfied criteria. Site under consideration.
Port Lavaca-Point Comfort						
S17	Port Lavaca-Point Comfort	✓	✓		No	Land not available. Site is being developed as the Calhoun LNG Project.

[a] Screening criteria include channel access (CA), zoning/isolation (Z/I), and available land (AL).

3.3.4 Site Selection

The final phase of the site alternatives evaluation consisted of an evaluation the two port sites using project-specific criteria pertaining to site-specific factors, such as marine operations, access to the pipeline grid, environmental permitting, and project economics. Each of these criteria and the specific factors used to evaluate each site are summarized in **table 3.3.4-1**.

TABLE 3.3.4-1

Criteria Used to Evaluate Port LNG Terminal Site Alternatives

Criteria	Description
Site Specific Factors	
Ease of Acquisition	Preference given to parcels currently available for development in industrial areas or dredge placement areas.
Area Available	The site should have sufficient area for the land-based components of the terminal and the marine berth, and provide for the spacing between equipment and tanks specified by NFPA 59A.
Infrastructure	The terminal would require a reliable source of power and suitable roads, as well as barge access for delivery of materials during construction. Existence of industries in the area would create additional market for the gas and the potential for use of alternate sources of energy.
Marine Operations	
Ship Traffic Volume	Transit of LNG carriers would be subject to certain restrictions that may affect the traffic of other ships; the busier the port the higher the risk of affecting other users of the channels.
Channel Access	The faster a carrier can reach the terminal, unload the LNG, and return to the sea, the better the economics of the terminal. Also, a shorter channel would lessen the effect on traffic of other ships due to the transit restrictions on LNG carriers. Availability of a channel with enough depth (40 feet), width for the operation of a typical LNG carrier, (950 feet long, 150 feet wide) and air draft (180 feet).
Maneuvering Area Amplitude and Proximity	A minimum diameter of 1,200 feet and 40 feet depth.
Access to Pipeline	
Distance to Interstate Pipeline System	Sites that were near existing pipeline systems would be more favorable. It was assumed that the routing issues and construction techniques would be similar for all onshore sites.
Takeaway Capacity	Pipeline system available capacity and consistent demand. Pipelines in the region should have a minimum aggregate capacity available of 2.6 Bcf/d.
Environmental Permitting	
Public Perception	Avoid visibility from residential areas.
Environmental Consequences	Minimize environmental impacts by using potential sites located within a previously disturbed area, including dredge placement sites, and areas already zoned for development.
Compatibility with Region/Port Plans	The site should be compatible with the planned development of adjacent properties.
Land Use Zoning	Site should be located within a site zoned for industrial development to help confine any environmental impacts to previously industrialized areas.
Distance to Populated Areas	Sites were ranked by comparison of their distance to populated areas or residences.
Project Economics	
Capital Cost	A relative comparison based on the capital expense derived from local conditions for each site.
Operating Cost	A relative comparison based on the knowledge of industrial development of each area. It is expected that maintenance contractors and resources would be more available in industrialized areas, which should result in a lower cost.

Based on these criteria, both sites were determined to be acceptable. Because the proposed site has satisfied all criteria and is strongly supported by the community and state and local elected officials, an alternative site would have to exhibit a clear environmental advantage over the proposed site to be considered preferable. Because of Brownsville's location (the only remaining port satisfying all of the selection criteria) in the southernmost point of Texas, takeaway capacity is limited since the pipeline

system is designed to deliver natural gas into, not to move it out of, the Brownsville area. Development of a site at Brownsville may require 40 miles or more of large diameter pipeline and possibly additional downstream facilities (pipeline and potentially compressor stations) to transport up to 3.0 Bcf/d of natural gas northward. Additionally, use of the Brownsville site would not meet one of the primary Project objectives of providing a natural gas send-out pipeline that could deliver natural gas into Transco's Zone 3, downstream of Compressor Station No. 45, in Beauregard Parish, Louisiana. Therefore, we did not conduct any further analysis of this alternative site location.

