# Site Selection For The Expansion Of The Strategic Petroleum Reserve Draft Environmental Impact Statement

## VOLUME 1

## Summary and Chapters 1 - 7

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U.S. Department of Energy
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DOE/EIS-0385

# Draft Environmental Impact Statement for Site Selection for the Expansion of the Strategic Petroleum Reserve
# Document No. DOE/EIS-0385

**Responsible Federal Agency**: U.S. Department of Energy (DOE), Office of Petroleum Reserves

**Location**: Potential new SPR storage sites are located in Lafourche Parish, Louisiana; Perry and Claiborne Counties, Mississippi; and Brazoria County, Texas. Existing Strategic Petroleum Reserve (SPR) storage sites that could be expanded are located in Cameron, Calcasieu, and Iberville Parishes, Louisiana; and Jefferson County, Texas. Associated pipelines, marine terminals, and other facilities that might be developed are located in East Baton Rouge, East Feliciana, St. James, Terrebonne, West Baton Rouge, and West Feliciana Parishes, Louisiana; Adams, Amite, Forrest, George, Greene, Hinds, Jackson, Jefferson, Lamar, Lincoln, Marion, Pike, Warren, Walthall, and Wilkinson Counties, Mississippi; and Galveston County, Texas.

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**Abstract**: As required by the Energy Policy Act of 2005 (P.L. 109-58), DOE would expand the SPR to its full authorized 1 billion-barrel capacity by selecting additional storage sites. DOE would develop one new site or a combination of two new sites, and would expand capacity at two or three existing sites. Storage capacity would be developed by solution mining of salt domes and disposing of the resulting salt brine by ocean discharge or underground injection. New pipelines, marine terminal facilities, and other infrastructure could also be required.

DOE has determined that site selection and expansion constitute a major Federal action within the meaning of the National Environmental Policy Act of 1969, as amended (42 USC 4321-4347). The *Federal Register* "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Public Scoping Meetings; Site Selection for the Expansion of the Strategic Petroleum Reserve" was published on September 1, 2005 (70 FR 52088). See also the subsequent notices to extend the public scoping period and reschedule public meetings (70 FR 56649, September 28, 2005 and 70 FR 70600, November 22, 2005). DOE held public scoping meetings on October 11, 2005, in Lake Jackson, Texas; on October 17, 2005, in Jackson, Mississippi; on October 18, 2005, in Houma, Louisiana; and on December 7, 2005, in Port Gibson, Mississippi. DOE also solicited written comments on the scope of the EIS in the Notice of Intent.

DOE has prepared this draft EIS to address the environmental impacts of the proposed expansion of the capacity of the Strategic Petroleum Reserve and the range of reasonable alternatives, including the "No Action" alternative, under which SPR storage capacity would not be expanded. DOE will use the draft EIS to ensure that it has the information needed for purposes of informed decision-making. DOE's decisions will be issued subsequent to the Final EIS, in the form of a Record of Decision, no sooner than 30 days after publication of the Notice of Availability of the final EIS.


**Public Comments**: Locations and times of public hearings on this draft EIS will be announced in the *Federal Register* on May 26, 2006. Comments on this Draft EIS will be accepted for a period of 45 days following its issuance and will be considered in the preparation of the final EIS. Any comments received later will be considered to the extent practicable.

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# Glossary

To help readers more fully understand this Environmental Impact Statement, we have used bold type for technical and scientific terms, as well as plain English terms used differently in this context, the first time each appears in the text. This Glossary provides a full definition of each of those terms. In some cases, the definition of the term also appears in a highlighted box near the first occurrence of the term in the text.

| TERM | DEFINITION |
|---|---|
| **8-hour ozone standard** | A national ambient air quality standard for ground-level ozone, the primary constituent of smog. The standard is set at 0.08 parts per million and is measured as the 3-year average of an annual 4th-highest daily maximum 8-hour ozone concentration. |
| **A-weighted decibel (dBA)** | A frequency-weighted noise unit that is widely used for traffic and industrial noise measurements. The A-weighted decibel scale approximates the frequency response of the human ear and thus correlates well with loudness. |
| **Alluvial** | Relating to, composed of, or found in the clay, silt, sand, gravel, or similar detritus material deposited by running water. |
| **Anadromous fish** | Fish that spend most of their lives in salt water but migrate into freshwater tributaries to spawn (e.g., Gulf sturgeon and Alabama shad). |
| **Anhydrite** | A mineral, anhydrous calcium sulfate (chemical formula $CaSO_4$), occurring naturally in salt deposits. Anhydrite is much less soluble than salt, so anhydrite solids must be removed from brine before the brine can be disposed of in the ocean or injected into underground wells. |
| **Aquifer** | A body of rock or soil that is capable of transmitting groundwater and yielding usable quantities of water to wells or springs. |
| **Base flood** | A flood that has a 1 percent chance of occurrence in any given year (also known as a 100-year flood). |
| **Basement fault** | The fault that displaces basement rocks (metamorphic and igneous rocks underlying the sedimentary rocks) and originated prior to deposition of overlying sedimentary rocks. Such faults may or may not extend upward into overlying strata, depending upon their history of rejuvenation. |
| **Bathymetry** | The measurement of water depths in oceans, seas, and lakes. |
| **Benthic organism (benthos)** | A form of aquatic plant or animal life that is found on or near the bottom of a stream, lake, or ocean. |
| **Berm** | A horizontal, narrow ledge at the bottom or top of an embankment used to stabilize the slope by intercepting sliding earth. |

| TERM | DEFINITION |
|---|---|
| **Borehole** | A hole made by drilling into the ground to study stratification, to release underground pressures, or to construct a production well, a disposal well, or a storage cavern in salt rock. |
| **Brine** | Water with a salt concentration greater than 35 parts per thousand. Sea water has a similar average concentration. In comparison, discharged brine has a typical concentration of 263 parts per thousand. |
| **Brine pond** | Lined pond where brine is disposed and impounded so that solids and contaminants, such as oil, can settle. |
| **Bulkhead** | Retaining walls designed to hold or prevent the sliding of soil caused by erosion and wave action. |
| **Caliper** | An instrument used to measure the diameter of a drill hole to determine the hardness or softness of the individual rocks. |
| **Caliper pig** | An electronic device that moves through the inside of a pipeline to determine by acoustical means the thickness of the pipeline wall. |
| **Candidate species** | Plants and animals native to the United States for which the U.S. Fish and Wildlife Service or the National Marine Fisheries Service has sufficient information on biological vulnerability and threats to justify proposing addition to the threatened and endangered species list, but cannot do so immediately because other species have a higher priority for listing. The Services determine the relative listing priority of candidate species in accordance with general listing priority guidelines published in the *Federal Register*. (See endangered species and threatened species.) |
| **Canopy** | Overhanging plants shading the surface below them (such as large trees). |
| **Caprock** | A layer of rock that is often found covering some or all of a salt dome. Caprock is chemically derived rock composed of anhydrite and other insoluble components of the salt that remain when the salt is washed away by groundwater and other forces. |
| **Casing** | Steel pipe used in oil wells to seal off fluids from the borehole and to prevent the walls of the hole from sloughing off or caving. There may be several strings of casing in a well, one inside the other. |
| **Cavern** | An underground chamber or cavity created in a salt dome by solution mining and used for storing the petroleum. |
| **Clay** | Soil consisting of inorganic material, the grains of which have diameters smaller than 0.005 millimeters. |
| **Concentric cased wells** | Concentric cased wells are two wells, one located within the other. The two wells are separated by an inner casing and an outer casing, and the casings form two concentric rings. |

| TERM | DEFINITION |
|---|---|
| **Creep** | In engineering usage, creep is any general, slow displacement under load. |
| **Critical habitat** | Habitat essential to the conservation of an endangered or threatened species that has been designated so by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures outlined in the Endangered Species Act and its implementing regulations (50 CFR Part 424). The lists of critical habitats can be found in 50 CFR 17.95 (fish and wildlife), 50 CFR 17.96 (plants), and 50 CFR 226 (marine species). |
| **Crustaceans** | A class of aquatic invertebrate organisms with a hard external skeleton. |
| **Day Night Average Noise Level** | A 24-hour average of noise levels. |
| **Decibel (db)** | A unit for expressing the relative intensity of sounds on a logarithmic scale from zero (the average least perceptible sound) to about 130 (the average level at which sound causes pain to humans). |
| **Design value** | A pollutant concentration, based on ambient measurement, which describes the air quality status of a given area. Areas in which the design value exceeds the NAAQS may result in a nonattainment designation for the area. |
| **Diffuser** | The structure at the end of a pipeline that disperses an effluent discharge into a receiving water body by the action of jet dilution through a series of ports. |
| **Drawdown** | The process of removing oil from a storage cavern by displacing the oil with water or brine. |
| **Drilling mud** | A mixture of clays, chemicals, and water that is pumped down a drill pipe to lubricate and cool the drilling bit, to flush out the cuttings, and to stabilize the sides of a hole being drilled. |
| **Easement** | An easement is a right held by one party to make specific, limited use of land owned by another party. An easement is granted by the owner of the property for the convenience or ease of the party using the property. Common easements include the right to pass across the property or the right to construct a pipeline under the land or a power line over the land. |
| **Ecoregion** | A region containing relatively similar ecological systems as determined by variations in climate, vegetation, and landform. |
| **Ecosystem** | A community of organisms and their physical environment interacting as an ecological unit. |

| TERM | DEFINITION |
|---|---|
| **Endangered species** | Plants or animals that are in danger of extinction through all or a significant portion of their habitat ranges and that have been listed as endangered by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures outlined in the Endangered Species Act and its implementing regulations (50 CFR Part 424). The lists of endangered species can be found in 50 CFR 17.11 (wildlife), 50 CFR 17.12 (plants), and 50 CFR 222.23(a) (marine organisms). The states considered in this EIS also list species as endangered. |
| **Estuarine system** | Deep water habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean. Ocean water is at least occasionally diluted by freshwater runoff from the land, and their interplay results in a nutrient trap making the estuarine system more productive than either freshwater or marine systems. |
| **Estuary** | A semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with fresh water. |
| **Floodplains** | The lowlands and relatively flat areas adjoining inland and coastal waters with the flood-prone areas of offshore islands. Floodplains include, at a minimum, that area with at least a 1-percent chance of being inundated by a flood in any given year. |
| **Fluvial deltaic** | Produced by the action of a stream or river and in the typical form of the Greek letter delta. |
| **Geophysics** | The physics of the Earth and its environment, including the physics of fields such as meteorology, oceanography, and seismology. |
| **Growth fault** | A type of normal fault that develops and continues to move during sedimentation and typically has thicker strata on the downthrown, hanging wall side of the fault than in the footwall. Growth faults are common in the Gulf of Mexico and in other areas where the Earth's crust is subsiding rapidly or being pulled apart. |
| **Grubbing** | Clearing of land by digging up roots or stumps. |
| **Historic property** | As defined in 36 CFR 800.16 of the National Historic Preservation Act, "historic property means any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meets the National Register criteria." |

| TERM | DEFINITION |
|---|---|
| **Hydrostatic test** | Test of strength and leak-resistance of a vessel, pipe, or other hollow equipment using internal pressurization with a test liquid. |
| **In-migration** | The movement of people into a given geographic area. |
| **Invertebrate** | An animal lacking a backbone and internal skeleton. |
| **Level equivalents (Leq)** | Level of noise (in decibels) averaged over a period of time. |
| **Laydown yard** | Storage area for equipment and materials to be used for maintenance or construction. |
| **Lithic scatter** | A distribution of cultural items that consists primarily of lithic (i.e., stone) material. The scatter may include formed tools such as points or knives, or it may contain only chipping debris from tool-making activities. |
| **Marsh** | A transitional land-water area with more or less continuously waterlogged soil characterized by aquatic and grass-like vegetation, but without an accumulation of peat. |
| **Metropolitan Statistical Area (MSA)** | A metropolitan statistical area is an area containing a recognized population nucleus (such as a city) and adjacent communities (sometimes considered suburbs) that have a high degree of integration with that nucleus. One of the major purposes in defining MSAs is to provide a nationally consistent definition for collecting, tabulating, and publishing federal statistics for a set of geographical areas. |
| **Midden soil** | Soil that has been changed by long-term human occupation; it typically contains bits of charcoal and other organic materials derived from human use. Midden soil is often darker in color and has a looser texture than surrounding soils. Archaeologists consider midden soil as evidence that a site was used for long-term residence or revisited regularly over many years, rather than reflecting short-term activities. |
| **Normal fault** | A fault in which the hanging wall has apparently gone down with relation to the footwall. |
| **Oil blanket** | A quantity of oil that is used during the development of storage caverns in salt domes. The oil is injected into the cavern, where it floats on top of the water used during solution mining and blankets the cavern roof, thereby preventing the water from dissolving salt at the top of the cavern. |
| **Overhang** | The part of the salt that projects out laterally from the top of a salt dome and is like the cap of a mushroom. |
| **Overstory** | The tallest spatially dominant species in a forest; usually composed of coniferous or deciduous tree species. |
| **Palustrine** | Of, pertaining to, or living in, a marsh or swamp; marshy. |

