

## **5.0 CUMULATIVE IMPACTS**

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### **5.1 INTRODUCTION**

Cumulative impact has been defined by the President’s Council on Environmental Quality (CEQ) as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or persons undertakes such action.” Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Impacts include both direct effects, which are caused by an action and occur at the same time and place as the action, and indirect effects, which are also caused by the action and occur later in time and are farther removed in distance, but which are still reasonably foreseeable. Ecological effects refer to effects on natural resources and on the components, structures, and functioning of affected ecosystems, whether direct, indirect, or cumulative.

In assessing cumulative impact, consideration is given to (1) the degree to which the proposed action affects public health or safety, (2) unique characteristics of the geographic area, (3) the degree to which the effects on the quality of the human environment are likely to be highly controversial, (4) the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks, and (5) whether the action is related to other actions with individually insignificant, but cumulatively significant impacts, on the environment.

Cumulative effects can result from many different activities including the addition of materials to the environment from multiple sources, repeated removal of materials or organisms from the environment, and repeated environmental changes over large areas and long periods. More complicated cumulative effects occur when stresses of different types combine to produce a single effect or suite of effects. For example, large, contiguous habitats can be fragmented, making it difficult for organisms to locate and maintain populations between disjunctive habitat fragments. Cumulative impacts may also occur when the timings of perturbations are so close that the effects of one are not dissipated before the next occurs, or when the timings of perturbations are so close in space that their effects overlap.

Relative to cumulative impacts, 11 parameters were addressed for 8 past, present, and reasonably foreseeable future projects viewed as pertinent to the future condition of the Project Area and the surrounding area. Parameters to be addressed include ecological, physical, chemical, socioeconomic, and cultural attributes.

#### **5.1.1 Cumulative Impact Assessment Methodology**

This discussion describes the application of the cumulative impact assessment methodology to the proposed alternative. Projects evaluated in the cumulative impact assessment include the following:

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Reasonably foreseeable future actions:

- Freeport Harbor Channel Improvement Project (Federal project);
- Freeport LNG Project, Phases I and II;
- Center Point Energy, Inc. (associated with supplying electricity for the Freeport LNG Project);
- Port Freeport Modifications;
- Strategic Oil Reserve (Stratton Ridge underground storage); and
- Teppco-Seaway Crude Pipeline Company (potential modifications or relocation of facilities resulting from improvements to the Freeport Harbor Channel project).

Past or present actions:

- The GIWW, which crosses the existing Freeport Harbor Channel project near mile 1.5;
- Freeport Hurricane Flood Protection Levees;
- Strategic Oil Reserve (Bryan Mound); and
- Freeport Harbor 45-ft Project.

Direct impacts that could be quantified in acreage were considered for habitat assessment when information was available. Habitats for cumulative impact assessment were identified from reports developed for the above proposed projects and include the types of information included in Table 5.1-1.

TABLE 5.1-1  
CUMULATIVE ECOLOGICAL/ECONOMIC IMPACTS

Ecological Environment	Physical/Chemical Environments	Socioeconomic Assets
Wetlands (coastal marshes)	Air Quality Noise Impacts	Cultural Resources
Benthos	Turbidity	Commercial Fisheries
Essential Fish Habitat	Contaminated Sediments (vicinity of DOW Chemical)	Recreational Fisheries
Threatened/Endangered Species	Shoreline/Bank Erosion (Quintana Island, Surfside and inner reaches of channel alignment route)	

### 5.1.2 Evaluation Criteria

Cumulative effects were determined by reviewing impacts as described in the project documents and determined from recent habitat information obtained from Section 3.0. Acreage of each habitat in the study was determined from this assessment, if available.

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### **5.1.2.1 Individual Project Evaluation**

Individual project documents were reviewed for impacts to selected habitats based on the evaluation criteria described above. No attempts were made to verify or update published documents, nor were the disposal practices proposed in reviewed documents verified for current ongoing projects. In addition, no field data were collected to verify project impacts described in reviewed documents. Mitigation outlined in individual project documents may be in place or proposed. This analysis recognizes that some of the projects assessed are undergoing revisions that may alter their environmental impact. This analysis relied only on existing published documents. If acreage was available, it was summed for each habitat to obtain a cumulative acreage impact for each project. It should be noted that because of the diverse mix of documents that were reviewed for cumulative impacts and because of the fact that not all documents used the same definitions or even the same categories of resources, it was sometimes necessary to lump or modify categories so that the quantities in this section may not be exactly comparable with those presented in sections 3 and 4 of this EIS. However, every attempt has been made to make this section internally consistent, so that all projects included in Cumulative Impacts are evaluated comparably.