3.3.5 Conclusions

Because development of an onshore LNG import terminal requires a shoreline site with ocean access, development of new sites having the appropriate characteristics would have a greater environmental impact than use of existing port sites. Therefore, our evaluation of site alternatives was confined to sites within existing ports or within previously disturbed areas. Based on the analysis presented above, 17 sites met the minimum siting criteria. Of these sites, five sites have been approved as LNG terminals; one is the proposed site; five are currently planned for development of LNG terminals; three are inaccessible by ship; one is too small; one is unavailable for development; and one site (Brownsville) does not meet one of the primary Project objectives or offer a significant environmental advantage over the proposed site. The proposed Project would be mostly located on land that has been historically used for dredge material placement, best fulfills the technical and economic criteria required to meet the Project objectives, and has received overwhelming support of the community and elected officials. Since the other viable alternative sites are not available and the Brownsville site could not readily serve Transco's Zone 3, we have concluded that there are no practical alternative sites offering a clear environmental advantage to the Port Arthur LNG Project. We also note that, if the U.S. is going to use LNG to meet rising energy demand and replace declining domestic production of natural gas, multiple LNG import terminals will be required.

3.4 DREDGE MATERIAL PLACEMENT AREA ALTERNATIVES

Construction of the slip would require the dredging of approximately 5.3 million yd^3 of material and construction of the turning basin would require the dredging of approximately 1.4 million yd^3 for a total of 6.7 million yd^3. Sempra initially identified five potential DMPAs, shown in **figure 3.4-1**, for placement of dredged material from the slip and turning basin. Sempra is proposing to use DMPA 1-2 as its initial placement area, with subsequent transfer of some of the material to other areas for beneficial reuse. Sempra's physical and chemical analyses of the material that would be dredged indicate that it is suitable for beneficial reuse.

3.4.1 DMPA 1-2

The proposed DMPA (DMPA 1-2), located on Sempra-owned property, is approximately 600 acres in size and has a capacity of 7.8 million yd^3 based on a raising the levee 12 feet. The site is part of a former COE DMPA used in conjunction with the Port Arthur Ship Canal dredging and the construction of the Taylor Bayou Bypass. The site has been inactive for a number of years, but the levees remain in place. The existing levees would have to be raised using existing material from within the DMPA or material that would be mechanically excavated from the marine berth and turning basin. Development of this DMPA would encompass approximately 600 acres, 583 acres of which are emergent wetlands. Sempra proposes to restore these wetlands in place, in kind. It is likely that a new discharge structure also would be required. The water used to hydraulically convey the dredged material would be discharged to a canal that empties into the Gulf Intracoastal Waterway (GIWW).

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Figure 3.4-1

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3.4.2 DMPA 8

The second area (DMPA 8), owned by the COE, is located directly across the Port Arthur Ship Canal from the LNG terminal. The site is an active placement area and is approximately 3,705 acres. This site may require some levee improvement. Capacity of this site is 47.8 million yd^3 based on raising the levee 12 feet. A disposal fee of $1.50 per yd^3 is charged for this area.

3.4.3 DMPA 11

The third area (DMPA 11) is an active placement area located on Pleasure Island, across the Port Arthur Ship Canal from the marine terminal, north of DMPA 8. The site is approximately 1,882 acres with a capacity of 24.3 million yd^3, based on raising the levee 12 feet. This site also may require some levee improvement. A disposal fee of $1.50 per yd^3 is charged for this area.

3.4.4 Texas Point

The fourth area (Texas Point) is located on the west side of the Sabine Pass jetties. The site is part of the Texas Point National Wildlife Refuge. The site has a recent history of considerable shoreline erosion. During recent COE maintenance dredging of the SNWW from 2000 to 2001, approximately 400,000 yd^3 was hydraulically placed along the shoreline to replenish the eroding marshes. Due to the distance from the LNG terminal site (approximately 10.5 miles), use of hydraulic dredges to convey the dredged material may not be economically feasible.

