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STUDY TITLE: Coastal Wetlands Impacts – OCS Canal Widening Rates and Effectiveness of OCS Pipeline Canal Mitigation

REPORT TITLE: Outer Continental Shelf (OCS)-Related Pipelines and Navigation Canals in the Western and Central Gulf of Mexico: Relative Impacts on Wetland Habitats and Effectiveness of Mitigation

CONTRACT NUMBER: 01-97-RU-14961

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREAS: Western and Central

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KEY WORDS: Navigation; channels; canals; pipelines; Gulf coast; subsidence; landloss; wetland loss; OCS; oil and gas; saltwater intrusion; mitigation

BACKGROUND: The coastal region of the Gulf coast states (Texas, Louisiana, Mississippi, and Alabama) contains a diverse array of wetland systems and encompasses one of the largest expanses of coastal wetlands in the contiguous United States. These wetland ecosystems range from forested swamps to fresh, brackish, and saline marsh expanses; the wetlands provide numerous ecological and economic benefits and are integral to the Nation's economy, culture, and natural environment.

An often cited cause of wetland loss in Louisiana is infrastructure development for oil and gas activities; an estimated 15,000 kilometers of oil and gas pipelines cross wetlands of Louisiana and approximately 50,000 oil and gas production facilities are located in coastal Louisiana. A number of previous studies of varying scales and focus have examined the impacts of some of this infrastructure and suggest that it may contribute to coastal wetland loss through a variety of mechanisms including saltwater intrusion, hydrological alterations, and direct alteration of habitats (for example., conversion of marsh to open water canals). Despite these studies, the full extent to which Outer Continental Shelf (OCS)-related oil and gas activities have contributed to and exacerbated overall coastal wetland loss along the Gulf coast of the United States remains unclear, as does the extent to which construction and mitigation techniques can be used to minimize their impacts.

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OBJECTIVES: (1) Provide an overview of the current state of knowledge on construction and mitigation practices associated with OCS-related pipelines and navigation canals in the gulf coast region; (2) Quantitatively analyze the effects of OCS-related pipelines and navigation canals on land loss, wetland loss, and changes in fresh and nonfresh marsh areas; (3) To use selected case studies of OCS-related pipelines and navigation canals to evaluate the effectiveness of construction and mitigation practices used to mitigate their effects on land loss, wetland loss, and changes in fresh and nonfresh marsh areas (section 3 of this report).

DESCRIPTION: The study area boundaries incorporate the MMS western (Mexico/Texas border to Texas/Louisiana border) and central (Texas/Louisiana border to a point south of the eastern edge of Mobile Bay, Alabama) planning areas of the Gulf of Mexico. The study area is further subdivided into five subareas based on geologic and political features: Texas barrier islands (TBI), Texas chenier plain (TCP), Louisiana chenier plain (LCP), Louisiana deltaic plain (LDP), and the Mississippi-Alabama coastal plain (MACP).

The project was organized into four major components: (1) Literature review: a review of the literature of activities, impacts, and mitigation practices associated with OCS-related pipelines and navigation canals, (2) GIS analysis: collection and collation of spatial data on locations and habitats of OCS-related pipelines and navigation canals, as well as generation of datasets on land loss and habitat change within the immediate vicinity of these pipelines and navigation canals, (3) analysis of land loss and habitat change: statistical analyses of trends in land loss and habitat change and the impacts of the construction of pipelines and navigation canals on those trends, and (4) mitigation effectiveness: an evaluation of the effectiveness of mitigation techniques at ameliorating the impacts of pipelines and navigation canals.

SIGNIFICANT CONCLUSIONS: The construction of OCS-related pipelines through coastal ecosystems can cause locally intense habitat changes, thereby contributing to the loss of critically important land and wetland areas (for example, conversion to open water or upland or the conversion of fresh to nonfresh marsh). Some construction methods create a greater impact per unit length than others (for example, flotation canals versus backfilled push-pull ditches, or directionally drilled canals). Direct impacts result from dredging activities, while indirect impacts occur through local hydrologic changes (for example, altered flooding patterns created by spoil banks or saltwater intrusion). Although pipeline impacts can be severe, they can be greatly minimized or avoided with proper application of mitigation techniques; this is true even for impacts from flotation canals. Our analyses revealed that the degree of impacts associated with specific pipeline canals varied widely, with some pipelines contributing to habitat loss and others not, depending largely on the extent and quality of mitigation applied, regardless of region or habitat crossed. Our analyses also suggest that the cumulative effect of hundreds of pipelines contributes to regional trends in land loss.

Compared to those from a pipeline canal, impacts from a navigation canal are typically larger, more persistent (for example, canal widening and saltwater intrusion), and more difficult to minimize (for example, to remain functional, a navigation canal cannot be backfilled). Canal widening rates have slowed in recent years, apparently as a result of increased bank stabilization efforts (see chapter 6), but saltwater intrusion and other hydrologic effects persist for all navigation canals. Given the direct, uncontrollable impacts of a functioning navigation canal (for example, saltwater intrusion), the key to mitigating additional impacts is bank stabilization, and where possible, beneficial use of dredged material from maintenance dredging activities to create wetland or upland habitats (for example, such activities have been successful with the Calcasieu Ship Channel).

STUDY RESULTS: Impacts from construction of OCS-related pipelines can be minimized or altogether avoided if care is taken to reestablish and maintain the marsh elevation and local hydrologic regime that existed prior to construction. This entails the use of techniques like backfilling and avoiding the creation of spoil banks. There are several effective methods for ensuring this happens.

1. **Mitigation.** Impacts can be minimized or altogether avoided if adequate mitigation is carefully planned and executed for every project. Partial or no mitigation (for example, push-pull ditching without backfilling, or directional drilling without shoreline stabilization) virtually ensures that impacts will occur.

2. **Maintenance.** Routine maintenance of mitigation measures can be conducted to maintain preconstruction elevation and hydrologic conditions in relation to long-term process influences such as soil subsidence.

3. **Construction Method.** If more than one construction method is suitable for a given coastal environment, the least damaging and most easily mitigated method can be used. For example, construction of flotation canals has the biggest impact of all methods, and it is the most difficult construction method to mitigate. This method can sometimes be avoided by using push-pull ditching with backfilling or directional drilling. An additional approach to make construction less harmful is to construct bulkheads or dams at all waterway and beach crossings to stabilize these vulnerable habitats.

Accepting as given the direct, uncontrollable impacts of a functioning navigation canal (that is, saltwater intrusion), additional impacts can be mitigated with bank stabilization, and where possible, beneficial use of dredged material (produced during maintenance dredging activities) to create wetland or upland habitats (for example, as has been done for the Calcasieu Ship Channel).

STUDY PRODUCT: Johnston, James B., D. Cahoon, and M. La Peyre. 2009. Outer Continental Shelf (OCS)-related pipelines and navigation canals in the western and central Gulf of Mexico: relative impacts on wetland habitats and effectiveness of mitigation. Final report for the U.S. Dept of the Interior, Minerals Management Service Gulf of Mexico OCS Region, Metairie, LA. OCS Study MMS 2009-048. Contract No. 01-97-RU-14961. 192 pp.

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* P.I.'s affiliation may be different than that listed for Project Managers.