### **5.1.2.2 Resource Impact Evaluation**

Biological/ecological, physical/chemical, and cultural/socioeconomic resource impacts were evaluated based on individual project reviews. In Table 5.1-2, a quantitative assessment of biological/ecological resources is presented. A qualitative discussion of biological/ecological, physical/chemical resources, and cultural/socioeconomic resources is presented below, using information published in reviewed documents. The following is a brief description of the evaluated projects.

## **5.2 REASONABLY FORESEEABLE FUTURE ACTIONS**

### **5.2.1 Freeport Harbor Channel Improvement Project**

The USACE has completed preliminary economic and an alternatives screening for improvements along the Freeport Harbor Channel that include deepening and widening portions of the channel. The BRHND of Brazoria County, Texas (Port Freeport) is the non-Federal sponsor for the project. Proposed improvements include widening the Entrance and Jetty Channel, widening and deepening to the Upper Turning Basin, and improving the Stauffer Channel. The proposed dredge and fill activities constitutes a major Federal action and an EIS is being prepared.

The proposed project begins at Channel Station -427+00 at the Entrance Channel extension and continues to Station +225+00 at the Stauffer Turning Basin along the existing Freeport Harbor Channel in Brazoria County, Texas. The Freeport Harbor Channel is currently maintained by the USACE to a depth of -47 ft MLT offshore and -45 ft MLT inshore at a width of 400 ft. The existing channel is approximately 6.3 miles in length. The proposed project (-60 ft MLT and 600-ft width) may also include widening and deepening the Lower Turning Basin, Brazosport Turning Basin and Upper Turning Basin, as well as improving the channel to the Stauffer Turning Basin.

TABLE 5.1-2  
CUMULATIVE IMPACTS

Project	Freeport Harbor Channel Widening Project	Freeport LNG Project	Port Freeport Modifications	Stratton Ridge Underground Storage	GIWW	Freeport Hurricane Flood Protection Levees	Bryan Mound Oil Reserve	Freeport Harbor 45-ft Project	Total
<b>RESOURCE</b>									
Wetlands impacted (acres)	NI	57	2.08	538	NI	NI	NI	40	637.1
Wetlands created (acres)	NI	NA	15.7	NA	NA	NI	NA	NA	15.7
Benthos	NI	NI	NA	NI	NI	NI	NI	NI	NI
Threatened/Endangered Species	NI	NI	NA	Potential impact to bald eagle habitat	NI	NI	NI	NI	POTENTIAL IMPACT TO BALD EAGLE
Salt Marsh	NI	NA	NA	NA	NI	NI	NI	NA	NI
Flats	NI	NA	NA	NA	NI	NI	NI	NA	NI
Shallow Bay Bottom Habitat (0 to -12 MLT)	NI	13.9 ac created	NA	4.7 ppt salinity increase	NI	NI	NI	NI	INCREASE IN SALINITY
Submerged Aquatic Vegetation (SAV)	NI	NA	NA	4.7 ppt salinity increase	NI	NI	NI	NI	INCREASE IN SALINITY
Essential Fish Habitat (subtotal of salt marsh, flats, shallow bay bottom habitat, and SAV)	NI	NI	NA	4.7 ppt salinity increase	NI	NI	NI	NI	INCREASE IN SALINITY
Air Quality	NA	NI	NA	NI	NI	NI	NI	NI	NI
Noise	NI	NI*	NA	Minor	NI	NI	NI	NI	MINOR
Water Quality	NI	NI	NA	4.7 ppt salinity increase	NI	NI	NI	NI	INCREASE IN SALINITY
Sediment quality	NI	NI	NA	NI	NI	NI	NI	NI	NI
Shoreline/Bank Erosion	Beach placement	NI	NA	NI	NI	NI	NI	0.85 mile beach placement	Net positive effect from placement

TABLE 5.1-2 (Concluded)

