Compensatory Saltmarsh Created For Elba LNG Plant

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Southern LNG Inc. (SLNG) expanded its receiving and pipeline sendout facilities near Savannah, GA, causing the loss of protected and regulated saltmarsh habitat. Federal and state regulatory agencies in Georgia and adjoining South Carolina required SLNG to compensate for the loss of these saltmarsh habitats.

This presented a major problem for the company because while wetland compensatory mitigation banks normally are available to mitigate for such damages, coastal Georgia does not have saltmarsh mitigation banks. The solution was to create a compensatory wetland that appears to be performing successfully.

Project Design

SLNG was already working with Applied Technology & Management (ATM), an experienced environmental consultant group with expertise in modeling the Savannah River and working in the surrounding area. SLNG, along with the consultant, developed a potential mitigation scenario for compensating for the loss of these saltmarsh resources in both the Georgia and adjacent South Carolina jurisdictions.

To mitigate for the impacts to wetlands in South Carolina, SLNG developed a U.S. Army Corps of Engineers (COE) application that would be submitted jointly to the Charleston, SC and Savannah, GA districts. South Carolina requires mitigation for the loss of wetlands based on the Charleston COE's Standard Operating Procedure for calculating wetland impacts.

The Charleston COE required compensatory mitigation at a 2:1 ratio for the 0.65-acre of impact; therefore SLNG was required to find mitigation for 1.3 acres. SLNG knew that getting both public and regulatory permit approval for such saltmarsh impacts would be difficult without providing adequate saltmarsh compensatory mitigation.

Policies in the U.S., such as "no net loss" of wetlands as well as activities involving dredge and fill of wetlands, are regulated pursuant to the Clean Water Act. Compensatory mitigation is the improvement of low quality wetlands or the creation of new wetlands where wetlands did not exist before, in response to wetland impacts due to construction.

Compensatory mitigation can be used to offset damages by development or construction activities that contribute to the loss of wetlands. In many instances, commercial compensatory wetland mitigation banks have been established where developers can purchase credits to offset their impacts in lieu of creating on-site compensatory mitigation. These commercially available saltmarsh mitigation banks do not exist within Georgia, which presented a major problem for SLNG.

No alternative site or engineering design could avoid impacts where the proposed slip was located, and extensive engineering design and planning had already reduced the saltmarsh impacts to the lowest extent possible. Therefore, the only viable solution was to develop on-site and in-kind compensatory wetland mitigation on Elba Island.

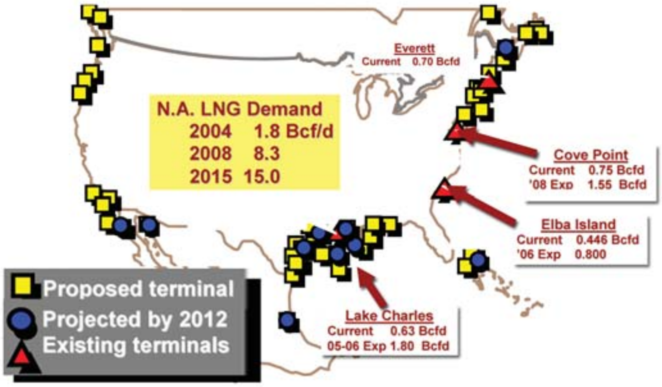

Figure 1: North American LNG Terminals
(Source: El Paso Corp., based on www.ferc.gov/industries/lng.asp)

Create A Site

SLNG and ATM began the process by selecting a site suitable for development of a wetland site for compensatory mitigation. The southernmost tip of Elba Island, an upland area of approximately 11 acres that was overgrown with non-native and nuisance species, was identified as a candidate site. Next, a mitigation plan was designed that would create an 11-acre site containing both saltmarsh and upland buffer planted with native species. The COE accepted this mitigation plan, and SLNG's turning basin COE permit was granted.

A major part of the Elba Island expansion project was the creation of a new LNG vessel berthing slip. This new slip would be cut into Elba Island and would be 1,615 feet in length, 1,350 feet in width at the entrance tapering down to 735 feet, and dredged to -42 feet MLW (3.3 million cubic yards of dredge material). This activity would directly contribute to the permanent loss of 2.64 acres of tidal marsh and 0.80 acres of tidal mudflats.

Because the creation of the mitigation site had not yet begun, SLNG went back to the COE to discuss the new project and impacts, entering into a fairly complex arena of agency negotiation. The U.S. Coast Guard, which provides security for the LNG vessels as well as the Port of Savannah, became very involved in the expansion when it was first proposed, especially after the Sept. 11 terrorist attacks.

