ACCESS NUMBER: 30325

STUDY TITLE: Impacts of OCS-Related Activities on Sensitive Coastal Habitats

REPORT TITLE: Pipelines, Navigation Channels, and Facilities in Sensitive Coastal Habitats, An Analysis of Outer Continental Shelf Impacts, Coastal Gulf of Mexico, Volume I: Technical Narrative and Volume II: Atlas of Physical, Cultural, and Biological Parameters

CONTRACT NUMBER: 14-12-0001-30325

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREAS: Western, Central, and Eastern Gulf of Mexico

FISCAL YEARS OF PROJECT FUNDING: 1986, 1987

COMPLETION DATE OF REPORT: October 1989

COSTS: FY 1986: $100,000; FY 1987: $344,481 CUMULATIVE PROJECT COST: $444,481

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KEY WORDS: Outer Continental Shelf, Pipelines, Navigation Channels OCS Facilities, Barrier Islands, Beaches, Wetlands, OCS Impacts, TX, LA, MS, AL, FL, Gulf of Mexico Coastal Region

BACKGROUND: Since the 1950's, there has been extensive development of infrastructure, i.e., pipeline navigation channels, and petroleum-related facilities, to support hydrocarbon production from the Gulf of Mexico OCS region. OCS-related activities have been blamed for detrimental impacts to the barrier islands, beaches, and wetlands on the northern Gulf of Mexico coast. Prospects for OCS activities in the Eastern Gulf required that past impacts be documented in order to gage the potential for future impacts in frontier exploration and production areas.

OBJECTIVES: 1) Document the extent and significance of impacts of OCS-related activities on sensitive coastal habitats (barrier islands, barrier beaches, and wetlands) on the Northern Gulf of Mexico coastal area; 2) Correlate observable and quantifiable impacts of OCS-related activities to construction techniques and/or environmental

conditions (geological, biological, hydrological and cultural); 3) Predict impact of future OCS activities on the Northern Gulf of Mexico coast.

DESCRIPTION: The study area includes all barrier islands and beaches along the Northern Gulf of Mexico from Cameron County, TX through Bay County FL and all sumergent grassbeds and emergent wetlands except those located between East Bay, TX and the LA-MS border.

The research effort included four major tasks. Task one summarized impacts attributed to OCS-related activities and assembled relevant data on OCS pipelines, facilities, and navigation channels. Questioners went to petroleum companies to verify location, size, line content, date and method of pipeline construction. Data were tabulated, OCS pipelines and related facilities were mapped, and pipeline construction techniques and mitigation measures were summarized. Navigation channels improved for OCS activities were identified. Physical and cultural environmental parameters having a potential influence on type and extent of OCS impacts were mapped and characterizations were written for the four Gulf Coastal Systems. State and Federal polices, guidelines, and laws presently governing implacement of pipelines, navigation channels, and facilities in sensitive coastal habitats were documented by state.

Task two quantified direct impacts of all OCS pipelines by: 1) measuring and comparing rate of shoreline change at shore crossings of pipeline rights-of-way (ROW) and controls for all OCS lines crossing barrier islands and beaches and 2) measuring change in canal width for OCS lines in flotation canals through barrier islands, beaches, and wetlands in the TX Barrier Islands and North Central Gulf Coast Systems. Air photos provided descriptions of OCS lines, navigation channels, OCS-related facilities, and surroundings. Direct impacts of three (Matagorda, Mermentau, Belle Pass) out of 11 OCS navigation channels were quantified by measuring changes in channel width and comparing difference in shoreline position updrift and downdrift of channel jetties over time.

Task three involved field sampling at 11 pipelines representative of various construction techniques (open flotation canal, open and backfilled push-pull ditches) in each coastal sites revealed differences in analysis of vibracores and beach profiles at ROW and control sites revealed differences in morphology and stratigraphy attributable to pipelines. Bathymetric profiles and observations on water movement and salinity indicated a pipeline's impact on local circulation and drainage patterns. Percent cover estimations within a 1 m2 quadrant and clipping, drying, and weighing of 1/16 m2subsamples documented differences in plant standing crop biomass at pipeline ROW and control sites. Statistical analyses were performed with Statview computer software.

Task four summarized impacts of pipelines, navigation channels, and OCS-related facilities by coastal system and related the impacts, to system characteristics. Future impacts were discussed in terms of existing regulations, construction techniques, and coastal system characteristics.

SIGNIFICANT CONCLUSIONS: The extent of pipeline impact varied with construction technique and coastal system but lines could be placed in most systems with little impact if environmental processes are properly considered. Backfilled push-pull ditches scarred the least and became virtually indistinguishable with time except in the Mississippi Delta System. Even flotation canals trapped fine grained material and became capped by beach material where there was adequate material in transport. Canals at eroding marsh shores require bulkhead replacement to minimize interior marsh erosion and push-pull ditch lines must be lowered at retreating shores because of shallow burial. Navigation channels need a maintenance program to retain dredged material inshore to restore natural shore processes of beach maintenance and land building.