Project	Freeport Harbor Channel Widening Project	Freeport LNG Project	Port Freeport Modifications	Stratton Ridge Underground Storage	GIWW	Freeport Hurricane Flood Protection Levees	Bryan Mound Oil Reserve	Freeport Harbor 45-ft Project	Total
Cultural Resources	Possible nautical site impact	Possible loss of historic resources	NA	Possible loss of historic resources	NI	NI	NI	NI	POSSIBLE LOSS OF RESOURCES
Commercial Fishereies	NI	NI	NA	NI	NI	NI	NI	NI	NI
Recreational Fisheries	NI	NI	NA	NI	NI	NI	NI	Created areas	POSITIVE EFFECT

NI = No long-term impacts; NA = Not Available; \* = with mitigation.

Note: No impact information was available for the Federal Freeport Harbor Channel Improvement Project, the Center Point Energy Project, or the Teppco-Seaway Crude Pipeline Company Project.

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Approximately 27.8 mcy of new work material and 150 mcy of maintenance material over the 50-year period of economic evaluation are expected to be produced by the proposed project. Dredged material may be placed in existing UCPAs, new UCPAs, a dispersive ocean placement site, or BU sites (to be determined).

At the time this document was prepared, the evaluation of potential impacts associated with this project was not complete. Thus, no potential impact information was available.

## **5.2.2 Freeport LNG Project**

The Freeport LNG Development, L.P. (Freeport LNG) LNG Import Terminal Project (Freeport LNG Project) is to develop the necessary infrastructure to deliver natural gas to shippers at the Stratton Ridge Meter Station by 2007. To this end, Freeport LNG is constructing a new LNG facility on Quintana Island, Brazoria County, Texas. The final EIS for Phase I of this project lists the following components for the Freeport LNG Project (FERC, 2004).

- LNG ship docking and unloading facilities with a protected single berth equipped with mooring and breasting dolphins, three liquid unloading arms, and one vapor return arm;
- reconfiguration of a storm protection levee and a permanent access road;
- two 26-inch-diameter (32-inch outside diameter) LNG transfer lines, one 16-inch-diameter vapor return line, and service lines (instrument air, nitrogen, potable water, and firewater);
- two double-walled LNG storage tanks each with a usable volume of 1,006,000 barrels (3.5 billion cubic ft of gas equivalent);
- six 3,240 gallon-per-minute (gpm) in-tank pumps;
- seven 2.315 gpm high-pressure LNG booster pumps;
- three boil-off gas compressors and a condensing system;
- six high-pressure LNG vaporizers using a primary closed circuit water/glycol solution heated with twelve water/glycol boilers during cold weather and a set of intermediate heat exchangers using a secondary circulating water system heated by an air tower during warm weather, and circulation pumps for both systems;
- two natural gas superheaters and two fuel gas heaters;
- ancillary utilities, buildings, and service facilities at the LNG terminal; and
- 9.6 miles of 36-inch-diameter natural gas pipeline extending from the LNG import terminal to a proposed Stratton Ridge Meter Station.

Phase II of the project includes construction of an additional LNG ship berth and associated unloading facilities with the capacity to unload up to 200 LNG ships per year, additional vaporizers and associated systems, including an air tower, and an additional LNG storage tank and associated systems (FERC, 2006). The second berth would be located adjacent to the Phase I berth and would be dredged to a depth of -46.5 ft. Approximately 144,000 cy of surface materials would be removed for construction of the dock

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and used as fill material elsewhere on the site. Approximately 754,000 cy of dredged material would be pumped to an existing DMPA that is currently being used by the Port and has been authorized by the USACE. Two LNG transfer lines (each 0.99 mile long) would extend across the LNG site boundary.

Impacts associated with both phases of the project include the permanent loss of approximately 57 acres of wetlands and the conversion of approximately 13.9 acres of upland to open-bay bottom.

### **5.2.3 Center Point Energy, Inc**

Construction and operation of the Freeport LNG Project would require that new, dedicated electrical service be brought to the LNG Terminal site. Freeport LNG has requested Center Point Energy to provide a new 69-kV electric transmission line to the Freeport LNG substation, which is to be located on the site of the proposed storage and vaporization facility on Quintana Island. The new line would connect to an existing Center Point Energy substation on the mainland. No information regarding potential impacts associated with this project was available.