| TERM | DEFINITION |
|---|---|
| **Palustrine wetland** | All non-tidal wetlands dominated by trees, shrubs, or persistent emergent vegetation. Includes wetlands traditionally called marshes, swamps, or bogs. |
| **Particulate matter** | Any material suspended in the air in the form of minute solid particles or liquid droplets, especially when considered as an atmospheric pollutant. A number following denotes the upper limit of the diameter of particles included. Thus, PM10 includes only those particles equal to or less than 10 micrometers (0.0004 inch) in diameter; PM2.5 includes only those particles equal to or less than 2.5 micrometers (0.0001 inch) in diameter. |
| **Perennial** | A plant with a lifespan of two or more years. |
| **Permeability** | Capacity for transmitting a fluid a given distance through an interval of time. |
| **Piercement** | A dome or anticlinal fold in which a mobile plastic core (i.e., salt) has ruptured the more brittle overlying rock. Also known as a diapir, dipiric fold, piercement dome, or piercing fold. |
| **Pig** | A cylindrical device (3- to 7-feet long) inserted in a pipeline for the purpose of sweeping the line clean of water, rust, or other foreign matter. |
| **Pigging** | In pigging operations, inspection and cleaning devices called pigs are sent through pipelines to check the condition of pipelines and clean them. Caliper pigging is used to determine the thickness of pipeline walls. |
| **Plankton** | Passively floating or weakly mobile, microscopic aquatic plants (phytoplankton) and animals (zooplankton). |
| **Plug** | To fill a well's borehole with cement or other impervious matter to prevent the flow of water, gas, or oil from one strata to another when a well is abandoned; to place a permanent obstruction at the junction of a saline water body and pipeline ROW to prevent salt water intrusion into fresh water or to prevent the formation of new water courses. |
| **Radial Fault** | A fault belonging to a system that radiates from a point. |
| **Raw water** | Raw water is fresh surface water or salt water that is supplied to a site from a substantial water source. |
| **Right-of-way (ROW)** | The right held by one person over another person's land for a specific use; rights of tenants are excluded. The strip of land for which permission has been granted to build and maintain a linear structure, such as a road, railroad, pipeline, or transmission line. |
| **Rip rapping** | Rip rapping is the process by which rocks or other materials (rip rap) are placed along the banks of a body of water to prevent erosion. |

| TERM | DEFINITION |
|---|---|
| **Riverine** | Relating to, formed by, or resembling a river. |
| **Rock salt formation** | See salt dome. |
| **Salinization** | To treat or impregnate with salt. |
| **Salt dome** | A subsurface geologic structure consisting of a vertical cylinder of salt that may be anywhere from 0.5 to 6 miles (1 to 10 kilometers) across and up to 20,000 feet (6,100 meters) deep. Domes are formed when salt from buried salt pans flows upward due to its buoyancy. |
| **Scrub-shrub** | Areas dominated by woody vegetation less than 6 meters (20 feet) tall, which includes true shrubs and young trees. |
| **Seismic** | Related to the activity of naturally or artificially induced earthquakes or earth vibrations, where the seismic waves are the elastic waves produced by these vibrations. |
| **Shear zone** | A tabular area of rock that has been crushed and broken into fragments by many parallel fractures resulting from shear strain; often becomes a channel for underground fluids and the seat of ore deposition. |
| **Shell middens** | A subtype of midden soil that has been altered by human occupation. Shell midden includes large amounts of fragmented mollusk shell mixed with charcoal and other organic materials derived from human use. Archaeologists interpret shell midden sites as the result of long-term residence or regular reuse, where the debris from a shellfish-rich diet has become part of the site. |
| **Shell scatters** | Distributions of cultural material that consist primarily of shell fragments. Shell scatters do not contain the visibly and texturally different soil of shell middens, and they are interpreted as the result of short-term use or use for only a single activity (such as shellfish harvesting) rather than residence. |
| **Silt** | Soil consisting of inorganic material, the grains of which have diameters between 0.0625 mm and 0.2 mm. |
| **Skimmers** | A self-propelled, boat-like oil spill clean-up device that removes spilled oil from the surface of a water body into a tank. |
| **Soil liquefaction** | Process that occurs when saturated sediments are shaken by an earthquake. The soil can lose its strength and cause the collapse of structures with foundations in the sediment. |
| **Solution mining** | The process of creating space in rock salt by dissolving the salt with injected water and removing the resultant brine. |

| TERM | DEFINITION |
|---|---|
| **Special status species** | State and Federally listed threatened, endangered, and candidate species; marine mammals; migratory birds; federally managed fisheries; and Forest Service's Regional Forester Sensitive Species. |
| **Spoil** | Dirt or rock that has been removed from its original location, destroying the composition of the soil in the process. |
| **Spud barge** | A flat-decked floating structure that has devices similar to legs, called spuds, which are lowered from underneath the barge and pushed into the waterway floor to anchor the structure in place. |
| **Stratigraphic** | Dealing with the origin, composition, distribution, and succession of geological strata. |
| **Subsidence** | The geological sinking or downward settling of an area on the Earth's surface, resulting in the formation of a depression. |
| **Sump** | The space below the bottom end of a well pipe where liquid collects. |
| **Surfactant** | A soluble compound that reduces the surface tension of liquids, or reduces interfacial tension between two liquids or a liquid and a solid. |
| **Tank farm** | A facility that temporarily stores petroleum in large tanks connected to a pipeline. |
| **Threatened species** | Any plants or animals that are likely to become endangered species within the foreseeable future throughout all or a significant portion of their habitat ranges and which have been listed as threatened by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures set out in the Endangered Species Act and its implementing regulations (50 CFR Part 424). (See endangered species.) The lists of threatened species can be found at 50 CFR 17.11 (wildlife), 17.12 (plants), and 227.4 (marine organisms). The states considered in this EIS also list species as threatened. |
| **Understory** | Low-lying vegetation growing beneath the overstory of a forest; usually composed of herbaceous plants, shrubs, and small saplings. |
| **Uplands** | Generally dry land that is different from lowlands, marsh, swamp, and wetlands. |
| **Volatile organic compound (VOC)** | Any organic compound that participates in atmospheric photochemical reactions; also a nationally regulated air pollutant. |

| TERM | DEFINITION |
|---|---|
| **Wetlands** | An area that is inundated by surface water or groundwater with a frequency sufficient to support, and under normal circumstances would support, a prevalence of vegetative or aquatic life that requires saturated- or seasonally saturated-soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas (e.g., sloughs, potholes, wet meadows, river overflow areas, mudflats, and natural ponds). |

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# Chapter 1. Purpose and Need for Action

## 1.1 BACKGROUND

**Glossary Terms:** To help readers more fully understand this Environmental Impact Statement, we have used bold type for technical and scientific terms the first time each appears in the text. The Glossary provides a full definition of each of these terms. In some cases, the definition of the term also appears in a highlighted text box near the first occurrence of the term in the text.

The Strategic Petroleum Reserve (SPR) is a national stockpile of petroleum (crude oil). Following the 1973-74 oil embargo, the SPR was established pursuant to the Energy Policy and Conservation Act of 1975 to protect the United States from interruption in petroleum supplies that would be detrimental to our energy security, national security, and economy. The SPR currently consists of four underground oil storage facilities along the Gulf Coast—two in Louisiana (Bayou Choctaw and West Hackberry) and two in Texas (Big Hill and Bryan Mound)—and an administrative facility in New Orleans, LA. At the storage facilities, crude oil is stored in caverns constructed by the **solution mining** of **rock salt formations (salt domes)**. The four SPR facilities have a combined current storage capacity of 727 million barrels (MMB) and an inventory of 688 MMB as of May 4, 2006.

If the United States is confronted with an economically-threatening disruption in oil supplies, the President can use the SPR as an emergency response tool, transferring oil from the SPR into the commercial oil distribution systems. The SPR has been used twice under these conditions. First, at the beginning of Operation Desert Storm in 1991, the United States joined its allies in assuring the adequacy of global oil supplies when war broke out in the Persian Gulf. An emergency sale of SPR crude oil was announced the day the war began. The second instance was in September 2005 after Hurricane Katrina devastated the oil production, distribution, and refining industries in the Gulf regions of Louisiana and Mississippi. In addition to national energy emergencies, crude oil has been withdrawn many times from the SPR sites for other reasons. Small quantities of oil are routinely pumped from the storage caverns to test the reserve's equipment. In addition, oil has been removed from the caverns under the legal authority to "exchange" SPR crude oil with private companies, where the SPR ultimately receives more oil than it released.

The U.S. Department of Energy (DOE) conducted planning activities for the expansion of the SPR to 1 billion barrels under prior congressional directives in 1988 and 1990. The expansion planning directive in 1988 resulted in an initial plan entitled *Report to Congress on Expansion of the Strategic Petroleum Reserve to One Billion Barrels* (DOE 1989b). The expansion planning directive in 1990 likewise resulted in *Report to Congress on Candidate Sites for Expansion of the Strategic Petroleum Reserve to One Billion Barrels* (DOE 1991b) and the preparation of *Draft Environmental Impact Statement, DOE/EIS–0165–D* in 1992, which assessed five candidate sites for the expansion of the SPR to 1 billion barrels: Big Hill, TX; Stratton Ridge, TX; Weeks Island, LA; Cote Blanche, LA; and Richton, MS (DOE 1992a). DOE/EIS–0165–D is available on the DOE Fossil Energy Web site at http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html. Prior to completion of the final EIS, DOE notified Congress that due to the existence of a large unfilled capacity in the SPR, DOE would be deferring any site selection decisions and expansion of the SPR until such time that oil fill of the SPR supported the need for further capacity development.

## 1.2 PURPOSE AND NEED

On August 8, 2005, the President signed the Energy Policy Act of 2005 (EPACT). Section 303 of EPACT states that:

> "Not later than 1 year after the date of enactment of this Act, the Secretary shall complete a proceeding to select, from sites that the Secretary has previously studied, sites necessary to enable acquisition by the Secretary of the full authorized volume of the Strategic Petroleum Reserve."

Thus, the purpose and need for agency action is to select and develop the sites to expand SPR capacity from 727 million barrels to 1 billion barrels.

## 1.3 DOE DECISION

This environmental impact statement (EIS) will be used by DOE to make a decision on site selection for expansion of the SPR. As outlined more completely in Chapter 2 of this document, DOE is analyzing potential impacts from a new site at Bruinsburg, MS; Chacahoula, LA; Clovelly, LA; Richton, MS; and Stratton Ridge, TX; and two combinations of both Clovelly, LA, and Bruinsburg, MS. In addition, DOE is studying impacts from expanding capacity at Bayou Choctaw, LA, Big Hill, TX, and West Hackberry, LA.

## 1.4 NATIONAL ENVIRONMENTAL POLICY ACT PROCESS

DOE has determined that the expansion of the SPR required by EPACT constitutes a major Federal action that is subject to the National Environmental Policy Act (NEPA). This EIS document has been prepared in accordance with NEPA, the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Parts 1500–1508), DOE NEPA regulations (10 CFR Part 1021) and **wetland** and **floodplain** regulations (10 CFR 1022). This EIS assesses the potential environmental impacts of the development of new SPR sites and the expansion of existing SPR sites and their associated infrastructures.

### 1.4.1 Scoping and Public Involvement

On September 1, 2005, DOE published a Notice of Intent to Prepare an EIS (70 FR 52088). The Notice of Intent invited interested agencies, organizations, Native American tribes, and members of the public to submit comments or suggestions to assist DOE in identifying significant environmental issues and determining the appropriate scope of the EIS. The notice also identified the dates and locations of public scoping meetings and stated that the public scoping period would run from September 1 to October 14, 2005.

As a result of the effects of Hurricanes Katrina and Rita on the Gulf Coast region, DOE issued a Notice to Extend the Public Scoping Period and Reschedule Public Scoping Meetings, extending the scoping period by 2 weeks, until October 28, 2005 (70 FR 56649, September 28, 2005). In the notice, DOE also announced the cancellation of the public scoping meetings in Hattiesburg and Pascagoula, MS, and provided new dates and locations for the other public scoping meetings. On October 27, 2005, Governor Haley Barbour of Mississippi requested the Secretary of Energy to include a new site in the EIS. In response, DOE extended the public scoping period until December 19, 2005 (70 FR 70600, November 22, 2005) and scheduled another scoping meeting.

### 1.4.2 Summary of Public Scoping Process

DOE held four public scoping meetings, as shown in table 1.3.2-1.

**Table 1.3.2-1: Scoping Meetings**

| Location | Date | Proposed Sites Close to Meeting Location | Attendance | Speakers |
|---|---|---|---|---|
| Lake Jackson, TX | October 11, 2005 | Stratton Ridge, TX | 16 | 0 |
| Jackson, MS | October 17, 2005 | Richton, MS | 24 | 4 |
| Houma, LA | October 18, 2005 | Chacahoula, LA, and Clovelly, LA | 19 | 3 |
| Port Gibson, MS | December 7, 2005 | Bruinsburg, MS | 21 | 7 |

The public scoping meetings were attended by approximately 80 people, some of whom provided oral and written comments. During the scoping period, DOE also met with Federal and state agencies with jurisdiction over the proposed new and existing SPR expansion sites in Louisiana, Mississippi, and Texas. At these meetings, DOE received comments from the agencies on environmental issues to be reviewed after review of scoping comments.

#### 1.4.2.1 Summary of Scoping Comments

DOE received 67 scoping comments from 48 members of the public, companies, organizations, and government agencies. Comments focused mainly, but not exclusively, on the impacts of the construction and operation of the SPR facilities on water, land, and marine resources, and on various habitats of land and marine species. The following paragraphs summarize the major issues addressed in the comments. Unless otherwise noted, the discussions and analyses included in the draft EIS address the core topics of these comments. Copies of the comments received during the scoping period and complete public meeting transcripts are available from the Internet site http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html.

**Public Health and Safety, Accidental Releases:** Commenters stated that DOE needs to address public health issues and the potential impacts on health and safety. One concern was the cumulative and secondary impacts the project presents for the increased risks of terrorism or accidents because of proposals to build liquid natural gas facilities near the proposed Stratton Ridge site. There is no longer a proposal to build such a facility near the Stratton Ridge site. The affected environment and analysis of potential environmental risks and public and occupational safety and health impacts are discussed in chapter 3, section 3.2.

**Land Use: C**ommenters asked that DOE examine various potential impacts including loss of prime farmland, adverse effects on coastal areas, and land use changes at storage sites, pipelines rights-of-way, and other facilities. Commenters expressed concern that the proposed locations of the caverns for the Richton and Stratton Ridge sites would preclude other uses of the salt domes or affect mineral rights and expressed concern that the proposed Stratton Ridge site is located in the vicinity of security areas of existing and proposed industrial facilities. Affected land uses and site-specific analysis of potential land use impacts associated with the SPR sites are discussed in chapter 3, section 3.3. One commenter suggested that the EIS address impacts on the Gulf Islands National Seashore; however, the proposed action would not affect the Seashore.