The Coast Guard emphasized that the slip was critical to meeting a perceived threat to the LNG facility and vessels docked in the Savannah River. The Coast Guard indicated that the increased frequency of LNG vessels docking in the Savannah River could contribute to a bottleneck, and that the creation of the slip will allow for a safer passage of other vessels as well as safer docking of LNG vessels.

The Coast Guard's heightened concerns after Sept. 11 were effectively communicated to the regulatory agencies as well as to the public. Since the economic community around the Savannah area thrives on the success and viability of the Port of Savannah, any improvements to the flow and safety of navigation on the Savannah River are generally well received.

The first step in designing a mitigation plan is to know the level of mitigation that would be required for South Carolina and Georgia. South Carolina requires mitigation for the loss of wetlands based on the Charleston COE's Standard Operating Procedure (SOP) for calculating wetland impacts.

The SOP scores the area proposed for impact by assigning it a credit value based on a functional assessment. In the SOP assessment, wetlands acreage is assigned a credit score depending on its value. For example, one acre of a high quality wetland could be worth five credits and one acre of a low quality wetland could be worth one credit.

Saltmarsh in the impacted area would generally have a credit ratio that results in 2:1. Therefore, SLNG offered to mitigate by compensating 1.30 acres (0.65 acres x 2) of saltmarsh from the creation site instead of running the tedious SOP analysis for the turning basin project impacts. This offer was accepted by the South Carolina COE.

After the proposal of the new slip, it was determined that SLNG also needed to mitigate for proposed impacts to the saltmarsh in Georgia, where the new slip was going to be cut into the island. The new slip was going to impact 2.64 acres of saltmarsh and 0.80 acres of protected estuarine mudflats. Georgia requires that compensa-

Figure 2: Southern tip of Elba Island.

tion of wetlands loss be calculated using the Savannah COE's SOP.

The Georgia SOP generally results in a 2:1 ratio for the loss of like saltmarsh, similar to South Carolina's credit analysis. In this case, however, SLNG chose to run the SOP credit analysis rather than offering to mitigate at a 2:1 credit ratio. Once it was determined that the 11-acre site was to be used to mitigate for wetland impact in two states instead of one, SLNG made every effort to maximize the potential credit value of the site.

By performing the SOP, SLNG was able to apply the SOP to the proposed creation site to generate a surplus of credits for potential future use. ATM completed the SOP and the calculation yielded a need to mitigate for 21.1 credits in Georgia.

Figure 3: Entry of the first ship into the new LNG slip, February 2, 2006.

Site Study

SLNG then surveyed and studied the approximate 11-acre parcel of upland area at the southern end of the island to determine how to properly design the mitigation to provide both South Carolina's 1.3 acres and Georgia's 21.1 credits. Analysis of the survey and study data revealed that a mitigation site could be designed to create 7.5 acres of saltmarsh and 3.9 acres of upland buffer.

SLNG then applied the SOP for the planned upland buffer and saltmarsh. The credit calculation gave 2.8 credits for the upland buffer and 31.1 credits for the saltmarsh, for a total of 33.8 credits. Since the design for the mitigation site as planned would potentially yield 33.8 credits and only 21.1 compensatory credits were needed, the result would be a surplus of 12.7 credits.

Preparations For Construction

Once all the agencies approved SLNG's Elba Island Mitigation Plan (The Plan), it was time to put the Plan into effect. Before the Plan was approved, however, SLNG began collecting data on tidal conditions to accurately measure elevations of the tidal flux. Because accurate data on both tidal elevation flux and land survey are critical design parameters for developing the grading plan, surveys of the site were also conducted prior to the Plan's approval.

Figure 4: Tidal staff gauge for piezometer reference, (ATM 2004b).

Precise grading elevations were required, not only to successfully meet the hydrologic parameters for the species that were to be planted for the saltmarsh, but also to design the feeder creek system where the mudflats would be located. Soil calculations were conducted to make sure the volume of soil from the graded area would result in a properly designed upland buffer.

If too much material was applied to the buffer, it would be too steep, resulting in erosion, slope failure, and loss of buffer material, either into the river or into the planned 7.5 acres of saltmarsh anticipated.

A pre-construction meeting was held between SLNG's environmental project manager and the construction contractor to discuss environmental issues, including but not limited to permit specifications and conditions, erosion and sedimentation control, best management practices, nuisance species eradication methods, spill prevention and waste management.

Remove Nuisance Species

Site construction began in early May 2003 and was completed on July 16, 2003. The first action taken was to remove all of the upland nuisance vegetation and burn it utilizing a forced air incinerator box. As feasible, all root and seed material not burned was buried a minimum of six feet deep under the proposed upland buffer location.