### **5.2.4 Port Freeport Modifications**

Several projects were identified by Port Freeport as reasonably foreseeable projects in the Freeport area. These include the expansion of public docks (Dock 5), a cool storage facility, construction of berth 7, the Gulf Coast Regional Spaceport, and park upgrades and a new marina. Additionally, upgrades or additions are planned at two facilities currently operating at the Port, BASF, and RCI. Because many of these projects are still in the conceptual planning stages, there is very little information available regarding their potential impacts. However, a brief description of each follows.

#### **5.2.4.1 Expansion of Dock 5**

Development of Parcel No. 25/Berth 5 property will further augment the Port's warehousing and rail facilities. Transit Shed 6 adjacent to Dock 5 will be a 125,000-square ft facility with rail access (BRHND, 2004). According to Port Freeport's Environmental Coordinator, potential impacts associated with the Dock 5 expansion will include minimum to no wetland impacts for the initial phase and dredging activities with placement of dredged material in the Port's UCPAs (Personal communication with Lisa McMichael, August 23, 2006).

#### **5.2.4.2 Cool Storage Facility**

A 38,000- to 40,000-square-ft new waterfront cold storage facility is under construction to serve needs of fruit importers Dole Fresh Fruit Co. and Chiquita Brands Inc. The facility will handle palletized fruit and other temperature-sensitive commodities (BRHND, 2004). Construction of the facility involves conversion of a transit shed and does not involve construction of undeveloped land. It will contain four cubicles for fresh fruit storage that can be off-loaded as breakbulk cargo for ships or trucks (Personal communication with Lisa McMichael, August 23, 2006).

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#### **5.2.4.3 Construction of Berth 7**

This would be a new 800-ft-long berth with 20 acres of stabilized backlands for new containerized and/or breakbulk cargo activity. The facility will ultimately be 1,200 ft long and is designed to handle new generation gantry cranes and vessels up to 48-ft draft (BRHND, 2004). According to Port Freeport's Environmental Coordinator, the project is expected to impact approximately 2.08 acres of jurisdictional Waters of the U.S. The Port is mitigating for that loss with the creation of 15.7 acres of wetlands. Specifically, 8.5 acres of new wetland would be created and 7.2 acres of existing wetlands in the Peach Point Wildlife Management Area would be enhanced (Personal communication with Lisa McMichael, August 23, 2006).

#### **5.2.4.4 Gulf Coast Regional Spaceport**

The Gulf Coast Regional Spaceport Development Corporation has proposed the construction of a Gulf Coast Regional Spaceport in Brazoria County. The action would require the Federal Aviation Administration (FAA) to issue a launch site operator license to support the launches of suborbital rockets in Brazoria County. The preferred location for the spaceport is south of Big Slough Road, several miles north of Port Freeport in Brazoria County. Construction would include a ½-mile access road and a 40-ft by 40-ft launch pad. The spaceport would support up to eight launches per year of suborbital rockets, with each launch lasting 15 minutes or less. Issuing a launch license is considered a major Federal action and is subject to the NEPA process (Gulf Coast Regional Spaceport Development Corporation, 2006). A public scoping meeting for preparation of an Environmental Assessment was held July 11, 2006 at the Lake Jackson Civic Center. No potential impact information was available for review at the time this document was prepared.

#### **5.2.4.5 Park Upgrades and Marina**

Improvements are anticipated for Freeport's Memorial Park and Bryan Beach Park. Improvements at Memorial Park include electrical upgrades and repairs, such as in-ground halogen light fixtures, accent flood lights, and a sound system that includes 40 weather-resistant speakers and four amplifiers. The goals of the project are to provide security lighting, landscape and American flag lighting, powering the fountains and making public address with the sound system (*The Alliance*, 2006i). At Bryan Beach Park, there are plans for a parking lot and a 2.9-mile crushed oyster shell trail. Restroom facilities may also be constructed at the park (*The Alliance*, 2006g).

The Port has proposed a marina on the Old Brazos River that would market to large high-end boats. Additionally, a marina is being planned in Surfside off the Highway 332 Bridge. The marina would have a 400-slip dry-dock facility with a restaurant, retail shops, showers and a laundry facility. It would cater to sporting craft rather than larger boats (*The Alliance*, 2006c).