3.4.5 J. D. Murphree Wildlife Management Area (WMA)

The fifth area, the J. D. Murphree WMA, is located immediately to the west of the LNG terminal site. Loss of overland flows of freshwater and salt water intrusion are resulting in the conversion of emergent wetlands to open waters through plant mortality and wave erosion within the WMA. Texas Parks and Wildlife Department (TPWD) personnel have identified two canal filling projects and four selective open water managed disposal areas that would prevent saltwater intrusion into the marsh through two existing flow conduits, reduce saline inflow into other portions of the wetlands and, if applied correctly, should result in the reestablishment of emergent wetlands by adventitious vegetative expansion into areas that are increasingly becoming open water. Representatives from the TPWD, J. D. Murphree WMA, have indicated a desire to receive on the order of 1 million yd^3 of fine sandy non-clumping material to use for these projects. In evaluating this request, Sempra determined that the pipeline that would be required to hydraulically convey the dredged material to the placement areas would be too large to place the material in the specific areas requested by TPWD. Sempra is proposing an approach to provide the requested material by first conveying it to DMPA 1-2, and then placing a small dredge in the DMPA that could convey the quantities of material required to the locations designated by the TPWD personnel, as needed. As discussed in its Revised Draft Wetland Mitigation Plan (appendix G), Sempra proposes to fill at least 160 acres of open water with dredged material at the J. D. Murphree WMA.

3.4.6 Conclusion

The COE prefers that dredged material not be placed in a Federal DMPA, such as DMPAs 8 and 11, and that dredged material be used for beneficial use. Furthermore, NOAA recommended that Sempra meet with the TPWD, NOAA Fisheries, and other federal and state agencies to more fully develop a beneficial use plan for the dredged material. Since DMPAs 8 and 11 are Federal DMPAs, use of these sites would reduce the amount of material these sites could receive from others. Although the Texas Point DMPA would allow for beneficial reuse, the distance from the terminal site may render it economically infeasible. Use of DMPA 1-2 has the potential for beneficial reuse and also would avoid filling

COE-operated DMPAs. We believe that DMPA 1-2 is the best initial placement location. We also believe that Sempra's plan for the subsequent transfer of at least some the material to the WMA for beneficial reuse could serve as a positive environmental impact.

3.5 PIPELINE ALTERNATIVES

3.5.1 Pipeline System Alternatives

System alternatives are those that could replace all or part of the proposed Project by making use of existing natural gas pipeline facilities to connect the LNG terminal with existing interstate natural gas pipeline systems. Our analysis of pipeline system alternatives included examination of the use of existing pipeline systems to meet the objectives of the proposed Port Arthur LNG Project. These objectives include the transportation of vaporized LNG (up to 3.0 Bcf/d) into the interstate natural gas pipeline system for subsequent transportation to markets in Texas, Louisiana, the Midwest and the eastern U.S., thus meeting projected natural gas demand and replacing declining natural gas production in the Gulf region.

3.5.1.1 Use of Existing Pipeline Systems

Currently, there is no existing pipeline system that could be used to move the vaporized LNG from the proposed Port Arthur LNG terminal location to the existing interstate and intrastate natural gas pipeline systems. There are two existing natural gas transportation systems near the Port Arthur terminal site: an interstate pipeline operated by NGPL and an intrastate pipeline operated by Centana. These systems have a total capacity of about 1 Bcf/d and could not transport the additional 1.5 to 3.0 Bcf/d proposed by Sempra to the intrastate and interstate markets without construction of a new pipeline system similar to that proposed. Since construction of similar facilities would result in similar environmental impacts, we conducted no further analysis of existing pipeline system alternatives.

3.5.1.2 Use of Proposed Pipeline Systems

There are two other LNG projects with proposed send-out pipelines in the same vicinity as the Port Arthur LNG Project: the Sabine Pass, and Golden Pass LNG projects. The send-out pipeline for the Sabine Pass project extends east for 16 miles from the Sabine Pass LNG terminal to Johnsons Bayou in Cameron Parish, Louisiana, and is not a practical alternative for Port Arthur because it would not meet Sempra's stated purpose. The send-out pipelines for the Golden Pass project include an approximate 78-mile-long pipeline and adjacent 43-mile-long loop that generally extend west, north, and then northeastward to proposed interconnections with an existing AEP Texoma pipeline near Beaumont, Texas, and the existing Transco pipeline near Starks, Louisiana. Potential interconnects include NGPL, Florida Gas, Tennessee Gas, Texas Eastern Transmission Corporation, and Transco.