**Geology:** Commenters expressed concerns about cavern creep and subsidence that might be caused by the creation of additional oil storage caverns at the already extensively developed Stratton Ridge salt dome, and suggested that the EIS evaluate this potential for adverse impacts. The affected environment and site-specific analysis of potential geology and soils impacts for each SPR site are discussed in chapter 3, section 3.4.

**Air Quality:** Noting that the Bayou Choctaw, Big Hill, and Stratton Ridge sites are in air quality nonattainment areas for the 8-hour ozone ambient standard and that they are subject to the Clean Air Act General Conformity rule and related state regulations, commenters asked that DOE estimate the potential emissions of volatile organic compounds and oxides of nitrogen during construction and operation at these sites and compare them to conformity threshold levels. Conformity analyses for the Bayou Choctaw, Big Hill, and Stratton Ridge sites are discussed in chapter 3, section 3.5. Other issues raised by commenters included cumulative air pollutant emissions and emissions from the oil blanket during solution mining. The affected environment and analysis of potential air quality impacts of construction and operation of the proposed action are discussed in chapter 3, section 3.5 and chapter 4.

**Water Resources:** Commenters requested that DOE evaluate the potential impacts of construction and operation of new oil storage caverns and underground injection wells on local aquifers, and the secondary and cumulative impacts of SPR expansion on wetlands and water quality, including water salinity. Commenters expressed concern about potential impacts to rivers and coastal areas. Commenters also requested analyses of potential impacts of water withdrawal from freshwater bodies for SPR expansion and operation, runoff from construction and operation of SPR facilities, and brine disposal in the Gulf of Mexico. Commenters suggested alternative sources of raw water intake for the Stratton Ridge and Richton sites. The affected environment and analysis of potential impacts to water resources from construction and operation of the Proposed Action are discussed in chapter 3, section 3.6 and chapter 4.

**Biological Resources:** Commenters asked that the EIS analyze the potential primary, secondary, and cumulative impacts of SPR expansion on a variety of habitats and species. Habitats of particular concern included wetlands and essential fish habitat (EFH). Fauna of concern included shrimp, oysters, and native fish species including those that are commercially important; migratory marine species including sharks and billfishes; water birds; migratory birds; and some threatened and endangered species such as the Bald Eagle, Diamondback Terrapin, Gulf Sturgeon, Red-bellied Turtle, Brown Pelican, and Louisiana Black Bear, and also candidate species. Commenters identified specific biological resource areas (e.g., forested wetlands, wildlife refuges, national seashores, national forests, and live bottoms crossed by offshore brine disposal pipelines) or specific flora or fauna species (e.g., specific locations of bald eagle nesting areas) in the project vicinity with respect to specific SPR sites, pipeline rights-of-way, raw water withdrawal areas, and brine disposal areas.

The affected environment and potential impacts to biological resources from construction and operation of the Proposed Action are discussed in chapter 3, section 3.7. The impact assessment methodology for plants, wetlands, and wildlife is described in section 3.7.1.1; for special status species (including threatened and endangered species, marine mammals, and managed fisheries) in section 3.7.1.2; for EFH in section 3.7.1.3; and for special status areas (including national wildlife refuges, wilderness areas, Coastal Wetlands Planning, Protection and Restoration Act areas, and coastal natural resource areas) in section 3.7.1.4. Potential impacts associated with specific areas of concern and specific species of concern identified by commenters are addressed in the site-specific impact analyses in section 3.7.

**Socioeconomics:** Commenters requested that DOE evaluate potential economic impacts on local communities, commercial and recreational fishing interests, tourism, and other economic interests in Louisiana, Mississippi, and Texas, particularly in areas affected by Hurricane Katrina. Similarly, commenters expressed concern about impacts to local industries by competition for workers and housing already in short supply. The affected environment and analysis of potential socioeconomic impacts of construction and operation of the proposed action are discussed in chapter 3, section 3.8.

**Cultural Resources:** Commenters addressed potential Native American concerns, particularly for the Richton and Bruinsburg sites. Commenters also identified themselves as having cultural affiliation with specific SPR sites, and requested that they be notified and that specific procedures be followed in the event that cultural artifacts are discovered during SPR site development. They also suggested the need for archaeological and cultural surveys at the Stratton Ridge, Richton, and Big Hill sites should these sites be selected by DOE. The site-specific cultural resources affected environment and potential impacts to cultural resources for each SPR site are discussed in chapter 3, section 3.9. Specific procedures that would be implemented by DOE for the selected sites are also discussed in Section 3.9.

**Environmental Justice:** A commenter requested that DOE fully consider the environmental justice impacts of additional environmental risk and pollution associated with SPR expansion in low-income communities in light of the effects of Hurricane Katrina. Commenters also identified specific aspects (e.g., income level) of their communities. The affected environment and site-specific environmental justice impact analyses for each SPR site are presented in chapter 3, section 3.11.

**Alternatives:** Commenters proposed alternative locations for the storage of crude oil. The suggestions included sites in Louisiana, Texas, New Mexico, and Virginia. A discussion of the proposed action and alternatives, including a discussion of the statutory basis for selection of alternatives and alternatives considered but eliminated from detailed study, is included in chapter 2, section 2.7.

**Irreversible and Irretrievable Commitment of Resources:** A commenter expressed concern that development of SPR storage caverns would result in the irretrievable loss of salt resources that could otherwise be used for chlorine production. This issue is analyzed in chapter 3, section 3.3 and chapter 5.

**Cumulative Impacts:** Commenters requested that secondary and cumulative impacts of the Proposed Action and similar past, ongoing, or future actions, including cumulative impacts to water quality, biological resources, air quality, and socioeconomics, be addressed. Commenters identified specific actions (e.g., proposed liquefied natural gas facilities, future oil and gas production and pipelines) and requested that impacts of these actions be considered in the cumulative impacts analysis. Commenters also identified specific impacts (e.g., fish mortality caused by Hurricane Katrina) and requested that such impacts be considered in the cumulative impact analysis. Commenters suggested that the cumulative impacts analysis address specific activities (e.g., commercial fishing). Relevant actions and analysis of potential cumulative impacts of the proposed action are discussed in chapter 4.

**Mitigation:** Commenters requested that measures to avoid, minimize, and offset impacts (e.g., impacts to wetlands) of construction and operation of the Proposed Action be discussed in a mitigation section of the EIS. Commenters suggested specific mitigation measures be applied to specific SPR sites, pipeline rights-of-way, raw water intake areas, or brine disposal areas. The potential impacts and the associated mitigation measures are discussed in the same sections of the EIS (e.g., mitigation measures for impacts to wetlands are discussed in section 3.7 and appendix B).

### 1.4.3 Final Environmental Impact Statement and Record of Decision

DOE invites interested agencies, organizations, Native American tribes, and members of the public to submit comments on all aspects of this draft EIS. Locations and times of public hearings on the draft EIS will be announced in the Federal Register on May 26, 2006. Oral and written comments at those hearings are encouraged. Commenters are also encouraged to send written comments to Donald Silawsky, Office of Petroleum Reserves (FE-47), U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585-0301, or electronic mail at Donald.Silawsky@hq.doe.gov. Please note that conventional mail to DOE may be delayed by anthrax screening. The public comment period will be open for 45 days following publication of the draft EIS in the Federal Register. Any comments received later will be considered to the extent practicable.

DOE will consider all comments on the draft EIS in preparing the final EIS in accordance with NEPA, CEQ NEPA regulations, and DOE NEPA regulations. It will include the oral and written comments received on the draft EIS and responses from DOE.

No decision on the proposed action will be made by DOE until a minimum of 30 days after the Environmental Protection Agency's notice of availability of the final EIS. After this period, DOE will issue a Record of Decision concerning the proposed action. The Record of Decision will notify the public of the alternative that DOE has selected and the reasons for that decision. DOE will publish the Record of Decision in the Federal Register and post it on the DOE Fossil Energy Web site at http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html.

# Chapter 2.  Proposed Action and Alternatives

## 2.1 INTRODUCTION

The proposed action and alternatives are described below in section 2.2.  Sections 2.3 through 2.5 describe the activities necessary to construct and operate a typical SPR storage site, the associated infrastructure, and the facilities needed at each potential new site and expansion site.  Section 2.6 describes the no-action alternative.  In addition, section 2.7 discusses the alternatives that have been eliminated from detailed study.  Section 2.8 compares the environmental impacts of the alternatives.

## 2.2 PROPOSED ACTION

EPACT Section 303 states that in evaluating sites for SPR expansion, DOE:

> [s]hall first consider and give preference to the five sites which the Secretary previously addressed in the Draft Environmental Impact Statement, DOE/EIS-0165-D.  However, the Secretary, in his discretion may select other sites as proposed by a State where a site has been previously studied by the Secretary to meet the full authorized volume of the Strategic Petroleum Reserve [1 billion barrels].

EPACT Section 301(e) directs the Secretary to "… acquire petroleum in quantities sufficient to fill …" the SPR to 1 billion barrels.  Consistent with these mandates, DOE's proposed action is to develop one or two new SPR sites, to expand petroleum storage capacity at two or three existing SPR sites, and to fill the SPR to its full authorized volume of 1 billion barrels.  Sections 2.2.1 and 2.2.2 describe the potential development of new SPR sites and the potential expansion of existing SPR sites, respectively.

### 2.2.1 Potential New Sites

As required by EPACT Section 303, DOE has limited its review of potential new sites for expansion of the SPR to:  (1) sites that DOE addressed in the 1992 draft EIS and (2) sites proposed by a state where DOE has previously studied a site.  The following five potential new sites meet those conditions and are considered in this draft EIS:

- Richton, MS, and Stratton Ridge, TX, which were addressed in the 1992 draft EIS;
- Clovelly and Chacahoula, LA, which the Governor of Louisiana requested the Secretary of Energy consider; and
- Bruinsburg, MS, which the Governor of Mississippi requested that the Secretary of Energy consider.

While the 1992 draft EIS addressed the potential new salt dome sites at Cote Blanche, LA, and Weeks Island, LA, DOE's preliminary review of these sites for this draft EIS concluded that they are no longer viable due to the sale of the DOE's Weeks Island crude oil pipeline and its subsequent conversion to natural gas transmission.

### 2.2.2 Potential Expansion Sites

In addition to potential new sites, this draft EIS considers expanding the following three existing SPR sites:

- Big Hill, TX, which was addressed in the 1992 draft EIS; and
- Bayou Choctaw and West Hackberry, LA, which the Governor of Louisiana requested that the Secretary of Energy consider.

Figure 2.2.2-1 shows the location of the proposed new and expansion sites and their associated crude oil distribution complexes.

### 2.2.3 Alternatives

In developing the range of reasonable alternatives to fulfill its proposed action, DOE first considered expansions of the three existing storage sites, which would capitalize on existing site infrastructure and operations and thereby minimize development time and construction and operations costs. DOE, however, cannot reach its goal of 273 MMB simply by expanding capacity at existing sites. The amount of new capacity that can be developed at each existing site is limited by the physical size of the salt dome, the site's infrastructure for cavern development, the capacity of the commercial petroleum distribution infrastructure to handle an increased rate of oil withdrawal from the site, and other constraints. DOE has determined that, at most, it could create up to 153 MMB of new capacity by expanding existing SPR sites: DOE's site at Bayou Choctaw, LA, could be expanded by up to 30 MMB; Big Hill, TX, by up to 108 MMB; and West Hackberry, LA, by up to 15 MMB. Accordingly, DOE must develop one or more new SPR storage sites to meet its 273 MMB target and the alternatives discussed below are various proposals for combinations of expanded sites and new sites.

In examining potential new sites, DOE proposes to develop a new site with a capacity of 160 MMB, which is necessary to provide the capability to store two types of crude oil and support a drawdown rate of 1 million barrels per day. Five potential new sites have been designated for consideration in this draft EIS: Bruinsburg, MS; Chacahoula, LA; Clovelly, LA; Richton, MS; and Stratton Ridge, TX. All sites but Clovelly have the capability to provide 160 MMB of storage capacity. The Clovelly site is constrained to a maximum of 120 MMB by both the size of the salt dome and the existing commercial salt cavern storage operation on the dome. Due to the small size of the salt domes at Clovelly and Bruinsburg, DOE considers not only alternatives where Clovelly or Bruinsburg is the only new SPR site, but also alternatives with capacity at both Clovelly and Bruinsburg. From these various possibilities, DOE proposes the following alternatives set forth in table 2.2.3-1 below.

DOE has analyzed the potential impact of its proposed action for each potential location separately. This will permit the public and DOE decision-makers to understand the impacts unique to each site and each combination of sites. In its record of decision, DOE's decision-maker will determine which combination of sites best meets the Department's goal of 273 MMB of additional capacity.

As shown in table 2.2.3-1, for each alternative except for Clovelly and no-action, there are two scenarios for expanding the SPR to achieve the 1,000 MMB of storage capacity. The following subsections review the proposed new SPR sites and the existing SPR sites proposed for expansion.

**Table 2.2.3-1: Alternatives**

| New Sites and Capacity | Expansion Sites and Added Capacity | Total New Capacity* |
|---|---|---|
| Clovelly, LA (120 MMB) | 153 MMB<br>Bayou Choctaw (30 MMB)<br>Big Hill (108 MMB)<br>West Hackberry (15 MMB) | 273 MMB |
| Bruinsburg, MS (160 MMB) | 115 MMB<br>Bayou Choctaw (20 MMB)<br>Big Hill (80 MMB)<br>West Hackberry (15 MMB)<br>**OR**<br>116 MMB<br>Bayou Choctaw (20 MMB)<br>Big Hill (96 MMB) | 275 MMB<br>or<br>276 MMB |
| Chacahoula, LA (160 MMB) | | |
| Clovelly (80MMB)/Bruinsburg (80 MMB) | | |
| Richton, MS (160 MMB) | | |
| Stratton Ridge, TX (160 MMB) | | |
| Clovelly (90 MMB)/ Bruinsburg (80 MMB) | 107 MMB<br>Bayou Choctaw (20 MMB)<br>Big Hill (72 MMB)<br>West Hackberry (15 MMB)<br>**OR**<br>104 MMB<br>Bayou Choctaw (20 MMB)<br>Big Hill (84 MMB) | 277 MMB<br>or<br>274 MMB |
| No-action alternative | None | None |

* DOE would not fill the SPR beyond 1 billion barrels if it developed more than 273 MMB of new capacity.