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#### **5.2.4.6 BASF Polycaprolactam Facility**

A polycaprolactam plant is currently under construction at the BASF facilities in Port Freeport. The project is scheduled for completion in mid-2007 (Real Estate Center, 2006). The plant will build on the existing nylon polymer operations and will produce nylon polymers for engineering plastics used in automotive parts, electronics, and sporting goods, as well as other products (*The Alliance*, 2005a). According to the Texas Hub Environmental Team Leader for BASF, projected air emissions for the project have been permitted and process wastewater will be treated onsite under their existing Texas Pollution Discharge Elimination System (TPDES) wastewater discharge permit. No increased water emissions are associated with the project (Personal communication with Michael Baxter July 17, 2006).

#### **5.2.4.7 RCI**

American Rice Inc. (ARI) has plans for an expansion of its on-port facilities. Proposed facilities include:

- a 151,165-square ft, fully automated warehouse on 4.3 acres for storage of finished goods;
- 8 steel storage bins encompassing 45,225 square ft on 1.3 acres for holding rice brought by barge and truck;
- A 36,206-square ft instant rice plant on 1 acre for producing instant and microwavable products;
- A 116,736-square ft olive oil bottling plant on 3.4 acres; and
- A cookie-baking facility.

These improvements are expected to employ approximately 335 people in the Freeport area. In addition, RCI plans to relocate their North American operation headquarters to Freeport (*The Alliance*, 2006j). No information regarding potential environmental impacts was available at the time this document was prepared.

#### **5.2.5 Proposed Stratton Ridge Strategic Oil Reserve**

In 2006, the U.S. Department of Energy (DOE) issued a draft EIS for expansion of the Strategic Petroleum Reserve (SPR) system. The alternatives considered in the DEIS were expansion of two or three existing facilities and development of one or two new facilities. Potential new sites addressed in the EIS were at Richton and Bruinsburg, Mississippi, Stratton Ridge, Texas, and Clovelly and Chachoula, Louisiana, and expansion was proposed at Big Hill, Texas, and Bayou Choctaw and West Hackberry, Louisiana. Bryan Mound was not mentioned in the DEIS and, therefore, the DOE apparently has no plans for expansion or alteration of the Bryan Mound facility. The proposed new Stratton Ridge facility is ~5 miles northwest of Freeport and a brine disposal line is proposed to pass less than 4 miles northwest of the Freeport Harbor Channel. The Stratton Ridge site would encompass about 269 acres plus an additional 102-acre security area around the site. According to the DEIS (DOE, 2006), the Stratton Ridge facility would provide an additional 160 million barrels of crude oil storage in 16 caverns, would use the GIWW as a water source, would include a new brine diffuser in the Gulf of Mexico, and would require

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approximately 61 miles of ROW for new pipelines, roads, and power lines. Potential impacts associated with the proposed facility include the construction of new ROW through the Brazoria NWR, and the loss of 538 acres of wetlands from fill, conversion at the site, and ROW easements. The alternative could affect potential foraging, roosting, and nesting habitat for the Federally threatened bald eagle. Additionally, increased salinity in the Gulf (up to 4.7 ppt), resulting from brine diffusion, would affect EFH, although the increase would be within the normal salinity concentration range for the Gulf. Brine disposal pipeline construction would disturb 320,000 square ft of sediment that is EFH (DOE, 2006).

## **5.2.6 Teppco-Seaway Crude Pipeline Company**

Construction of the proposed Federal Freeport Harbor Channel Improvement Project may result in the relocation of facilities associated with the Teppco-Seaway Crude Pipeline Company. Additional information regarding the potential relocation and associated impacts was not available at the time this report was prepared.

## **5.3 PAST OR PRESENT ACTIONS**

### **5.3.1 GIWW**

Routine maintenance dredging will continue to occur along the GIWW in the vicinity of Freeport Harbor. According to the USACE FEIS for maintenance dredging of the GIWW (USACE, 1975), the portion of the GIWW from Chocolate Bayou to Freeport Harbor is dredged at approximately 36-month intervals and the estimated annual maintenance material is 750,000 cy. The portion from Freeport Harbor to Cedar Lakes is maintained every 24 months with an estimated annual maintenance material of 1,000,000 cy. Dredged material from the GIWW in the vicinity of the project area is placed in UCPAs designated for GIWW maintenance dredging. The proposed widening of the Freeport Channel will not affect the continuing maintenance dredging of the GIWW.