The Golden Pass pipeline is designed to transport the volumes from the LNG terminal. To transport the Project's volumes (1.5 to 3.0 Bcf/d), proposed Golden Pass pipeline system would require modification, either by use of larger diameter pipelines, additional looping, or compression. Additionally, use of this system alternative would not meet one of the primary Project objectives of delivering natural gas into Transco's Zone 3, downstream of Compressor Station No. 45, in Beauregard Parish, Louisiana. Further, it may not be possible for the existing pipelines along the route of the Golden Pass project to accept the volumes from all three projects at the various proposed interconnect locations. Reducing the number of interconnections would limit the diversity of supply to the interstate and intrastate natural gas markets. For these reasons, we did no further analysis of a system alternative that would make use of these proposed send-out pipelines.

In addition, Kinder Morgan Energy Partners, L.P. have announced a 137-mile-long pipeline starting at the Sabine Pass LNG terminal and ending in Evangeline Parish, Louisiana (Kinder Morgan Louisiana Pipeline). We do not have sufficient information on this planned pipeline to conduct an in depth alternative analysis of it. We do know that from the south end of Sabine Lake to just south of the Intracoastal Waterway the Kinder Morgan Louisiana Pipeline appears to follow the route of the previously proposed Pearl Crossing Pipeline.[6] This pipeline is designed to transport up to 3.4 Bcf/d of natural gas from the Sabine Pass LNG terminal.

3.5.2 Major Pipeline Route Alternatives

In evaluating pipeline alternatives, we reviewed both route alternatives and route variations. We examined route alternatives that could reduce overall environmental impacts associated with the pipeline route and could avoid or reduce impact to environmentally sensitive resources, namely extensive wetlands. Route alternatives generally follow a different alignment for a portion of the proposed route. Route variations differ from route alternatives in that they are identified to avoid or reduce construction impacts on specific localized resources that may include cultural resource sites, residences, sensitive habitats, or site-specific terrain conditions.

3.5.2.1 Alternative Route 1

We evaluated one route alternative to the 70-mile-long pipeline (**table 3.5.2-1** and **figure 3.5.2-1**), Alternative Route 1. Alternative Route 1 is approximately 84.3 miles long. It would follow the existing

TABLE 3.5.2-1

Environmental Comparison of Alternative Route 1 and the Proposed 70-Mile-Long Pipeline Route

Environmental Factor	Proposed Route	Alternative Route 1
Total Length (miles)	70.0	84.3
Length Adjacent to Existing Rights-of-Way (miles)	28.3	63
Acres Disturbed for Construction[(a)]	933.3	1,124
Waterbody Crossings (no.)	48	46
Length in Wetlands (miles)	37.3	34.1
Length in Open Water (miles)	17.8	2.1
National Wildlife Refuges Crossed (miles)	0	5.7
Residences within 50 Feet of Construction Work Area	0	7
Potentially Occurring Protected Species	15	15
Designated EFH species	4	4

[(a)] Based on a 110-foot-wide right-of-way, not including extra workspace.

NGPL pipeline right-of-way east for about 21 miles to the point where it intersects with the Transco and Tennessee Gas corridor. It would follow this corridor northward for about 41 miles until it reaches the east-west trending Transco corridor; it would follow this corridor about 22 miles ending at Compressor Station No. 45.

[6] The Pearl Crossing Pipeline was withdrawn by ExxonMobil.

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Figure 3.5.2-1

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We analyzed Alternative Route 1 in an attempt to follow existing utility corridors to the maximum extent possible. While Alternative Route 1 would follow existing utility corridors for 75 percent of its length, and would cross fewer waterbodies and fewer miles of wetlands than the proposed route, it would be longer, have overall greater environmental impact, work areas would likely be within 50 feet of seven residences, and it would cross 5.7 miles of the Sabine National Wildlife Refuge. The refuge managers have stated that they would not allow a new pipeline to cross the National Wildlife Refuge. For these reasons, this alternative would not be environmentally preferable to the proposed route and we eliminated it from further consideration.

3.5.2.2 Alternative Route 2

We also evaluated one alternative to the proposed 3-mile-long pipeline route (**table 3.5.2-2** and **figure 3.5.2-2**), Alternative Route 2, which is approximately 2.72 miles long. It would follow the proposed route for the first mile, but then proceed eastward and southeastward to follow SH 87 to the NGPL pipeline terminus.