## 2.3 BACKGROUND ON CONSTRUCTION AND OPERATION OF SPR STORAGE SITES

An SPR storage site would consist of a number of individual systems that would play a role in storing and distributing oil. Crude oil storage caverns would be created in large salt domes. To create these storage caverns, **raw water** would be brought to the site through a RWI system. This raw water would be pumped into the salt dome to dissolve the salt in a process known as solution mining. Raw water would be supplied to expansion sites and new sites from surface water sources. This water would dissolve the salt and produce a brine solution, which would be disposed of through a brine disposal system. The systems and processes used to construct and operate SPR sites are described below and illustrated in figure 2.3-1 and figure 2.3-2. After a cavern has been successfully created, oil would be pumped in for storage through the crude oil distribution system until it would be removed through a process called drawdown and then redistributed.

> **Salt domes** are subsurface geologic structures consisting of a vertical cylinder of salt, and may be anywhere from 0.5 to 6 miles (1 to 10 kilometers) across and up to 20,000 feet (6,100 meters) deep. Domes are formed when salt from buried salt pans flow upward due to its buoyancy.

> **Raw water** is fresh surface water that is supplied to the site from a substantial water source.

Solution-mined caverns in salt domes have been used to store liquids and gases for more than half a century. In the early 1950s, salt caverns were first used to store crude oil in England and liquid petroleum gas in the United States, Canada, and several European countries. Natural gases began being stored in salt caverns in the United States and Canada in the 1960s. DOE has been using solution mining to develop caverns in the salt domes along the Gulf Coast since the 1970s, and it began filling the SPR salt caverns with crude oil in 1978.

> **Brine** is water with a salt concentration greater than 35 parts per thousand. Sea water has a similar average concentration. In comparison discharged brine has a typical concentration of 263 parts per thousand.

### 2.3.1 Cavern Creation, Fill, and Drawdown System

Developing a cavern would take approximately 2 years, although multiple caverns can be created simultaneously. Because the caverns would be created simultaneously, it would take up to 5 years to complete the development of sixteen 10 MMB caverns. The top of each cavern would be located between 1,500 feet and 3,500 feet (460 meters and 1,607 meters) below the ground. Each cavern would be designed to hold 6.7 to 12 MMB of crude oil.

DOE would use a four-stage solution-mining process to create a cavern (figure 2.3-1). First, DOE would drill a pair of **concentric cased wells** into the salt dome, and then pump water through the wells until the **sumps** from each coalesce into a single sump so that water can be pumped down one well and brine displaced out through the other (figure 2.3-1, step I). During this process, **drilling mud** (which is not a hazardous waste) would be generated and deposited onsite, and brine would be discharged in one of two ways. Brine would be discharged into the Gulf of Mexico in accordance with the terms of applicable permits at any new site (except Bruinsburg) and the expansion at Big Hill. For the Bruinsburg, Bayou Choctaw, and West Hackberry sites, brine would be disposed of via injection wells that inject brine into deep non-potable groundwater aquifer systems. Brine disposal is described in section 2.3.3. As solution mining proceeds, any insolubles in the brine would drop to the bottom of the cavern.

> **Concentric cased wells** are two wells, one located within the other. The two wells are separated by an inner casing and an outer casing, and the casings form two concentric rings.

> **A sump** is the space below the bottom end of a well pipe where liquid collects.

> Approximately 7 million barrels of brine are created for every 1 million barrels of cavern space created.

The second stage would involve developing the cavern chimney, which is the narrow upper part of the cavern illustrated in figure 2.3-1, step II. Water would flow into the well at the bottom of the developing cavern, and brine resulting from leached cavern walls would be pumped out at the top. DOE would carefully control upward cavern development to produce the desired cavern size and shape. This would be done by regulating water flow and varying the position of the injection piping.

In the third stage of cavern development, cavity growth would be directed downward by injecting a quantity of oil that floats on the water and blankets the cavern roof, thereby protecting the cavity from further upward solution mining (see figure 2.3-1, step III). This process works because the chemical composition of water differs from that of crude oil. Water is a polar substance, and it breaks the ionic bonds between the sodium and chloride, causing salt dissolution. In contrast, crude oil is nonpolar and does not break the bonds and dissolve salt. Thus, when the oil is injected and floats on the water at the top of the cavern, it prevents the water from dissolving salt at the top wall of the cavern toward the ground surface.

In the fourth stage of cavern development, the body of the cavern would be enlarged to its planned capacity by lowering the water injection point in the cavern (see figure 2.3-1, step IV).

DOE would monitor the cavern development process using computer and sonar instruments. After the initial cavity is created, a sonar **caliper** survey would verify that the cavern is developing as planned. During solution mining, DOE would use computer modeling to predict the size and shape of the cavern. The water injection level would be adjusted to create the desired size and shape. DOE would use sonar surveys two more times to measure each cavern and adjust the computer model accordingly. Upon completion, each cavern would be roughly cylindrical in shape, tapering slightly inward from top to bottom.  A typical SPR storage cavern, with a planned storage capacity of 10 MMB, would be leached (solution mined) to an 11–MMB volume, approximately 2,200 feet (670 meters) high and 260 feet (79 meters) wide at the widest point (see figure 2.3-1).

DOE would test the structural integrity of the caverns in two phases.  The first phase would involve two **hydrostatic tests** of each well in a cavern.  This phase is designed to check the pressure-drop response of the entire cavern to gross leakage.  The second phase would employ a nitrogen well-leak test on each well.  This test, which would last at least 5 days, is designed to detect small leaks in the well walls and wellhead.  DOE would approve a cavern for oil storage only if the testing demonstrates that total leakage would be less than 100 barrels of oil per year for each well entering the cavern.  This is within the accuracy of current accepted evaluation techniques.

Besides being the most economical way to store oil for long periods of time, the use of salt caverns is also one of the most environmentally secure.  The salt walls of the storage caverns are "self-healing."  Extreme geologic pressures make the salt walls rock hard.  If any cracks were to develop, they would be closed almost instantly.  In addition, the natural temperature difference between the top of the caverns and the bottom keeps the crude oil continuously circulating, helping maintain the oil at a consistent quality.

The fact that oil floats on water is the underlying mechanism used to move oil in and out of the SPR caverns.  After completing integrity testing, DOE would fill the cavern with oil through one well as the brine is displaced from the second well (see figure 2.3-2).  Oil would be delivered to the site through pipelines.  Oil in the caverns would be stored until drawdown.

During drawdown, oil would be displaced by water and pumped through the site's transfer metering station and distribution pipeline to the receiving terminal.  Heat exchangers onsite would be used to cool the oil to prevent release of volatile organic compounds, hydrogen sulfide, and benzene when the oil is delivered from the storage sites into tanks at terminals.  (Long-term storage in underground salt domes heats oil above the temperature at which it is originally stored.)

The layout of the caverns would depend on site characteristics, but generally it would reflect the current cavern layout at the Big Hill site (see section 2.5.2.).  Cavern spacing would be based on specific criteria detailed in the Level III Design Criteria for the SPR that ensure cavern integrity and stability (DOE 2001a).  These criteria detail minimum cavern center-to-center spacing, cavern pillar thickness, distances from the pillar thickness to the edge of the dome and to the property line, distance between the top of the cavern roof to the top of the salt, and the ratio of pillar thickness to final cavern diameter.  A safety factor is also specified to allow for **borehole** deviation when drilling and for uncertainties regarding proximity to the edge of the dome.

A dike would surround the wellhead area at each cavern to contain and control any spills that might result from a manifold failure or blowout.  Drains would be located on either side of the dike.  The containment area would have the capacity to remove accumulated rainwater and would be drained to the stormwater drainage system.

### 2.3.2 Raw Water Intake System

The RWI system would supply raw water for both cavern solution mining and oil drawdown activities.  The main component of this system, the RWI structure, would be located on a water source with sufficient flow to supply up to 1.2 million barrels per day (MMBD) or 50.4 million gallons per day of water for cavern solution mining and up to 1.2 MMBD for drawdown.  A typical RWI structure would be a steel and concrete platform sufficiently elevated to withstand a 100-year flood (see figure 2.3.2-1).  It would have four 1,500-horsepower, vertical, centrifugal pumps, each with a capacity of approximately 0.46 MMBD to remove water from the water source. The water then would be transported through a pipeline to the SPR storage site. After the water reaches the site, 3,500-horsepower injection pumps would pump it to the caverns for solution mining or drawdown operations.

> **Rip rapping** is the process by which rocks or other materials (rip rap) are placed along the banks of a body of water to prevent erosion.

The RWI structure would have a concrete sump on an intake channel equipped with bar racks and traveling screens to remove debris and return aquatic life to the water source. The effective cross section of the screens would be sufficient to ensure a maximum intake velocity of 0.5 feet (0.15 meters) per second. The intake channel would be **rip rapped** according to U.S. Army Corps of Engineers (USACE) permit requirements to prevent shore erosion. The landward portion of the structure would be surrounded by a fence with security lights.

In addition to the RWI pumps, two sealed, firewater, vertical, centrifugal, 100-horsepower pumps would maintain pressure in the RWI structure when the intake pumps are not operating. These pumps also would provide water at the RWI structure in case of fire. Power to the RWI would be provided on parallel, high-voltage, 34.5-kilovolt power lines supported on self-weathering 75-foot (23-meter) steel monopoles, however, based on the local power distribution system 115-kilovolt or 138 kilovolt power lines may be used. Typically, the new power line ROW would be built from the storage site to the RWI along a **right-of-way (ROW)** shared with the raw water pipeline. The ROWs for parallel 34.5-kilovolt power lines would be 60 feet (18 meters), and for parallel 115-kilovolt or 138 kilovolt power lines would be 150 feet (46 meters). Power to the RWI would be provided from the storage site substation or from nearby existing power lines.

### 2.3.3 Brine Disposal System

> **Anhydrites** are mineral, anhydrous calcium sulfates (chemical formula $CaSO_4$), occurring naturally in salt deposits. Anhydrite is much less soluble than salt, so anhydrite solids must be removed from brine before brine can be disposed of in the ocean or injected into underground wells.

DOE would use two methods of disposing of brine produced during cavern solution mining: ocean disposal or injection wells. At Big Hill and each of the proposed new sites except Bruinsburg, the brine would be directly discharged into the Gulf of Mexico through a brine **diffuser** system. Brine would be displaced from caverns into a **brine pond** with a high-density polyethylene liner, where **anhydrites** would be separated from the brine by gravity settling. From this pond, the brine would flow into a different area of the pond or into a second pond or area, where any residual oil floating on the surface of the brine would be skimmed off. Oil collected by the **skimmer** boom would be stored temporarily in a waste oil tank, and after evaluation, it would be returned to inventory. Any oil failing evaluation would be disposed of offsite as waste (see section 2.3.10).

Finally, the brine would be pumped into the brine disposal pipeline. The brine would be treated with ammonium bisulfite, which scavenges dissolved oxygen, thereby reducing corrosion in the brine disposal pipeline. Vertical, centrifugal pumps would pump at a rate of up to 1.2 MMBD to the disposal point.

For ocean disposal, the brine disposal pipeline would be buried below the bottom of the Gulf of Mexico and extend until the water is at least 30 feet (9 meters) deep. After the brine reaches that point, it would be discharged underwater vertically through a diffuser with 3-inch (7.6-centimeter) nozzles mounted vertically and spaced 60 feet (19 meters) apart. The diffuser would extend over 4,000 feet (1,200 meters) beyond the pipeline. The diffuser would have up to 60 exit ports that can be opened or closed in order to maintain a minimum brine exit velocity of 30 feet (9.1 meters) per second. Each nozzle on the diffuser would be equipped with a flexible rubber hose that would extend 4 feet (1.2 meters) above the Gulf floor and with a diffuser guard designed to prevent interference with shrimping and other fishing activities. Discharged brine would have a salinity of about 263 parts per thousand, whereas the seawater in the gulf has an average salinity of 35 parts per thousand.

Under the proposed expansion at the Bayou Choctaw and West Hackberry sites, brine would be disposed of using existing and proposed new brine injection wells. Brine disposal at West Hackberry would use the existing brine disposal wells, while brine disposal at Bayou Choctaw would use the existing and up to six new brine injection wells. At the West Hackberry site, existing caverns would be purchased, and brine would only be disposed of during the oil fill. An underground injection system also would be used to dispose of brine from the proposed Bruinsburg site. The process for moving the brine to underground injection wells would be similar to that of the Gulf of Mexico disposal method—first to separating ponds before being pumped into disposal pipelines—except for the final disposal point. In this method, the brine would be injected into wells specifically designed and permitted to inject brine into deep non-potable groundwater aquifer systems.

### 2.3.4 Crude Oil Distribution System

SPR storage sites would be connected to a crude oil distribution system as a means of filling caverns for storage and distributing oil during drawdown. The crude oil distribution system would consist of a series of onsite and offsite pipelines and pumps connecting to an existing oil distribution network. To accommodate some of the new sites being considered, the existing distribution network also may be expanded to include new **tank farms**, terminals, and other equipment. The existing SPR storage facilities are linked to three major Gulf Coast crude oil distribution complexes (see figure 2.2.2-1). The proposed new or expanded SPR storage facilities at Bruinsburg, Chacahoula, Clovelly, Richton, and Bayou Choctaw would be connected to the Capline Complex. The proposed new SPR storage facility at Stratton Ridge would be connected to the Seaway Complex. The existing and proposed SPR storage facilities at West Hackberry would be linked to the Texoma distribution complex. The existing and proposed SPR storage facilities at Big Hill would be linked to both the Seaway and Texoma complexes. Each of these complexes includes oil refineries, pipelines, and marine oil terminals on the Gulf Coast. During an emergency drawdown of the SPR, crude oil would be transported by pipeline, barge, or tanker.