### **5.3.2 Freeport Hurricane Flood Protection Levees**

According to a 2006 report (Edge et al., 2006), the Freeport Harbor levee system is projected to be able to protect the City and Port from a 100-year hurricane, which is more extreme than any hurricane to hit the Freeport area since records have been kept. Therefore, it is not likely that any additional construction would be required for the levee system.

### **5.3.3 Bryan Mound Strategic Oil Reserve**

The Bryan Mound SPR Storage Site is part of the Nation's emergency oil stockpile and has a total storage capacity of 226 million barrels of oil. The system comprises more than twenty 10-million gallon chambers in a salt dome. The top of the dome is 1,200 ft below ground level and reaches a depth of 50,000 ft. The Bryan Mound site is close to port and terminal facilities at Freeport and to the Phillips Petroleum tank farm 3 miles to the east. Two principal crude oil pipelines extend from Bryan Mound—a

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4-mile, 30-inch-diameter line to the Phillips terminal and docks, and a 46-inch line to the ARCO Pipeline Company terminal in Texas City, Texas.

### **5.3.4 Freeport Harbor 45-Ft Project**

This is the existing project, which was constructed in 1978. The Freeport Harbor Jetty and Entrance Channels are currently maintained by the USACE to a depth of -47 ft MLT. The remainder of the channel is authorized at -45 ft MSL. The existing channels are approximately 6.3 miles in length and approximately 400 ft in width. The only on-going activity is the routine maintenance, which requires the removal of an average of 1.72 mcy/cycle (8.2 months), which equals 2.57 mcy/year of material for placement in UCPSs or the maintenance ODMDS.

## **5.4 RESULTS**

### **5.4.1 Wetlands**

The Freeport Widening Project would not impact any wetlands. Negative impacts (totaling 598.5 acres) are expected to occur to wetland habitat from the Freeport LNG project Phase I and II, (57 acres), Port Freeport modifications (3.5 acres), and the Strategic Oil Reserve project (538 acres). Based on available information, a total of 15.7 acres of wetland would be created through mitigation for the Port Freeport modifications. However, several of the projects evaluated had not yet identified wetland mitigation plans. It is reasonably foreseeable that permitting associated with the other projects would result in additional wetland construction and/or enhancement in the Freeport area.

Past and on-going projects have also affected wetlands in the study area. Based on the information available, the Freeport Harbor 45-ft project resulted in the loss of 40 acres of wetlands.

As noted in Section 3.12 of the EIS, there are approximately 31,400 acres of estuarine marsh wetlands, 38 acres of estuarine shrubland, 1,150 acres of freshwater marshes, 1,218 acres of freshwater shrub-scrub wetland, and 4,697 acres of forested wetlands in the study area. Major factors affecting wetlands in the study area are relative sea-level rise, subsidence, the diversion of the Brazos River, and conversion to upland habitat (White et al., 2004). However, as noted in Section 3.4, subsidence has diminished or stopped as groundwater, oil, and gas pumping has ceased.

Overall, cumulative impacts to wetlands in the study area are not expected to be significant, assuming mitigation for the Strategic Oil Reserve project.

### **5.4.2 Benthos**

Organisms present on open-bay bottom will be temporarily affected by the Project due to excavation and placement of dredged materials. Temporary impacts to benthic communities will also result from other potential projects in the area, including the Freeport LNG project, Stratton Oil Reserve project, and Port Freeport modifications. Past projects also temporarily impacted the benthos and ongoing dredging

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maintenance activities on the GIWW will continue to have temporary impacts on the benthos in the GIWW. The Strategic Oil Reserve project would result in an increase in salinity of about 4.7 ppt and the Freeport LNG project (Phase II) would result in the creation of approximately 13.9 acres of bay bottom habitat (DOE, 2006).

As noted in Section 4.14.2, excavation of open-water bottom buries and removes organisms, but organisms can rapidly recolonize, whereas disposal of dredged material in the open-water smothers or buries existing benthic communities. Although benthic communities recover fairly rapidly, the communities present in early successional stages of recovery are not necessarily the same as those buried by the dredged material. Additionally, repeated dredging in one place may prevent benthic organisms from fully developing (Dankers and Zuidema, 1995), resulting in a shift in community structure (Montagna et al., 1998). However, the new assemblages would still provide an adequate food source for the aquatic community.