TABLE 3.5.2-2

Environmental Comparison of Alternative Route 2 and the Proposed 3-Mile-Long Pipeline Route

Environmental Factor	Proposed Route	Alternative Route 2
Total Length (miles)	2.62	2.72
Length Adjacent to Existing Rights-of-Way (miles)	0	0.75
Acres Disturbed for Construction[(a)]	35	36
Waterbody Crossings (no.)	2	1
Length in Wetlands (miles)	1.4	2.1
Length in Open Water (miles)	0.65	0.05
Residences within 50 Feet of Construction Work Area	0	0
Potentially Occurring Protected Species	14	14
Designated EFH species	4	4

[(a)] Based on a 110-foot-wide right-of-way, not including extra workspace.

We analyzed this alternative in an attempt to avoid construction across Keith Lake. While the alternative route would be slightly longer, would cross more wetlands, and have slightly more disturbance; it would not cross Keith Lake, and; therefore, appears to be environmentally preferable to the proposed route. However, the FWS and NOAA Fisheries have stated that they would prefer that the route avoid the wetlands between Keith Lake and SH 87. In addition, the crossing of Keith Lake Cut would be by HDD, avoiding disturbance of the waterbody.

Because the agencies helped to design the proposed route and are in favor of it, we eliminated Alternative Route 2 from further consideration.

3.5.3 Route Variations

During the Commission Pre-Filing Process four route variations were evaluated (see **figure 3.5.3-1)**. Each of the route variations is discussed below.

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3.5.3.1 Route Variation 1

Route Variation 1 is an alternative crossing of Sabine Lake. This variation is approximately 18 miles long. This was the first route Sempra identified for the Sabine Lake crossing and, as shown in **figure 3.5.3-2**, Route Variation 1 crosses an area of uneven topography (the old river channel) in Sabine Lake three times. Installation of a submerged pipeline in an area of uneven topography would require additional excavation over what would be required when crossing a more level topography. This additional excavation would cause increased turbidity and sedimentation. This route variation is about 1.6 miles shorter than the portion of the proposed route it would replace (**table 3.5.3.1-1**), but would pose additional constructability challenges, potential increased turbidity, and could increase the duration of construction in the lake. Therefore, we do not recommend incorporating this route variation.

TABLE 3.5.3.1-1

Environmental Comparison of Route Variation 1 to the Proposed Route (MPs 2.0 to 20.0)

Environmental Factor	Route Variation 1	Proposed Route
Length (miles)	18	19.6
Length Adjacent to Existing Rights-of-Way (miles)	0	0
Acres Disturbed for Construction[(a)]	240	261.3
Waterbody Crossings (number)	4	2
Length in Wetlands (miles)	0.66	0.6
Length in Open Water (miles)	16.6	17.4
Residences within 50 Feet of Construction Work Area (number)	0	0

[(a)] Based on a 110-foot-wide right-of-way, not including extra work space.

3.5.3.2 Route Variation 2

Route Variation 2 would cross Sabine Lake along a similar alignment as Route Variation 1, but would cross north of the proposed route at approximately MP 18.2, continuing northeastward through Hickory Cove, exiting Sabine Lake, and proceeding northward, west of the city of Orange, Texas, before turning northeastward to rejoin the proposed route at approximate MP 40.3 (**figure 3.5.3-3**). This route was originally proposed by representatives of LADWF as a means of avoiding the wetlands bordering the northern exit from Sabine Lake. This variation is approximately 42.2 miles long, would replace approximately 38.3 miles of the proposed route, and would be entirely in Texas, passing to the west of the City of Orange. The variation would cross approximately 3.5 miles of wetlands and the proposed route would cross about 11.6 miles of wetlands (**table 3.5.3.2-1**). The proposed route also would cross the Sabine River and the Intracoastal Waterway. However, the variation could cross within 50 feet of up to twelve residences, whereas the portion of the proposed route it would replace would not cross within 50 feet of any residences. Although the proposed route would cross more than twice as much wetland area as the variation, it would be shorter, would affect about 52 fewer acres, and would not be near any residences. Additionally, after a field review of the route variation, we determined that it would cross substantial bottomland hardwood areas bordering the Sabine River and the Old River. The LADWF recommended that these areas not be affected by the pipeline crossing and that another route be considered. Therefore, we do not recommend Route Variation 2.