Grading And Erosion Control

After the clearing phase was completed, the site was resurveyed and elevation grading stakes were set out across the site. The line at which the upland buffer would meet the saltmarsh was graded to +7.5 Mean Low Water or MLW (the upper end of Mean High Water) and graded with a gradient toward the open water down to +5.0 MLW (the lower end of Mean High Water). This gradient would create a more natural slope and provide for a rich diversification of planted and opportunistic saltmarsh species to establish.

Accurate grading was one of the most vital aspects of the creation site: It was critical for the grade elevations to be accurate, because incorrect grading could lead to incorrect saltmarsh

Figure 6: Grading stakes set by elevation survey (ATM, 2005b).

Figure 5: Incinerator box for eradication of nuisance vegetation (ATM, 2004b).

hydrology, which would contribute to failure of the saltmarsh creation project. Highly qualified equipment operators working on both land and from barges conducted the grading operations.

Erosion control measures were taken. Once

Figure 7: Equipment used to grade the site to specific elevations.

the grading operations were completed, erosion control measures were implemented. Silt fence was installed at the base of the upland buffer to prevent any upland material from sliding into the newly created saltmarsh. Additionally, the upland buffer was graded at a 3:1 slope and planted with a cover crop of brown top millet to minimize erosion. Rock revetment protection was placed at the entrance to the feeder creek to prevent erosion from wave and wake action.

Workers introduced native saltmarsh species. The last phase of construction was the planting regimen. The Plan prescribed planting of 3,000 lowland maritime forest trees on the upland buffer. A partial list includes: slash pine, loblolly pine, water oak, sugarberry, laurel oak, live oak, red bay, sweet bay, loblolly bay, hackberry, American elm, black gum, yaupon, wax myrtle and saw palmetto.

The Plan prescribed planting smooth and saltmeadow cordgrass (Spartina sp.) in the saltmarsh. These species were nursery grown and planted on 2-foot centers from 1.75-inch pots. Along the water's edge, three rows of one-gallon size pots or larger were planted to help prevent erosion from wave and wake action.

Results

As mandated by the COE, the site requires seven years of successful monitoring before it can be authorized as a successful compensation. The site underwent its first year monitoring in November 2003, during which the site was resurveyed and measured for plant growth, wildlife usage and appropriate hydrology.

The as-built surveys revealed that instead of creating 7.5 acres of saltmarsh and 3.9 acres of upland buffer as planned, 6.54 acres of saltmarsh and 5.10 acres of upland buffer were created. Reapplication of the Georgia SOP analysis resulted in 3.5 credits for upland buffer and 26.2 credits for saltmarsh for a total of 29.7 credits, which still provided a surplus of 10.3 credits.

Saltmarsh and the upland buffer vegetation were monitored for percent cover, plant and stem density, and species diversity. The upland buffer was also monitored for planted species die-off and native species establishment. The measurements for both the saltmarsh and upland vegetation resulted in better-than-expected growth. The upland buffer required some manual pulling and spraying for invasive exotic plants.

Wildlife usage was measured by direct and indirect observations, specifically the direct observation of crabs, shellfish, wading birds, alligators and the indirect observation of deer and raccoon footprints and scat, all of which support positive usage of the site.

Critical to the health and sustainability of the saltmarsh is the need for appropriate hydrology. Staff gauges and piezometers determined tidal flux and soil moisture regimes respectively. Measurements from the site were compared to a reference saltmarsh adjacent to the site. The site flooding frequency, tidal flux, and soil moisture measurements were similar and consistent with the reference marsh. The hydrologic information from the saltmarsh indicated it was healthy.

Promising Results

Currently, the wetland site is in its fourth growing season and the preliminary results

Figure 8: Wetland plant spacing based on two-foot centers (ATM, 2004b).

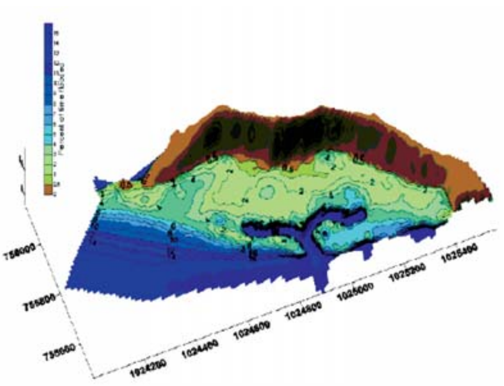

Figure 9: Flooding frequency contours for the wetland creation site (ATM, 2004b).

from the first three monitoring years appear more promising. The definitive results of the first year's monitoring report are very encouraging, and the creation site is well on its way to being a long-term successful wetland creation site. ***P&GJ***

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(This article is adapted from a presentation made at the International Pipeline Conference in Calgary sponsored by the American Society of Mechanical Engineers from Sept. 26-28, 2006.)

Figure 10: Wetland creation site, September 2005.