Overall cumulative impacts to the benthos in the study area are not expected to be significant. Dredging and use of ODMDSs would temporarily disrupt the benthic communities and a slight increase in salinity from the Stratton Ridge project could also result in localized shifts in the benthos. However, additional open-bay bottom would be created by the Freeport LNG project and the temporary impacts associated with dredging occur over a very small portion of the total open water in the area.

### **5.4.3 Essential Fish Habitat**

The proposed widening of the Freeport Entrance and Jetty Channels, the Freeport LNG Project, some of the Port Freeport modifications, the construction of the brine diffusion portion of the Stratton Ridge facility, and maintenance of the GIWW and Freeport Channels would result in placement of dredged material. Some of the material would be placed in UPCAs, thus not affecting EFH. However, placement of dredged material in open water placement sites could affect food sources in EFH, increase turbidity in the study area, and release contaminants.

Initial placement of dredged material would cover benthic organisms resulting in a loss of food source. As previously noted, recovery of some benthic organisms would likely occur relatively quickly, although the assemblage in the dredged material might differ from the assemblage that existed at the PA prior to construction. As noted in Section 4.9.1.1.1, turbidity is the most obvious impact of dredged material placement. Impacts to EFH from turbidity associated with ocean placement are not significant. If the material to be dredged is not contaminated, there would be no contamination issues with respect to EFH. Placement of dredged material associated with the projects included in this analysis would occur over time and would be subject to USACE and EPA permitting. Thus, it is reasonable to expect that dredged material associated with these projects that would be placed in open water placement sites would not contain contaminants.

Accidental spills have the potential to impact EFH, and larval and juvenile finfish could be affected significantly should a spill occur. Larval and juvenile finfish are less mobile and tend to be more

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susceptible to spills than adults. However, because of increased safety with the wider channel, as in the proposed alternative, there should be a slight decrease in the likelihood of oil spill chances.

#### **5.4.4 Threatened and Endangered Species**

Most of the proposed projects included in this analysis are not expected to significantly impact Federally protected species. The Stratton Ridge underground storage facility could impact the bald eagle and dredging activities associated with some of the projects could affect sea turtles. A BA and BO are being prepared for the Stratton Ridge project and conditions of the BO would reduce and mitigate for adverse impacts associated with the project. Additionally, project sponsors for projects requiring dredging activities would have to coordinate with FWS and NMFS in regards to potential impacts to sea turtles. The likelihood of direct sea turtle mortality can be reduced by restricting the use of hopper dredges to between December 1 and March 31, whenever possible. Any dredging activities outside of this timeframe (i.e., between April 1 and November 30) should be with pipeline dredges, where feasible, which turtles can more easily avoid. Preceding the hopper dredges with a trawler to capture turtles and relocate them can also reduce dredging impacts on sea turtles. This could be required in dredging contracts, and is required for present maintenance dredging. There could be minor impacts to sea turtles from potential mortality resulting from dredging activities.

#### **5.4.5 Submerged Aquatic Vegetation**

SAV could be impacted by potential increases in salinity associated with the Stratton Ridge facility. However, the 4.7 ppt salinity increase expected to occur as a result of the project would be sporadic, is not outside of the normal range of fluctuations within the area, and the discharge would be directly to the Gulf, not adjacent estuaries. No cumulative impacts to SAV are expected.

#### **5.4.6 Air Quality**

Objectionable odors (mercaptan, hydrogen sulfide) may result from the dredging of maintenance sediments containing high concentrations of organic matter in those reviewed projects requiring dredging. Temporary and intermittent maintenance dredging activities would emit NO<sub>x</sub> and CO primarily. During operation, pollutants expected to be emitted include NO<sub>x</sub>, CO, particulates, sulfur dioxides, and hydrocarbons. The project area occurs within the HGA, which is a non-attainment area for O<sub>3</sub> (Section 3.1.1.1). Therefore, all projects in the study area with the potential to affect air quality must coordinate with TCEQ in regards to the SIP. This coordination should ensure compliance with the SIP, and thus the NAAQS, resulting in no significant cumulative impact to air quality.