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TABLE 3.5.3.2-1 Environmental Comparison of Route Variation 2 to the Proposed Route (MPs 2.0 to 40.3)		
Environmental Factor	**Route Variation 2**	**Proposed Route**
Length (miles)	42.2	38.3
Length Adjacent to Existing Rights-of-Way (miles)	12.9	5.0
Acres Disturbed for Construction[(a)]	562.7	510.7
Waterbody Crossings (number)	10	15
Length in Wetlands (miles)	3.5	11.6
Length in Open Water (miles)	17.0	17.8
Residences within 50 Feet of Construction Work Area (number)	12	0

[(a)] Based on a 110-foot-wide right-of-way, not including extra work space.

3.5.3.3 Route Variation 3

Route Variation 3 (**figure 3.5.3-4**) was Sempra's originally proposed route to cross the marsh at the northern end of Sabine Lake, and would cross marsh areas identified by the Louisiana resource agencies as sensitive and fragile. Construction of the proposed route between approximate MPs 17.3 and 26 would cross approximately 6.2 miles of marsh and 2.2 miles of open water (**table 3.5.3.3-1**). Construction of the variation between the same MPs would cross about 7 miles of marsh and 1.9 miles of open water. Construction of the variation would result in more disturbance to marsh areas than would construction of the proposed route, and both Texas and Louisiana resource agencies agreed that the Louisiana marsh should be protected; therefore, we do not recommend Route Variation 3.

TABLE 3.5.3.3-1 Environmental Comparison of Route Variation 3 to the Proposed Route (MPs 17.3 to 26.0)		
Environmental Factor	**Route Variation 3**	**Proposed Route**
Length (miles)	8.7	8.8
Length Adjacent to Existing Rights-of-Way (miles)	0	2.5
Acres Disturbed for Construction[(a)]	116	117.3
Waterbody Crossings (number)	4	7
Length in Wetlands (miles)	7.0	6.2
Length in Open Water (miles)	1.9	2.2
Residences within 50 Feet of Construction Work Area (number)	0	0

[(a)] Based on a 110-foot-wide right-of-way, not including extra work space.

3.5.3.4 Route Variation 4

During public scoping, landowner, Morris Enterprises, Inc. (Morris) requested that a variation be considered to avoid interfering with a plan for developing its property. Morris requested that the pipeline be moved north of the existing Florida Gas Transmission pipeline instead of paralleling the south side of the pipeline. The route variation would cross over the existing pipeline near MP 40.3 and cross back to

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the south side of the existing right-of-way near MP 41.3 (**figure 3.5.3-5**). Although this route variation was analyzed in the draft EIS, Morris later submitted a letter indicating that the original alignment was acceptable. Therefore, this route variation was eliminated from the final EIS.

3.5.3.5 Temple-Inland Crown Point Distinctive Site Route Variations

During public scoping, a landowner, Temple-Inland, Inc. (Temple-Inland), requested that we look at route variations that would avoid crossing the Temple-Inland Crown Point Distinctive Site (Site) on its property. In addition, the FWS and several state agencies have expressed concern about construction in this area. This Site, from about MP 62.6 to MP 63.6, is currently being maintained as a longleaf pine savanna. For further discussion of the Site see section 4.5.2.

The proposed route would parallel the planned Hackberry (now Cameron) Pipeline through the site. Avoidance of this Site was examined in the Hackberry LNG Project Final EIS (page 3-40). In that document, it was determined that the proposed route variations did not provide a clear environmental advantage over the proposed route of the Hackberry Pipeline. The Commission approved the route of the Hackberry Pipeline through the Site, but required a site specific plan for the crossing of the Site. Now Sempra is proposing to cross this Site with not only the Hackberry Pipeline, but also the Port Arthur LNG Project 70-mile-long pipeline. In addition, Sempra has recently filed the Liberty Storage Project Pipeline, which includes a 30-inch-diameter pipeline, which also would cross this Site, parallel to the other two pipelines. While the mitigation required by the Hackberry Order is sufficient for a single pipeline we believe that this route may not be acceptable for the additional pipelines. Potentially tripling the workspaces and rights-of-way may cause significant impacts on the plant communities within the Site. In late June 2005, Sempra and Temple-Inland reached an agreement whereby Temple-Inland has agreed to allow Sempra to construct all three pipelines on its property in accordance with the terms of a Grant of Easement and Right-of-Way for Pipeline, Surface, and Road Use. However, because the FWS and several state agencies expressed concerns about construction in this area, we have examined several ways of avoiding this Site with the proposed 70-mile-long pipeline.