### 2.3.5 Site Support Structure and Equipment

To support storage site operations, several types of structures and equipment would be constructed at the site as needed. The following buildings would be needed to support operations and maintenance:

- Office and control room;
- Maintenance shop and warehouse;
- Crude oil, raw water, and brine pump enclosures;
- Sample storage building;
- Laboratory; and
- Security buildings.

These buildings typically would occupy a 35,000-square-foot (3,250-square-meter) area. To facilitate construction and site operations, DOE would build roads at the site. The roads generally would have two 10-foot (3-meter) lanes with 6-foot (1.8-meter) shoulders. Total roadway length for a site would average 5.1 miles (8.2 kilometers). DOE also would need miscellaneous surface facilities such as pump pads, piping manifolds, maintenance yards, **laydown yards**, and parking lots. Total storage facility surface area for new sites would range from 170 to 270 acres (69 to 110 hectares). Expansion sites range from

250 to 570 acres (100 to 230 hectares), and areas that would be added by proposed expansion would range from 96 to 240 acres (39 to 97 hectares).

An SPR site also would need an electrical substation, sewage treatment facility, lightning-protection system, and fire-safety system.  The fire-protection system would receive its water supply from either the RWI structure or an onsite tank.  In a fire, the water would be distributed through underground piping.  The system would include a foam (aqueous film-forming foam) spray system for controlling fires at the oil injection pump pads and oil loading center, an automatic sprinkler system inside buildings, and an onsite fire truck.

All SPR sites would be equipped with security systems and staffed by protective personnel.  The sites would be completely fenced with 7-foot (2.1-meter) chain-link fence and equipped with site perimeter surveillance and detection systems.  With the exception of Clovelly, the sites would maintain a 300-foot (91-meter) visual clear zone with perimeter lighting.  Personnel and vehicle entry would be restricted.  Site entrances would be equipped with vehicle barriers and entry portals for personnel screening.  Employee and visitor parking would be provided outside the controlled area.

Electrical power would be required for basic construction and operational activities, quarterly equipment testing, and annual testing of drawdown capabilities.  The number of pumps used at any one time and their energy requirements would vary depending on the number of caverns being developed, the type of activity, and the conditions of each pipe **casing**.  Cavern development would be the most energy-intensive activity, averaging approximately 12 million kilowatt-hours per month for a 16-cavern site.  The RWI, brine disposal, and oil fill and distribution systems would be powered by electric pumps.  During cavern development, pumps would usually run 24 hours each day.  Oil-fill energy requirements would be about 6 million kilowatt-hours per month.  During standby periods, energy requirements would be about 1 million kilowatt-hours per month for a 16-cavern site.  During standby periods, energy requirements would be about 0.5 million kilowatt-hours per month.  During drawdown periods, energy requirements would be greater than for oil fill and less than for cavern development, depending on the rate of drawdown.

High-voltage 115-kilovolt, 138-kilovolt, or 230-kilovolt power lines would be built to supply the substation at a new SPR storage site.  Two lines would be constructed for each site, generally using new ROWs or along ROWs shared with pipelines or roads.  The ROW for a single 115-kilovolt or 138-kilovolt power line would be 100 feet (30 meters) and the ROW for parallel 115-kilovolt or 138-kilovolt power lines would be 150 feet (46 meters).  The ROW for a single 230-kilovolt power line would be 100 feet (30 meters) and the ROW for a parallel 230-kilovolt power line would be 200 feet (60 meters).  A three-line single circuit would be supported on self-weathering 75-foot (23-meter) steel monopoles spaced at 600 to 900-foot (183- to 274-meter) intervals.

### 2.3.6 Storm Protection Measures

DOE has established emergency response plans at all existing SPR storage facilities to address major storm events such as hurricanes.  SPR staff would monitor weather and potential storms continually.  If a hurricane were projected to hit an operational storage facility, the threat level would be assessed and the appropriate emergency response plan would be initiated.  During threats, all loose materials onsite, including materials at the laydown areas, would be tied down or relocated to a secure area.  Windows on buildings would be secured with energy efficient storm shutters or prefabricated plywood covers.  Storage tanks would be checked to ensure that they are storing enough material to effectively weigh them down and prevent serious damage.  If the storage tanks are found to be too light, water would be added to them.  Finally, all nonessential personnel would be released from work, and site operations would be suspended.

Storm damage could potentially affect SPR storage facilities and support infrastructures, disrupt workforces, and result in communication interruptions. The effects of storm damage to a SPR storage facility can be best demonstrated by recent events. Storm protection measures—including activating back-up communication centers—were implemented when major Hurricanes Katrina (Category-4 landfall in Louisiana) and Rita (Category-3 landfall on the Louisiana/Texas border) devastated parts of the Gulf Coast region in August and September 2005. In addition to causing structural, economic, and social damage to a tri-state region in the Gulf Coast, these hurricanes shut down most crude oil and natural gas production and affected the ability of suppliers to get gasoline to national markets due to the closure of critical refineries in the region. Several SPR storage sites were directly affected, sustained some damage, and many employees were displaced from their homes. Notwithstanding, SPR operations were able to be restored almost immediately. The Oil Exchange Program providing crude oil to refiners in order to continue operations commenced in less than three days after Hurricane Rita and five days after Hurricane Katrina at which time President Bush declared a SPR drawdown—an action that has occurred only twice in 30 years. This demonstrates the effectiveness of planned SPR storm protection measures and of the resilience of SPR infrastructure to sustain short-term damage from major storm events.

### 2.3.7 Construction in Uplands

**Uplands** refer to generally dry land that is different from, marsh, swamp, and wetlands.

As described above, construction activities generally would include site preparation, development of RWI and brine disposal systems, cavern creation, development of any new oil pipelines needed to connect to existing distribution networks, and construction of support structures and equipment. The actual activities undertaken would depend on the sites selected and existing facilities at each site. The following sections describe required activities in developing a typical new SPR facility in **uplands**. Certain of these activities also pertain to expansion of existing facilities, particularly where new caverns would be developed.

#### *Clearing and Grubbing*

Construction of a new SPR facility would begin with clearing and **grubbing** the site. Clearing would consist of felling, trimming, and cutting trees into sections and removing surface vegetation, rubbish, and existing structures. Materials removed generally would be disposed of at an approved offsite facility. In most cases, onsite burning or disposal would not be permitted. Grubbing would include removing roots, stumps, brush, and general debris. As part of this work, topsoil also would be removed. Generally, uncontaminated native topsoil would be stockpiled on the site for use in restoring sloped areas, which then would be seeded with native vegetation to control erosion. Waste materials would be recycled or disposed of offsite.

All the land within a new site and within the 300-foot (91-meter) security buffer would require clearing and grubbing for initial site construction activities. These operations generally would require two crews (an onshore construction crew is about 52 people). Depending on the density of trees and brush, the clearing and grubbing would be completed in approximately 100 working days.

#### *Grading and Stabilization*

Grading and general embankment, stabilization, and compaction operations would begin as soon as clearing and grubbing are completed. As adequate site areas are cleared, rough grading (i.e., moving dirt from high areas of the site to lower areas) would begin. For a typical 300-acre (120-hectare) site, estimated daily production of graded materials would be 3,000 cubic yards (2,300 cubic meters) for two 300-horsepower dozers (short haul) and 2,500 cubic yards (1,900 cubic meters) for two 14-cubic-yard (11-cubic-meter) scrapers (long haul). Rough grading would require 5 to 10 working days. As areas of the site are cut to subgrade levels, the soil would be stabilized with lime and then compacted. Two crews would stabilize approximately 1 acre (0.4 hectare) per day, requiring 130 working days for this operation. Placing and compacting embankment material would be done at a rate of 2,000 cubic yards (1,500 cubic meters) per day, requiring approximately 60 working days.

### 2.3.8 Construction in Wetlands

At the proposed Chacahoula and Clovelly sites, the majority of construction would occur in saturated or open-water wetlands. Construction would require dredging and filling of wetlands. Dredging is the removal of materials from the bottom of a body of water. It would be required at Clovelly for the construction of 9 of the 16 proposed caverns. At both Chacahoula and Clovelly, fill areas would be created for gravel roadways, onsite pipelines, onsite buildings and structures, and drilling pads above each well. The pipelines and roadways would be co-located to minimize construction impacts. The foundations of buildings would be placed on concrete or wooden piles driven into the earth below the water.

### 2.3.9 Pipeline Construction

Offsite pipelines for brine disposal, raw water, and crude oil distribution would be buried. In preparation for pipeline construction, DOE would clear the ROW, which requires preparation similar to that required for construction. DOE would give all possible consideration to preserving trees in the ROW. DOE also would grade the ROW to facilitate laying the pipeline, and would build temporary facilities such as roads and bridges for use during pipeline construction.

Five basic modes of pipeline construction would be used in uplands and wetlands through which a pipeline from any proposed site could pass. The method chosen for a particular pipeline would depend on terrain, pipe size, and presence of ground and surface water. The five modes are described below:

- **Conventional Land Lay:** This method generally would be used for pipe installation at higher elevations where groundwater or surface water conditions would not prevent the use of heavy equipment. The pipe would be installed in ditches excavated by backhoes and ditching machines. The pipeline would be assembled and lowered into the ditch using side-boom tractors and other equipment. The ditch then would be backfilled, returning the terrain to its original contour.

- **Conventional Push Ditch:** This method would be used in marshland areas where water depths are reasonably predictable. Timber mats support the heavy equipment used to create ditches of sufficient depth for pipeline installation. The pipeline would be assembled at the push site, on high ground, on a barge, or on a temporary platform, and then pushed into the ditch. Floats would be used to push the pipe into position. When these floats are removed, the concrete-coated pipe would sink to the bottom of the ditch. Returning the ROW to its original contour depends on the success of the backfilling and the ditch slope.

- **Flotation Canal:** For this method, which requires a minimum of 6 feet (1.8 meters) of water, a canal would be created to accommodate barges and floating equipment. The pipe would be installed in the canal through a sequential assembly operation on a barge deck. The canal would not be backfilled.

- **Modified Push Ditch:** This method would be most applicable in areas with predictable water levels such as coastal **marshes**. Shallow-draft barges would excavate a canal. A larger push barge would be used as a platform to assemble the pipe, and then, with flotation buoys, the pipe would be floated into the canal. The pipe is allowed to sink to the bottom of the canal when the flotation buoys are removed. Finally, the canal would be backfilled.

- **Directional Drilling:** This method is used for laying in a pipeline beneath major road and water crossings. The main advantage is that during construction, the method avoids disruption to traffic and sensitive environmental features. Using a slanted drill, construction workers would drill a pilot hole on one side of the crossing and then repeat this process on the other side. After drilling the pilot holes, workers would expand them to create sufficient space for the crude oil pipeline.

Pipeline construction in the Gulf of Mexico generally would require a trench about 20 feet (6.1 meters) below the ocean floor and 12 and 6 feet (3.7 and 1.8 meters) wide at its top and bottom, respectively. Pipeline construction would differ for coastal waters (i.e., within water depths of 12 to 15 feet [3.7 to 4.6 meters]) and offshore waters (i.e., beyond water depths of 12 to 15 feet [3.7 to 4.6 meters]). In coastal water, a mechanical dredge (e.g., clam bucket or dragline dredge) would excavate the pipeline route. Afterward, the pipeline would be assembled sequentially on a pipelay barge and then pushed off the pipe ramp. Flotation buoys would keep the pipeline suspended in the water until the pipeline was allowed to descend into the ROW.

In offshore water, excavation of the pipeline ROW would occur after the pipeline was laid. First, the pipeline would be assembled sequentially on a pipelay barge with a conveyor system, and then it would be pushed into the Gulf where it would be allowed to descend to the sea floor. A dredging sled, mounted on the stern of the trenching barge, then would be lowered to the ocean floor and positioned over the pipe. Hydraulic jets on the sled would displace the material around the pipe. The pipeline would then lie in the trench previously occupied by the displaced bottom material. Depending on the area's environmental sensitivity, the resulting suspended bottom material would dissipate in the Gulf water or be collected and disposed of in **spoils** areas.

Pipeline construction would require both construction **easements** and permanent easements. The width of the easements would vary with the type of terrain the pipeline crosses and other site characteristics. Table 2.3.9-1 lists the typical easement width requirements for pipelines. Figure 2.3.9-1 shows the typical layout of a pipeline easement in both uplands and wetlands. Chapter 3 uses these easement assumptions to calculate the acreages affected by pipeline construction.

An **easement** is a right held by one party to make specific, limited use of land owned by another party. An easement is granted by the owner of the property for the convenience or ease of the party using the property. Common easements include the right to pass across the property or the right to construct a pipeline under the land or a power line over the land.

**Table 2.3.9-1: Typical Widths of Pipeline Easements**

| Land Type | Construction Easement | Permanent Easement | Total Easement |
|---|---|---|---|
| **Single Pipeline** | | | |
| Uplands | 50 feet (15 meters) | 50 feet (15 meters) | 100 feet (30 meters) |
| Wetlands | 100 feet (30 meters) | 50 feet (15 meters) | 150 feet (46 meters) |
| Water | 100 feet (30 meters) | 50 feet (15 meters) | 150 feet (46 meters) |
| **Multiple Pipelines** | | | |
| Uplands | 120 feet (37 meters) | 50 feet (15 meters) | 170 feet (52 meters) |
| Wetlands | 150 feet (46 meters) | 100 feet (30 meters) | 250 feet (76 meters) |
| Water | 150 feet (46 meters) | 100 feet (30 meters) | 250 feet (76 meters) |

### 2.3.10 Operations and Maintenance

This section discusses typical operation and maintenance activities for SPR sites and pipeline systems.