#### **5.4.7 Noise**

Noise impacts included in those projects associated with dredging will include operation and maintenance noise. This impact will be temporary, will move up and down the project area depending on the section

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being dredged, and is not expected to differ from current maintenance dredging for many of the projects. Additionally, it is unlikely dredging would occur for more than one of the reviewed projects at one time.

#### **5.4.8 Water Quality**

For those projects that include dredging activities, dredging and placement operations are expected to temporarily degrade water quality in the project vicinity through increased turbidity and the release of nutrients from the sediment. No projects reviewed cited concerns with sediment contamination or nutrients, including the Widening Project.

Dredging and placement at proposed open water and upland PAs may increase suspended solids, release contaminants and bound nutrients, and deplete oxygen. This impact is temporary and, except for turbidity, insignificant. If temporary degradation occurs, the study area should rapidly return to ambient conditions upon completion of dredging.

The Stratton Ridge project may increase salinity in some areas by 4.7 ppt. However, according to their analysis (DOE, 2006), this is within the current range of natural fluctuations and should not substantially impact water quality.

Although increased ship traffic in the study area could increase the risk of a toxic spill, that risk is offset by the increased safety in the channel expected from the proposed widening project, the Federal channel improvement project, and increased safety measures associated with the transport of products to the LNG facility.

#### **5.4.9 Sediment Quality**

None of the projects reviewed are expected to impact sediment quality or disturb contaminated sediment. Although increased ship traffic in the study area could increase the risk of a spill that could eventually contaminate sediments, that risk is offset by the increased safety in the channel expected from the proposed widening project, the Federal channel improvement project, and increased safety measures associated with the transport of products to the LNG facility. Thus, no significant cumulative impacts to sediment quality are expected.

#### **5.4.10 Shoreline/Bank Erosion**

As noted in Section 3.3.1, the shoreline in the study area has been fluctuating since 1852. None of the projects reviewed are expected to alter the ongoing pattern. The proposed channel widening project would place approximately 300,000 cy of silty sand material on Quintana Beach in front of the Seaway PA or on Surfside beaches. The placement of this material, along with other placement projects that may occur in the area, may help to delay beach erosion. However, current overall erosion patterns would continue.

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#### **5.4.11 Cultural Resources**

Activities associated with any of the reviewed projects have the potential to adversely impact unknown cultural resources by altering the integrity of location, design, setting, materials, construction, or association that contributes to a resource's significance in accordance with the National Register criteria. Possible cultural resources that could be impacted by the reviewed projects were identified for the Freeport LNG facility and the Stratton Ridge facility. A barn located within the Freeport LNG project area would be removed during construction. The eligibility for NRHP of this barn is unknown. Several potential historic resources are located along the ROWs associated with the Stratton Ridge project. Both of these projects are considered Federal actions and are, therefore, required to coordinate with the SHPO for Section 106 compliance. Thus, any potential impacts to cultural resources associated with these projects would be avoided or mitigated for appropriately. In addition, the proposed widening project would impact six anomalies that lie within the project footprint. Prior to construction, these anomalies would need to be diver verified and the appropriate coordination with SHPO would occur.

#### **5.4.12 Commercial Fisheries**

None of the projects reviewed would impact commercial fisheries in the study area.

#### **5.4.13 Recreational Fisheries**

None of the projects reviewed would impact recreational fisheries in the area. It should be noted that when the Freeport Harbor 45-ft project was implemented, additional recreational fishing areas were created (USACE, 1978).

### **5.5 CONCLUSIONS**

Cumulative impacts due to past, existing, and reasonably foreseeable future projects, along with the proposed alternative, are not expected to have significant adverse effects in the study area. Many of the projects occurring in the general vicinity of the Freeport Harbor Channel are part of the continued urbanization and industrialization of Brazoria County. The majority of impacts associated with these projects would be minor and/or temporary and some result in positive impacts for the area. Existing governmental regulations, in conjunction with the goals and coordination of community planning efforts, address the issues that influence local and ecosystem-level conditions. Resources in the area are provided some protection through the coordination of the numerous stakeholder groups, local organizations, and State and Federal regulatory agencies, and through regulations such as the TCMP, the CWA, and the CAA. This coordination and regulation of resources should prevent or minimize negative impacts that could threaten the general health and sustainability of the region.

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