Our initial consideration would avoid disturbing the site by installing the pipeline by HDD. Because of the length of the crossing and the adjacent waterbodies, a single HDD is not feasible. We then examined a series of HDDs to avoid surface disturbance within the Site. The first HDD would start near MP 63 in a gap in the Site; this drill would exit near MP 62.5, on the south side of Beckwith Creek. The next HDD would also start near MP 63 and exit near MP 63.7 on the south side of the West Fork of Calcasieu River. A third HDD would be required to cross the West Fork of Calcasieu River. This plan has some drawbacks. It would require more and longer HDDs, which would increase the potential for failure. Further, additional extra workspaces and pipe make-up areas would be needed. Because of the topography and waterbodies, we could not find a location for the extra workspace areas. Therefore, we do not recommend using HDDs to avoid the entire site.

We reexamined the two route variations (5A and 5B) described in the Hackberry EIS (see **table 3.5.3.4-1** and **figure 3.5.3-6**). As discussed in the Hackberry EIS, both variations are longer (by 1,350 and 1,600 feet); both would affect less forested land, although one would affect more forested wetland. However, as noted, using a HDD to cross the waterbodies would probably avoid all forested wetland impacts. Regardless, both route variations would be longer, require an additional waterbody crossing, and affect new, previously unaffected landowners. Use of one of these two variations is an option for Sempra's two pipelines (Port Arthur and Liberty) that are still under review. However, this option would result in the creation of two new pipeline corridors, one through the Site (Cameron) and a larger corridor on an adjacent landowner's property (Port Arthur and Liberty).

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TABLE 3.5.3.4-1

Environmental Comparison of the Temple-Inland Route Variations (5A and 5B) to the Proposed Route[a]

Environmental Factor	Proposed Route	Temple-Inland Variation 5A	Temple-Inland Variation 5B
Length (feet)	11,600[b]	12,950	13,200
Total length of upland and wetland forest crossed (feet)	11,600	9,900	10,250
Length of NWI forested wetland crossed (feet)	950	1,000	350
Perennial Waterbodies Crossed (number)	0	1	1

[a] In order to provide an equitable comparison of the proposed route with the Temple-Inland Variations, information on each of the environmental factors were gathered for the pipeline route segments between 61.4 and 63.6.

[b] Although the total length of the proposed route between MP 61.4 and 63.6 is about 11,600 feet, construction across Temple-Inland's Crown Point Distinctive Site would be limited to a 2,967-foot-long right-of-way disturbance, which would affect about 5 acres of upland forest.

On July 15, 2005, Temple-Inland made a filing indicating that they had reached an agreement with Sempra on the crossing of the distinctive area. On July 26, 2005, Sempra filed alignment sheets showing the new alignment. Since the landowner and Sempra have agreed and we have not identified an environmentally superior route variation we do not recommend an alternative in this area.

3.5.3.6 Pearl Crossing Route Variation

The Louisiana Department of Wildlife and Fisheries (LDWF) has suggested that we analyze a route variation using a portion of the now withdrawn Pearl Crossing Pipeline route to reduce impacts on the marsh north of Sabine Lake (**figure 3.5.3-7**).[7] The Pearl Crossing Route Variation would replace the portion of the proposed route between MPs 18 and 28.1 (approximately 10.1 miles). The Pearl Crossing Route Variation would leave the proposed route at about MP 18 in Sabine Lake. The variation would head east crossing Shell Island and entering into the marsh east of the Sabine River. The variation would turn northeast paralleling the Sabine River, finally turning east to parallel the southern side of the Intracoastal Waterway. The variation would rejoin the proposed route near MP 28.1. A comparison of environmental factors for the two segments is provided in **table 3.5.5-1**.