STUDY RESULTS: Of 164 Federal OCS pipelines constructed between 1950 and 1986, 70% cross barrier island complexes or beaches and 30% land along marsh shores. The percentage of lines by coastal system is 57% for Mississippi Delta, 34% for Strandplain-Chenier Plain, 6% for Texas Barrier Islands and 3% for North Central Gulf Coast. Gas was carried in 65% of the lines and 77% of the lines are 20 in or less indiameter.

OCS navigation channels include: Matagorda Ship Channel, TX; Mermentau River Gulf of Mexico Channel, Freshwater Bayou, Lower Atchafalaya River, Bayous Boeuf, Black, and Chene, Houma Navigation Canal, Belle Pass, and Grand Pass, LA; and Gulfport Harbor, MS. Eleven categories of OCS-related facilities were identified, however, updating and verification is needed before impacts can be summarized adequately.

Impacts of the 10 OCS pipelines in the Texas Barrier Island System were virtually nil because of: mitigative construction techniques (i.e., backfilling), environmentally sensitive ROW alignments, adequate sediment in the barrier system, and a relatively stable, firm saline-to-brackish marsh.

Eighty percent of the 55 OCS lines in the Strandplain-Chenier Plan System appear to be in push-pull ditches while 20% of the lines share four flotation canals. All flotation cuts appear to have been bulkheaded originally near the shore. Nearshore cuts have filled with fine-grained clay and silty clays, often being revegetated near the beach. Where there is adequate coarse material, beaches have formed. In the absence of adequate sediment, new bulkheads have been constructed at retreating shorelines to prevent erosion into interior tidal systems.

Seventy-three percent of the 41 OCS lines crossing barrier shores in the Mississippi Delta System land at sites with "processing" facilities: East Timbalier, Belle Pass, and Grand Isle. Five lines fall in island passes and 49 have marsh landings. Construction techniques were difficult to determine from air photos because of natural and human shoreline alterations. Beach cuts were bulkheaded or naturally sealed by sand but bank erosion was extensive in interior marshes.

In the North Central Gulf Coast System, the backfilled push-pull ditches had revegetated but the sampled line had a ROW lower in elevations, less consolidated and with dominate vegetation different that the surrounding marsh. The flotation canals altered local drainage, had an average increase in width of 20% over the past 14 years, and was eroding around the coastal bulkhead.

The Matagorda Ship Channel did not widen at the island crossing because its banks are stabilized with rip rap but portions had scoured below authorized depth. The island widened updrift of the jetties but shoreline retreat accelerated downdrift of the jetties. In contrast, the Mermentau Channel, dredged in unconsolidated marsh substreate, was 99 m wider in 1985 than its authorized width of 61 m. Jetties have been extended inland due to erosion and there is accelerated erosion downdrift of the jetties. Both channels replaced maintained natural channels which have since shoaled and filled respectively. Belle Pass, 43 m wide in 1887, now averages 329 m in width. To maintain Belle Pass, jetties were extended and a west wing jetty was added by 1983. Shore retreat rates are greater downdrift of the jetties.

OCS-related facilities compromise a relatively small percentage of barrier island area and virtually no barrier beach area. Most facilities in Texas Barrier Islands and North Central Gulf Coast Systems appear to be sited on uplands which occur near the Gulf. In contract, more facilities have the potential to impact wetlands in the Strandplain-Chenier Plain and Mississippi Delta Systems because of the wide expanse of wetlands located between the Gulf and uplands. Quantification of wetlands impacts requires verification of sites and analysis of historic aerial photographs.

Further refinement of existing laws and regulations controlling construction in sensitive habitats, as well as improved technology, will prevent a repetition of negative impacts in most coastal areas. Emplacement in the Mississippi Delta System will remain a problem because of the extensive wetlands to be crossed and deterioration of the system due to natural processes and human activities. New OCS channels are unlikely but maintenance of existing channels will continue to degrade the environment unless the dredged material is retained inshore and managed as an accretionary process for land building. New citing of OCS facilities in coastal areas will be restricted to those having water dependent uses with avoidance of COBRA areas.

STUDY PRODUCTS: Wicker, K.M., R.E. Emmer, D.W. Roberts, and J. L. Van Beek, 1989. Pipelines, Navigation Channels, and Facilities in Sensitive Habitats, An Analysis of Outer Continental Shelf Impacts, Coastal Gulf of Mexico. Vol. 2. Atlas of Physical, Cultural, and Biological Parameters. OCS Report/MMS 89-0052, U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA 83 pp.

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