***Site Operations and Maintenance***

The main activities at an SPR site would include oil drawdown and fill and routine daily operations such as inspecting equipment, preparing log sheets, documenting data for equipment performance evaluation, reporting safety hazards, making environmental checks, performing laboratory work, and conducting maintenance activities. As necessary, a site would be sprayed with herbicides (e.g., around the fenceline) and pesticides (e.g., for fire ants and mosquitoes). Section 3.2 identifies these and other chemicals commonly used at an SPR site. An SPR facility would employ approximately 75 to 120 people onsite, depending on the site's final storage capacity. Operations and security personnel would be onsite 24 hours a day.

DOE would monitor cavern structural integrity daily by measuring pressure trends. DOE would test completed caverns for structural stability at least once every 5 years by using nitrogen well-leak tests as prescribed by methods acceptable to respective state regulators.

The central control room at an SPR site would remotely monitor many onsite activities and operations. Valves and other operating mechanisms along the oil pipeline would be adjusted from the control room. The control room operator also would detect any leaks in the brine pipeline and deviations in cavern pressure. An onsite data logger would collect data continuously about the condition of the facility. During oil movement, flow and pressure would be monitored hourly by manually checking the conditions at the valves. The control room would be staffed 24 hours a day, 7 days a week by at least one shift leader. The shift leader would direct staff to monitor situations at distant locations as needed.

Maintenance activities at an SPR site typically would include the preventive and corrective maintenance of solution mining equipment including pumps, motors, valves, instruments, piping, and "workovers" (work programs performed on existing cavern wells) to reposition cavern strings.

Hazardous materials are used in the operation and maintenance of existing SPR sites and would be used at proposed new and expansion sites. Table 2.3.10-1 itemizes the types and quantities of hazardous materials typically stored at existing SPR sites.

Spills of hazardous materials from SPR sites are required to be reported under several Federal and state laws and regulations and SPR site operating procedures. Emergency response procedures for each SPR site address the requirements for reporting spills of hazardous materials to the SPR operations and maintenance contractor, DOE, and appropriate Federal, state and/or local regulatory agencies.

Various local, state, and Federal requirements also govern the management of hazardous materials and responses to spills. For example, the Federal Clean Water Act and related state statutes and regulations require sites to develop and maintain a Spill Prevention, Control, and Countermeasures Plan, and the Pollution Prevention Act of 1990 requires sites to develop and maintain pollution prevention plans and stormwater pollution prevention plans. Each proposed new SPR site would be required to develop and implement a Spill Prevention, Control, and Countermeasures Plan, and each expansion site would be required to update the site plan to incorporate the additional storage infrastructure and operations. Other site-specific plans that would be part of each SPR site's environmental program include Emergency Response Procedures with spill reporting procedures and a Site Environmental Monitoring Plan.

**Table 2.3.10-1: Typical Quantities of Hazardous Materials Stored at Existing SPR Sites**

| Material (Use) | Typical Location | Maximum Daily Amount Stored Onsite (pounds) |
|---|---|---|
| Ammonium bisulfite solution (water treatment chemical) | Brine pad, raw water injection pad, equipment pad | 10,000–99,999 |
| Bromotrifluoromethane (refrigerant) | Various | 1,000–9,999 |
| Diesel fuel #2 (emergency power generation, motor fuel) | Emergency generator fuel tanks, property tank | 10,000–99,999 |
| FC–203CE Lightwater Brand AFFF (fire protection chemical) | Foam storage building | 10,000–99,999 |
| FC–203CF Lightwater Brand AFFF (fire protection chemical) | Foam deluge building | 10,000–99,000 |
| FC–600 Lightwater Brand ATC/AFFF (fire protection chemical) | Foam storage building | 10,000–99,999 |
| Ansulite 3% AFFF AFC–3A (fire protection chemical) | Firetrucks, foam storage building | 10,000–99,999 |
| Flogard POT805 (water treatment chemical) | Potable water building | 100–999 |
| Gasoline (motor fuel) | Property tank | 10,000–99,999 |
| Herbicides, such as Monsanto Rodeo and Red River 90 Spray Adjuvant (grounds maintenance) | Flammable storage building | 1,000–9,999 |
| Motor oil (motor lubricant) | Flammable storage building, equipment areas | 1,000–9,999 |
| Oil Base Sweep EZ Floor Sweep (property maintenance) | Maintenance building | 100–999 |
| Paints (property maintenance) | Flammable storage building | 1,000–9,999 |
| Silica, crystalline quartz | Maintenance building | 10,000–99,999 |
| Simple Green (cleaner, degreaser, deodorizer) | Maintenance building | 100–999 |
| Sodium hypochlorite solution (water treatment) | Potable water building | 100–999 |

To convert pounds to kilograms, multiply by 0.4536

Source: *Site Environmental Report for Calendar Year 2003*. DOE 2004f. Tables 2-2 through 2-7.

Each SPR site would also implement an environmental training program to ensure that applicable personnel are aware of the SPR Environmental Management System and environmental laws and regulations, and are trained in oil and hazardous material spill prevention and the safe handling of hazardous waste. In the event of a hazardous material release, trained emergency response personnel at the SPR site would respond to control and minimize spill impact.

Local, state, and Federal fire protection standards and guidelines applicable to existing SPR sites are identified in the *2003 Site Environmental Report Appendix A: Strategic Petroleum Reserve - DM Environmental Standards* (DOE 2004f). These standards and guidelines would also apply to proposed new SPR sites in Texas and Louisiana, and similar state and local standards and guidelines would apply to proposed new SPR sites in Mississippi.

Fire protection systems at existing SPR sites include firewater storage tanks and ponds, firewater pumps, and fire trucks. For example, firewater is supplied to the Bayou Choctaw and Big Hill sites through the RWI system and to the West Hackberry site through a deepwater well at a design rate of 375 gallons (1,400 liters) per minute. A secondary water supply is provided to the West Hackberry site from the Hackberry community water works at a rate of no more than 500 gallons (1,900 liters) per minute. All of these systems are equipped with a series of primary pumps, backup pumps, and firewater tanks. Each of the existing sites also has automatic and manually activated aqueous film forming foam systems for fire protection; sprinkler systems to protect control centers, maintenance buildings, foam buildings, and other buildings; a fire truck with pumps capable of using water or water/foam; and portable, trailer-mounted, foam-water pumps and portable fire extinguishers on wheels.

The SPR has adopted the National Interagency Incident Management System, the response management system required by the National Oil and Hazardous Substances Pollution Contingency Plan. Each existing SPR site has a group of well-trained Emergency Response Team personnel who can respond to emergencies such as spills and fires. These personnel and New Orleans response management personnel have been trained in the unified Incident Command System and a team of selected New Orleans response personnel is available to support extended site emergency operations when needed.

All of the fire protection systems at the existing SPR sites would be available for use if those sites are selected for expansion. Likewise, each of the proposed new sites would be equipped with fire protection systems that are functionally equivalent to those described above.

***Pipeline Operations and Maintenance***

DOE would inspect pipeline ROWs regularly for adjacent surface conditions and indications of leaks, **geophysical** activity, oil theft, sabotage, construction by others, and other factors affecting pipeline safety and operation. Weekly aerial patrols would monitor all general conditions affecting the ROW. Land and water patrols would investigate problems observed from the aerial patrols.

Nuisance vegetation along the pipeline ROW would be mowed regularly. In addition, defoliants would be used as needed to destroy additional vegetation that hinders pipeline operation and maintenance. Erosive conditions would be prevented and controlled by maintaining grass covers and constructing or maintaining terraces, **plugs**, and **bulkheads**.

> **Bulkheads** are retaining walls designed to hold or prevent the sliding of soil caused by erosion and wave action.

Other maintenance would include painting exposed portions of the pipeline and **pigging** the pipeline. Pigging monitors interior conditions of pipelines and ensures that efficient flow conditions are maintained. RWI pipelines would be cleaned periodically by scraper or brush **pig** operations. Use of "smart pigs" with ultrasonic detection and magnetometrics could be used as appropriate. **Caliper pigging** would be performed periodically to ensure pipeline integrity.

> In **pigging** operations, inspection and cleaning devices called "pigs" are sent through pipelines to check the condition of pipelines and clean them. Caliper pigging is used to determine the thickness of pipeline wells.

### 2.3.11 Decommissioning

Section 159(f) of the Energy Policy and Conservation Act authorizes DOE to use, lease, maintain, sell or otherwise dispose of land or interests in land, or of storage and related facilities acquired under the SPR program. DOE may decommission and dispose of an SPR storage facility if it could no longer effectively continue its program mission. This could arise for a variety of reasons: if the SPR storage facility was no longer able to maintain critical physical systems, retain geological integrity, support the SPR program mission economically, or remain in compliance with state, Federal, and DOE environmental, safety, and health requirements. In addition, decommissioning could take place if the SPR storage program were to be terminated by Congress at some future date.

Decommissioning of an SPR storage facility has been undertaken twice in the past. During the early 1990s, DOE disposed of the Sulphur Mines SPR storage facility, an unneeded SPR site in Louisiana, with replacement capacity to be developed by the then on-going enlargement of the caverns at Bayou Choctaw and Big Hill storage facilities. The Sulphur Mines SPR storage facility was sold to an outside commercial user. Pursuant to NEPA, DOE prepared an Environmental Assessment to assess the potential environmental consequences of decommissioning the Sulphur Mines storage facility (DOE 1990b) which resulted in the issuance of a Finding of No Significant Impact. In late 1999, the Weeks Island SPR site, Iberia Parish, Louisiana storage facility was successfully decommissioned by DOE. The Weeks Island Mine had served as an SPR storage facility from its conversion from a commercial room and pillar salt mine in 1977. Following oil fill in 1980-1982, it stored about 73 MMB of crude oil until late 1995, at which time DOE submitted a plan for decommissioning and initiated oil drawdown procedures. DOE recognized that groundwater was leaking into the stored oil chambers by means of a rapidly growing sinkhole that had developed over the southern periphery of the mine and that the integrity of the mine could no longer be assured and it was unsuited for continued crude oil storage. Pursuant to NEPA, DOE prepared an Environmental Assessment to assess the potential environmental consequences of decommission of the Weeks Island SPR site (DOE 1995a) which resulted in the issuance of a Finding of No Significant Impact.

Decommissioning activities at an SPR facility and associated potential environmental impacts would depend on the future use of the facility. If the site were destined for continued use as an oil storage facility, activities might consist of little more than a change in ownership. Oil in storage could be included in the sale or withdrawn and moved to another SPR site. If, however, DOE were to close the facility entirely, extensive closure activities could be necessary. Under this scenario, crude oil would be removed from the caverns by displacement with water, which eventually would form brine in the caverns. Cavern wells would be plugged with concrete to prevent brine leakage through the casing. All above ground facilities, such as buildings, pumps, site electrical substations, and RWI structures would be demolished or removed from the site. Brine ponds would be closed. Crude oil pipelines would be emptied, cleaned, and capped. Underground pipelines likely would be left in place. Pipeline water crossings would be abandoned, but pipelines crossing waterways would be modified to minimize the chance that they could become future hazards to navigation. Such actions might include filling the pipelines with cement or filling them with a substance to encourage oxidation and decomposition. Electric power lines would be removed. Finally, the site would be revegetated with native species.

At this time DOE has no known or planned timetable for such post-operational decommission activities at existing expansion sites or proposed new sites, and future decommission remains distant. Unlike the Weeks SPR storage facility, which was a converted salt pillar mine, only solution mined caverns specially constructed for crude oil storage are currently used at SPR facilities, and these caverns have intrinsic geological stability. Hence future decommissioning would likely occur as a currently unforecastable economic or strategic decision. Also, DOE has designed storage cavern construction to sustain a minimum of five cycles of drawdown and fill. DOE has determined, however, that 10 or more cycles generally can be sustained under the current design standards. Also, in the four decades of SPR experience, relatively few complete cycles have occurred. Thus, in the reasonably foreseeable future, proposed new caverns are unlikely to be decommissioned due to completion of their useful life.

Because the ranges of possible decommissioning activities and associated environmental impacts is so broad, and these activities remain remote in time, no further discussion is included in this draft EIS. If any future decommissioning of a SPR storage facility did become warranted, site-specific Environmental Assessments or EISs would then be undertaken as required under NEPA, and the potential environmental, socioeconomic, and other impacts to the SPR site would be evaluated.

## 2.4 POTENTIAL NEW SITES AND ASSOCIATED INFRASTRUCTURE

This section describes the proposed action at each of the proposed sites. It describes the proposed new sites and associated infrastructure in alphabetical order and then the proposed expansion sites in alphabetical order. Table 2.4-1 presents key information for each of the proposed alternatives.

Following are some important notes about the data shown in table 2.4-1:

- The number of acres listed for each storage site represents the area of the site plus the area of a 300-foot (91-meter) buffer zone around the site.
- Lengths of individual crude oil pipelines, electric power lines, and roads are shown separated by a + sign. The totals shown are an aggregate of these individual lengths.
- Values shown for new ROWs represent the total lengths of new ROWs that would be created for oil or brine pipelines, electric power lines, and roads. These ROWs often would be shared.
- Values shown for expanded or existing ROWs represent the total lengths of existing ROWs and existing ROWs that would be expanded, used for oil or brine pipelines, electric power lines, and roads. These ROWs often would be shared.
- Because they are included collectively in several of the alternatives, values for the expansion sites Bayou Choctaw, Big Hill, and West Hackberry are first listed separately and subsequently as a single aggregated total with the heading “3 Expansion Sites.”
- Similarly, when being included together in an alternative, values for the expansion sites Bayou Choctaw and Big Hill are first shown separately and subsequently as a single aggregated total with the heading “2 Expansion Sites.”

### 2.4.1 Bruinsburg Storage Site

The Bruinsburg salt dome is located in Claiborne County, MS, 10 miles (16 kilometers) west of the town of Port Gibson (see figure 2.4.1-1) and 40 miles (64 kilometers) southwest of the town of Vicksburg. This proposed new site would consist of 16 new caverns with a combined oil storage capacity of up to 160 MMBD. The site encompasses a cypress swamp, cotton fields, and an overlooking bluff. The maximum drawdown rate would be 1.0 MMBD. A proposed co-development of Clovelly and Bruinsburg is found in section 2.4.4.