The length and land use of the two routes are about the same. Both routes would require the crossing of Sabine Lake. The variation would cross seven fewer waterbodies. The variation would cross the marsh in a less sensitive, dryer, area. The proposed route would cross an additional 18,012 feet of wetlands when compared with the Pearl Crossing Variation using conventional construction techniques. If the construction methods proposed by Pearl Crossing were used (seven HDDs and reduced construction right-of-way width) disturbance to waterbodies and the marsh would be reduced even more. The seven areas would be drilled using Pearl Crossing's construction methods: Shell Island Shoreline (2 crossings), Sabine River East Pass (which includes the Sabine Lake Shoreline), saturated wetlands (2 crossings), and Burton Shell Slip. On the corresponding section of the propose route Sempra proposes to HDD the West Pass Sabine River, Sabine River, Cow Bayou and Cow Bayou Canal. Sempra's proposes to open cut

[7] We note that Kinder Morgan Energy Partners (Kinder Morgan) has announced plans for a pipeline that would use this same route; it also appears that there is only room enough for one pipeline along this route.

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TABLE 3.5.5-1

Environmental Comparison of Pearl Crossing Route Variation to Proposed Route Segment (MPs 18.0 to 28.1)

Environmental Factor	Pearl Crossing Route Variation	Proposed Route Segment
Length (miles)	10.1	10.1
Waterbody Crossings (number)	5	12
Wetland crossing using conventional construction (feet)	28,615	46,627
Wetland crossing using HDD crossings (feet)	12,618	46,627
Wetland Disturbed by Construction (acres)	35.9[(a)]	174.0 [(b)]
HDD (number)	6	4

[(a)] Based on a ROW width of 75 feet for forested wetlands and 85 feet for all other wetlands.

[(b)] Based on a ROW width of 125 feet.

Burton Slip and have an aerial crossing of the Sabine Lake Shoreline. If the variation is constructed using the seven HDDs, marsh impacts would be reduced by an additional 16,000 feet to about 12,618 feet. Use of the variation and Pearl Crossing's previously proposed construction right-of-way width along with the HDDs would result in a 138.1-acre reduction in wetland impacts over Sempra's proposed route and construction methods.

Use of the variation would require that Sempra's MLV proposed for MP 19.2 be moved. This could be placed on Shell Island, where it had been proposed in an earlier Sempra filing.

Because of the reduction of impacts to waterbodies and the marsh north of Sabine Lake we recommend that:

- **Sempra use the Pearl Crossing Route Variation, including the construction methods and right-of-way widths.**

However, we note that Kinder Morgan Energy Partners (Kinder Morgan) have initiated the pre-filing process for a pipeline which would use Pearl Crossing's route through the marsh. Since there is not enough space for two pipelines and the potential exists that the Kinder Morgan pipeline, if approved, may be constructed first we have included a recommendation in section 4.3.3.1 to reduce impacts to the Texas marsh if the Pearl Crossing Route Variation is not available.

3.5.4 Avoidance of Wetlands

Wetlands in the region of the proposed Project are unavoidable and expansive. Sempra's primary objective for siting the 70-mile-long pipeline route was to minimize the need for wetland construction, to the degree practicable, by following existing rights-of-way and other previously disturbed corridors. Route Variation 2 would avoid many of the wetlands at the northern end of Sabine Lake, but is much longer than the corresponding segment of the proposed route, and is not environmentally preferable to it. The current level of HDD technology does not lend itself favorably to crossing more of the marsh and wetland areas on the southern end of the route to a greater degree than what Sempra is already proposing.

Wetlands to the north of I-10, from MPs 37 to 50, are not as extensive and the potential effects of construction associated with the preferred route would be minimized by following existing rights-of-way.

Further to the north, from approximate MPs 50 to 70.0, the wetlands crossed by the preferred route are associated with the rivers and tributaries of the Calcasieu River, including the West Fork of the Calcasieu River, Houston River, Little River, Beckwith Creek, and Hickory Branch. The wetlands bordering these waterbodies, primarily bottomland hardwoods, vary in width adjacent to each of the waterbodies. The route Sempra proposes in this area was based on identifying potential crossing locations in areas where the wetlands were least extensive and where crossings could be made using the HDD technique. From approximately MPs 50 to 70.0, Sempra would cross all of the wetlands along the proposed route using the HDD technique.

The proposed route would be collocated with the approved Cameron pipeline route from approximately MPs 53.6 to 70.0, minimizing additional disturbance by using a common corridor. Alternate routing in this segment would require the creation of a new right-of-way and a greater amount of disturbance.

Conclusion

In conclusion, we have determined that the proposed Sempra project, as modified by our recommended mitigation and route variation, is the preferred alternative that can meet the project objectives.