The Bruinsburg site would encompass approximately 266 acres (108 hectares) that includes an active cotton farm and forested areas. Developing this new SPR facility would require constructing 16 new, 10-MMB-capacity caverns, as illustrated in figure 2.4.1-2. In addition, a water pumping system for cavern solution mining and oil drawdown; a brine settling and disposal system for cavern solution mining and oil fill; an oil pumping and measurement system for oil storage and distribution; administration, control, and maintenance buildings; and fire protection and physical security systems would be built. The location of the new caverns would be within the 100-year floodplain, whereas the facilities would be located outside of the 100-year floodplain on a bluff overlooking the caverns. A site access road from

## Table 2.4-1: Key Details of the Alternatives

| Alternative | Increased Storage Capacity MMB | No. of Caverns | Storage Site and Buffer | Pipelines (Miles per Pipeline) | | | Power Lines | Roads | New ROWs[b] | Expanded Existing ROWs[b] | Other Facilities | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Acres | Crude Oil | Water | Brine | Miles | Miles | Miles | Miles | Types | Acres |
| **Bruinsburg** | 160 | 16 | 365 | 39 and 109 | 4 | 14 | 11, 1, 4, 7, and 6 | 1 and 11 | 131 | 58 | IW, T, RWI | 215 |
| 3 Expansion sites | 115 | 10 and 3[a] | 287 | 23 | 0 | 2 | 0 | 2 | 2 | 24 | IW pads | 96 |
| *Bayou Choctaw* | *20* | *2* | *0* | *0* | *0* | *1* | *0* | *1* | *1* | *0* | *IW pads* | *96* |
| *Big Hill* | *80* | *8* | *206* | *23* | *0* | *1* | *0* | *0* | *0* | *24* | *None* | *0* |
| *West Hackberry* | *15* | *3[a]* | *81* | *0* | *0* | *0* | *0* | *1* | *1* | *0* | *None* | *0* |
| Total | 275 | 29 | 652 | 171 | 4 | 16 | 29 | 15 | 133 | 82 | | 311 |
| **Bruinsburg** | 160 | 16 | 365 | 39 and 109 | 4 | 14 | 11, 1, 4, 7, and 6 | 1 and 11 | 131 | 58 | IW, T, RWI | 215 |
| 2 Expansion sites | 116 | 8 and 2 | 206 | 23 | 0 | 2 | 0 | 1 | 1 | 24 | IW pads | 96 |
| *Bayou Choctaw* | *20* | *2* | *0* | *0* | *0* | *1* | *0* | *1* | *1* | *0* | *IW pads* | *96* |
| *Big Hill* | *96* | *8* | *206* | *23* | *0* | *1* | *0* | *0* | *0* | *24* | *None* | *0* |
| Total | 276 | 26 | 571 | 171 | 4 | 16 | 29 | 13 | 132 | 82 | | 311 |
| **Chacahoula** | 160 | 16 | 320 | 21 and 54 | 18 | 41 and 17[c] | 10, 15, and 5 | 4 | 64 | 86 | RWI | 1 |
| 3 Expansion sites | 115 | 10 and 3[a] | 287 | 23 | 0 | 2 | 0 | 2 | 2 | 24 | IW, T, RWI | 96 |
| Total | 275 | 29 | 607 | 98 | 18 | 60 | 30 | 6 | 66 | 110 | | 97 |
| **Chacahoula** | 160 | 16 | 440 | 21 and 54 | 18 | 41 and 17[c] | 10, 15, and 5 | 4 | 64 | 86 | RWI | 1 |
| 2 Expansion sites | 116 | 8 and 2 | 206 | 23 | 0 | 2 | 0 | 1 | 1 | 24 | IW Pads | 96 |
| Total | 276 | 26 | 646 | 98 | 18 | 60 | 30 | 5 | 65 | 101 | | 97 |
| **Clovelly** | 120 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | RWI/Off Site Fac | 5 |
| 3 Expansion sites | 153 | 11 and 4[a] | 289 | 23 | 0 | 2 | 0 | 2 | 2 | 24 | | 96 |
| *Bayou Choctaw* | *30* | *2 and 1[a]* | *2* | *0* | *0* | *1* | *0* | *1* | *1* | *0* | *IW Pads* | *96* |
| *Big Hill* | *108* | *9* | 206 | *23* | *0* | *1* | *0* | *0* | *0* | *24* | *None* | *0* |
| *West Hackberry* | *15* | *3[a]* | *81* | *0* | *0* | *0* | *0* | *1* | *1* | *0* | *None* | *0* |
| Total | 273 | 31 | 289 | 23 | 0 | 2 | 0 | 2 | 2 | 24 | | 101 |
| **Clovelly 80 MMB-Bruinsburg 80 MMB** | 160 | 20 | 254 | 86 | 4 | 8 | 11, 1, 4, 7, and 6 | 6 | 65 | 40 | IW, T, RWI. Off Site Fac | 113 |
| *Bruinsburg (80)* | *80* | *8* | *254* | *32 and 54* | *4* | *8* | *11, 1, 4, 7, and 6* | *1 and 5* | *65* | *40* | IW, T, RWI | *108* |
| *Clovelly (80)* | *80* | *12* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *RWI/Off Site Fac* | *5* |
| 3 Expansion sites | 115 | 10 and 3[a] | 287 | 23 | 0 | 2 | 0 | 2 | 2 | 24 | IW Pads | 96 |
| *Bayou Choctaw* | 20 | *2* | *0* | *0* | *0* | *1* | *0* | *1* | *1* | *0* | *IW pads* | *96* |

## Table 2.4-1: Key Details of the Alternatives

| Alternative | Increased Storage Capacity | No. of Caverns | Storage Site and Buffer | Pipelines (Miles per Pipeline) | | | Power Lines | Roads | New ROWs[b] | Expanded Existing ROWs[b] | Other Facilities | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MMB | | Acres | Crude Oil | Water | Brine | Miles | Miles | Miles | Miles | Types | Acres |
| *Big Hill* | 80 | *8* | *206* | *23* | *0* | *1* | *0* | *0* | *0* | *24* | *None* | *0* |
| *West Hackberry* | 15 | *3[a]* | *81* | *0* | *0* | *0* | *0* | *1* | *1* | *0* | *None* | *0* |
| Total | 275 | 33 | 541 | 109 | 4 | 10 | 29 | 8 | 67 | 64 | | 209 |
| | | | | | | | | | | | | |
| **Clovelly 80 MMB-Bruinsburg 80 MMB** | 160 | 20 | 254 | 86 | 4 | 8 | 11, 1, 4, 7, and 6 | 6 | 65 | 40 | IW, T, RWI | 113 |
| 2 Expansion sites | 116 | 8 and 2 | 206 | 23 | 0 | 2 | 0 | 1 | 1 | 24 | IW Pads | 96 |
| *Bayou Choctaw* | *20* | *2* | *0* | *0* | *0* | *1* | *0* | *1* | *1* | *0* | *IW pads* | *96* |
| *Big Hill* | *96* | *8* | *206* | *23* | *0* | *1* | *0* | *0* | *0* | *24* | *None* | *0* |
| Total | 276 | 26 | 460 | 109 | 4 | 10 | 29 | 7 | 66 | 64 | | 209 |
| **Clovelly 90 MMB-Bruinsburg 80 MMB** | 170 | 20 | 254 | 86 | 4 | 8 | 11, 1, 4, 7, and 6 | 6 | 65 | 40 | IW, T, RWI. Off Site Fac | 113 |
| *Bruinsburg (80)* | *80* | *8* | *254* | *32 and 54* | *4* | *8* | *11, 1, 4, 7, and 6* | *1 and 5* | *65* | *40* | IW, T, RWI | *108* |
| *Clovelly (90)* | *90* | *12* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *RWI/Off Site Fac* | *5* |
| 3 Expansion sites | 117 | 8 and 3[a] | 287 | 23 | 0 | 2 | 0 | 2 | 2 | 24 | IW pads | 96 |
| *Bayou Choctaw* | *20* | *2* | *0* | *0* | *0* | *1* | *0* | *1* | *1* | *0* | *IW pads* | *96* |
| *Big Hill* | *72* | 6 | *206* | *23* | *0* | *1* | *0* | *0* | *0* | *24* | *None* | *0* |
| *West Hackberry* | *15* | *3[a]* | *81* | *0* | *0* | *0* | *0* | *1* | *1* | *0* | *None* | *0* |
| Total | 277 | 31 | 541 | 109 | 4 | 10 | 29 | 8 | 67 | 64 | | 209 |
| **Clovelly 90 MMB-Bruinsburg 80 MMB** | 170 | 20 | 254 | 86 | 4 | 8 | 11, 1, 4, 7, and 6 | 6 | 65 | 40 | IW, T, RWI | 113 |
| *Bruinsburg (80)* | 80 | 8 | *254* | *32 and 54* | *4* | 8 | *11, 1, 4, 7, and 6* | 1 and 5 | 65 | *40* | IW, T, RWI | *108* |
| *Clovelly (90)* | 90 | 12 | 0 | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *RWI/Off Site Fac* | *5* |

## Table 2.4-1: Key Details of the Alternatives

| Alternative | Increased Storage Capacity MMB | No. of Caverns | Storage Site and Buffer Acres | Pipelines (Miles per Pipeline) Crude Oil | Water | Brine | Power Lines Miles | Roads Miles | New ROWs[b] Miles | Expanded Existing ROWs[b] Miles | Other Facilities Types | Acres |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Expansion sites | 104 | 7 and 2 | 206 | 23 | 0 | 2 | 0 | 1 | 1 | 24 | IW pads | 96 |
| *Bayou Choctaw* | *20* | *2* | *0* | *0* | *0* | *1* | *0* | *1* | *1* | *0* | *IW pads* | *96* |
| *Big Hill* | *84* | *7* | *206* | *23* | *0* | *1* | *0* | *0* | *0* | *24* | *None* | *0* |
| Total | 274 | 29 | 460 | 109 | 4 | 10 | 29 | 7 | 66 | 64 | | 209 |
| **Richton** | 160 | 16 | 387 | 88 and 116 | 10 | 87 and 13[c] | 11 | 2 | 144 | 72 | T, RWI | 131 |
| 3 Expansion sites | 115 | 10 and 3[a] | 287 | 23 | 0 | 2 | 0 | 2 | 2 | 24 | IW Pads | 96 |
| Total | 275 | 29 | 634 | 227 | 10 | 102 | 11 | 4 | 146 | 96 | | 227 |
| **Richton** | 160 | 16 | 347 | 88 and 116 | 10 | 87 and 13[c] | 11 | 2 | 144 | 72 | T, RWI | 131 |
| 2 Expansion sites | 116 | 8 and 2 | 206 | 23 | 0 | 2 | 0 | 1 | 1 | 24 | IW Pads | 96 |
| Total | 276 | 26 | 553 | 227 | 10 | 102 | 11 | 3 | 145 | 96 | | 227 |
| **Stratton Ridge** | 160 | 16 | 371 | 37 and 3 | 6 | 7 and 4[c] | 6 | 1 | 17 | 37 | T, RWI | 40 |
| 3 Expansion sites | 115 | 10 and 3[a] | 287 | 23 | 0 | 2 | 0 | 2 | 2 | 24 | IW Pads | 96 |
| Total | 275 | 29 | 678 | 60 | 6 | 13 | 6 | 3 | 19 | 61 | | 136 |
| **Stratton Ridge** | 160 | 16 | 371 | 37 and 3 | 6 | 7 and 4[c] | 6 | 1 | 17 | 37 | T, RWI | 40 |
| 2 Expansion sites | 116 | 8 and 2 | 206 | 23 | 0 | 2 | 0 | 1 | 1 | 24 | IW Pads | 96 |
| Total | 276 | 26 | 577 | 60 | 6 | 13 | 6 | 2 | 18 | 61 | | 136 |

1 mile = 1.61 kilometers; 1 acre = .0405 hectares

Notes:

[a] Acquired cavern
[b] The sum of the mileage of individual pipelines, power lines, and roads for expanded existing ROWs and new ROWs may not add up to the total mileage of the individual pipelines for a site because some pipelines, roads, and power lines share the same corridor
[c] Offshore

IW = injection wells; T = terminal(s)

Route 552 would be built, of which 1,200 feet (366 meters) would be new, and the remainder would be a refurbished road.

A security buffer surrounding the site would be created by clearing 99 acres (40 hectares) 300 feet (91 meters) beyond a security fenceline for line-of-sight surveillance. The security buffer area would be cleared of undergrowth, scrub, shrub, and any trees, and would be managed as an open area. To do so, DOE may purchase additional land or easements from owners of abutting lands.

Raw water for solution mining at the Bruinsburg site would be drawn from the Mississippi River through a 42-inch (107-centimeter) pipeline that would run 4 miles (6.6 kilometers) south-southwest from the main site. The RWI pipeline is illustrated in figure 2.4.1-1. An RWI structure of 0.54 acres (0.22 hectares) on a construction footprint of 1.07 acres (0.43 hectares), which would be constructed at the point where the pipeline meets the Mississippi River, would house a set of 2,500-horsepower intake pumps. Another set of 2,500-horsepower RWI pumps with a system capacity of 1.2 MMBD would be installed at the Bruinsburg site. An existing road would be refurbished to provide access to the RWI.

Of the new proposed sites, Bruinsburg would be the only site to use injection wells as its method of brine disposal. A 48- to 16-inch (122- to 41-centimeter), 14-mile (22-kilometer), brine disposal pipeline would transport the brine into underground injection wells located along the proposed Baton Rouge crude oil pipeline ROW. Sixty brine disposal wells would be spaced at 1,000-foot (300-meter) intervals along the ROW, but only 40 wells would operate at any one time. Twenty wells would be on standby or down for routine maintenance. An area of 230 feet by 230 feet (70 meters by 70 meters) would be cleared and fenced for each brine disposal well. The brine settling and disposal system would have a maximum capacity of 1.2 MMBD. An 11-mile (18-kilometer) road also would be constructed along the proposed brine pipeline to facilitate brine well construction and maintenance activities.

Crude oil would be transported to and from the storage site through two pipelines, as illustrated in figure 2.4.1-3. The first is a 30-inch (76-centimeter), 39-mile (62-kilometer) pipeline to the Capline Pipeline pump station at Peetsville, MS and a new 1.6 MMB storage terminal/tank farm that would be built on a 65-acre (26-hectare) site there. The Peetsville 65-acre (26-hectare) site would contain four 0.4 MMB oil storage tanks, support facilities, and an electrical substation (see figure 2.4.1-4). Electrical power to the substation would be provided from the abutting Peetsville pump station. Figure 2.4.1-4 illustrates the proposed facilities at Peetsville. The oil pumping and measurement system for oil storage and distribution would have a drawdown capacity of 0.5 MMBD from the caverns to the tank farm and 1.0 MMBD to the Capline system. The second pipeline is a 36-inch (91-centimeter), 109-mile (176-kilometer) pipeline to a terminal/tank farm that would be built on a 75-acre (30-hectare) site at Anchorage, LA. A tank farm similar to the Peetsville tank farm would be built connected by a 0.2-mile (0.3-kilometer) pipeline to the Placid refinery and a 0.8-mile (1.3-kilometer) pipeline to the nearby Exxon Mobil facility (see figure 2.4.1-5). The pipeline to the Placid refinery would provide DOE access to the Placid refinery marine terminal on the Mississippi River. Figure 2.4.1-5 illustrates the proposed facilities at Anchorage.

Two 138-kilovolt power lines would be built to a substation at the site, a 5-mile (9-kilometer) line to Vicksburg Entergy's Grand Gulf substation, and a 7-mile (12-kilometer) line to the Port Gibson west side substation, as illustrated in figure 2.4.1-1. Each power line would require a 100-foot (30-meter) ROW. Two parallel 34.5-kilovolt power lines from the site substation to the RWI would be constructed along the 4-mile (6.5-kilometer) corridor of the raw water pipeline, as illustrated in figure 2.4.1-1. The ROW would be 60 feet (18 meters) wide. Two parallel 7.5 kilovolt power lines would be constructed from the RWI to run 0.6 miles (1.0 kilometers) east to the brine disposal pipeline and then along the 11 miles (18 kilometers) of the brine disposal pipeline to power the injection wells.

### 2.4.2 Chacahoula Storage Site

The Chacahoula salt dome site is located 40 miles (64 kilometers) north of the Gulf of Mexico, in northwest Lafourche Parish, southwest of Thibodaux, LA (see figure 2.4.2-1). This proposed new site would consist of 16 new caverns with a total capacity of 160 MMB. The maximum drawdown rate would be 1.2 MMBD.

The Chacahoula site, which would encompass approximately 227 acres (92 hectares), lies largely under water in wetlands. A security fence and road would be built 45 feet (14 meters) inside the property line on top of a **berm**. A security buffer zone would be cleared extending 300 feet (91 meters) from the fence and would comprise an area of approximately 93 acres (38 hectares). The land within the property line would be fully cleared in order to improve visibility and line-of-sight. The security buffer area would be cleared of any undergrowth, scrub, and any trees, and would be managed as an open area.

The area is largely undeveloped except for three brine caverns that have been developed by the Texas Brine Company in the south-central part of the 1,700-acre (690-hectare) Chacahoula salt dome and gas drillings on the south and northeast sides of the dome. The SPR storage site also would require constructing 16 new, 10-MMB capacity caverns, 8 raw water injection pumps, 4 brine injection pumps, 3 oil injection pumps, and numerous onsite buildings. Within the Chacahoula site, approximately 120 acres (49 hectares) would be filled in for the onsite facilities, cavern pads, and security fence and roads. The remaining area would be managed as an open water or emergent wetland. The wetlands between well pads would not be filled. Wetland areas within the site would remain interconnected with those outside the site via culverts. Infrastructure such as buildings and disposal ponds would require clearing and filling. As illustrated in figure 2.4.2-2, the caverns would be arranged in four rows of four caverns each in the western portion of the salt dome. At the storage site, DOE would construct a pig launcher and receiver for the pipeline, cavern oil distribution piping, and three 1,750-horsepower oil injection pumps. In addition, a crude oil storage tank may be built to store oil for use during cavern solution mining and maintenance operations. A 1.5 mile (2.4 kilometer) access road would be constructed from the site to Route 309. Construction on the site also would include buildings, security systems, and other surface features that are described in section 2.3.5.

The raw water used for cavern solution mining and drawdown would be obtained using four 2,500-horsepower pumps from a new RWI system on the Intracoastal Waterway (ICW) approximately 10 miles (16 kilometers) south of the project site. The new RWI structure of 0.54 acres (0.22 hectares), on a construction footprint of 1.07 acres (0.43 hectares), would be connected to the storage site through a 42-inch (107-centimeter), 10-mile (16-kilometer) raw water pipeline. The majority of the RWI pipeline would parallel the proposed brine disposal pipeline. A 2.4 mile (4 kilometer) access road would be constructed from the RWI to highway 90. A map of the pipeline routes appear in figure 2.4.2-3. An onsite water distribution system would carry the water to eight 3,500-horsepower raw water injection pumps.

A new brine disposal system also would be constructed. Solution mining of the storage caverns would generate brine at a maximum rate of 1.2 MMBD. Brine would be disposed of through a 58-mile (93-kilometer), 48-inch (122-centimeter), pipeline to a diffuser offshore in the Gulf of Mexico (see figure 2.4.2-3), coordinates 28°56’1”N and 91°4’56”W. During oil fill, brine would be generated at a maximum rate of 225 MBD. The proposed pipeline would run approximately 17 miles (28 kilometers) offshore to a depth of 30 feet (9 meters). The ROW would consist of a 150-foot (46-meter) wide construction and a 50-foot (15-meter) wide permanent easement. Brine collection piping from each cavern, a brine pond system to remove any anhydrites and residual oil, and five new 1,000-horsepower brine booster pumps would be constructed onsite to complete the brine disposal system. Seven new 2,500-horsepower injection pumps also would be used to pump raw water into the caverns during oil drawdown.

Crude oil would be transported to and from the storage site through a 21-mile (34-kilometer), 48-inch (122-centimeter) pipeline to the St. James terminal on the Mississippi River and a 54-mile (87-kilometer), 42-inch (107-centimeter) pipeline to the Louisiana Offshore Oil Port (LOOP) terminal at Clovelly. The pipeline to the terminal would parallel the existing crude oil pipeline that runs to the Capline terminal, and it would share the ROW with the RWI pipeline. The pipeline to LOOP would follow the existing Shell-Texaco pipeline ROW (see figure 2.4.2-3).

Two 230-kilovolt power lines would be built to a substation at the site, one 10-mile (15-kilometer) power line from the Thibodaux substation on the Entergy 230-kilovolt power line and an 18-mile (26-kilometer) power line from the Terrebonne substation on the Entergy 230-kilovolt power line, as illustrated in figure 2.4.2-1. Each power line would require a 100-foot (30-meter) ROW, except for the last 3 miles (4 kilometers) where the two lines would run west in parallel to the site substation and require a 200-foot (60-meter) ROW. Two parallel 115-kilovolt power lines from a connecting point on Entergy's 115-kilovolt, 5-mile (7-kilometer) power line approximately 5 miles (7 kilometers) north of the RWI would be constructed along the corridor of the raw water pipeline to the RWI. The ROW requirement would be 150 feet (46 meters).

### 2.4.3 Clovelly Storage Site

> The **Louisiana Offshore Oil Port (LOOP)** is a private deepwater port operating off the coast of Louisiana. It is run by Louisiana Offshore Oil Port, Inc., a consortium of oil and gas producers. The onshore Clovelly dome storage system is a component of LOOP; it is not part of the existing SPR.

The Clovelly site would be located east of Galliano, LA, in Lafourche Parish at the site of the LOOP Clovelly dome storage facility, as shown in figure 2.4.3-1. Co-located with LOOP's existing storage caverns, DOE would construct sixteen 7.5-MMB caverns for a total capacity of 120 MMB (see figure 2.4.3-2). Except for a new RWI structure, the facility would use LOOP's existing infrastructure for cavern solution mining, brine disposal, and electrical power distribution. The drawdown rate would be up to 1.1 MMBD. A security buffer area would not be developed. However, DOE would install a perimeter fence around the caverns and supporting infrastructure. DOE also would construct an off-dome facility 4 miles (6 kilometers) to the west of the storage site along the facility access road (see figure 2.4.3-3). This facility would consist of a new office and control-room building, maintenance buildings, laboratory, and guardhouse complete with a security system as described in section 2.3.5. The description of a proposed co-development of Clovelly (80 or 90 MMB) with Bruinsburg (80 MMB) to reach 160 or 170 MMB of new storage capacity is described in section 2.4.4.

The LOOP complex is designed to accept crude oil from incoming supertankers capable of transporting approximately 2 MMB of oil per ship. The complex comprises a marine terminal located 20 miles (32 kilometers) offshore in the Gulf of Mexico and the onshore Clovelly dome storage facility. At its peak, this facility accepts 12 percent of the crude oil imported into the United States. When oil is accepted at the offshore marine terminal, it is unloaded from supertankers and transferred through pipelines at high flow rates to the Clovelly dome storage facility. Oil stored there is eventually delivered to the St. James terminal or to the Capline distribution complex.

Located in open water wetlands near the coast, LOOP's Clovelly dome storage facility can store up to 48 MMB of oil in eight salt dome caverns (see figure 2.4.3-2). The onsite caverns, wells, platforms, and pumping systems are accessible by barge. The control, office, and maintenance facilities are located west of the storage site. LOOP connects to an extensive crude oil distribution network, which would supply the crude oil for storage in the proposed SPR caverns. The brine disposal system includes a 220-acre (89-hectare), 28–MMB-capacity brine pond, and a 30-inch (76-centimeter) offshore diffuser pipeline with the capacity to dispose of 0.5 MMB of brine a day in the Gulf of Mexico.

To operate a new SPR storage facility at Clovelly, DOE would construct 16 caverns with a solution-mined capacity of 7.5 MMB each at a depth of 3,500 to 6,000 feet (1,100 to 1,800 meters) and an off-dome facility (see figure 2.4.3-3). Existing LOOP caverns are at a depth of 1,500 to 3,000 feet (460 to 900 meters) below ground surface. The caverns would be arranged in rows that run roughly southwest to northeast in line with the existing LOOP storage caverns. The layout of the caverns is illustrated in figure 2.4.3-2.

No additional pipelines would need to be constructed as part of the crude oil distribution system, except for internal connection piping; however, four additional, 2,000-horsepower oil injection pumps would be needed onsite to meet increased cavern fill-rate requirements.

The new SPR facility would tie into the existing brine disposal system. DOE would use the existing 28-mile (45-kilometer), 30-inch (76-centimeter) brine disposal pipeline and brine pond, but it would install three new, 2,000-horsepower brine pumps. New brine collection piping from each cavern to the LOOP brine disposal platform also would be constructed. When feasible, brine from the Clovelly brine reservoir would be used for draw-down events rather than from the DOE RWI.

DOE would construct a new 1.2 MMB capacity RWI and a 0.1 mile (0.23 kilometers) access road approximately 0.1 miles (0.02 kilometers) southwest of the proposed and existing caverns on a construction footprint of 1.07 acres (0.43 hectares). The new RWI would ensure that DOE would have independent capacity for a draw down event. DOE would install four additional, 2,500-horsepower fresh water intake pumps at the RWI structure and six additional, 3,500-horsepower raw water injection pumps at the storage site. A 24- to 42-inch (61- to 107-centimeter) onsite raw water pipeline and cavern headers would be installed to connect the new caverns to the new system.

No additional power lines would need to be built at the site to supplement the existing 115-kilovolt substation which has redundant capacity. Two new cable lines would be needed at the existing site substation with no ROW requirements. Two 4.16-kilovolt cable lines from the site's switchgear would be required to power the RWI pumps. There would be no ROW requirements.

### 2.4.4 Clovelly and Bruinsburg Storage Sites

Under the Clovelly 80 MMB and Bruinsburg 80 MMB or the Clovelly 90 MMB and Bruinsburg 80 MMB alternatives, DOE would develop 80 MMB of storage at Bruinsburg and 80 or 90 MMB of storage at Clovelly, totaling 160 or 170 MMB. The development of the Clovelly site would be similar to the 120 MMB option, except that only 12 caverns of 6.7 MMB or 7.5 MMB would be constructed to achieve a total capacity of 80 or 90 MMB (see figure 2.4.4-1). The remaining elements associated with the 120 MMB Clovelly option would be associated with the 80 or 90 MMB development at Clovelly. The development of the 80 MMB Bruinsburg site would be similar to the 160 MMB option, with the exception of 8 rather than 16 10-MMB caverns would be built, only 30 brine injection wells would be installed, and a smaller (0.28 acres [0.11 hectares]) RWI would be constructed with a construction footprint of 0.47 acres (0.19 hectares) (see figure 2.4.4-2 and figure 2.4.4-3).

The crude oil pipeline from Bruinsburg to Anchorage, LA, would not be developed, nor would the pipeline be built to the Peetsville pumping station. A new 30-inch (76-centimeter) and 16-inch (41-centimeter) crude oil pipelines would be constructed to run 19 miles (30 kilometers) from the Bruinsburg site to a split, where the 30-inch (76-centimeter) pipeline would run another 35 miles (57 kilometers) to Jackson, MS, and the 16-inch (41-centimeter) pipeline would run another 13 miles (21 kilometers) to Vicksburg, MS, as illustrated in figure 2.4.4-4. The crude oil pipelines would connect to the Vicksburg Entergy system to use existing facilities and to the existing Capline Jackson Pump Station. At Jackson, a 71-acre (29-hectare) terminal/tank farm would be built containing four 0.4-MMB oil storage tanks, support facilities, and an electrical substation.  Figure 2.4.4-5 illustrates the proposed facilities at Jackson.

At the Bruinsburg SPR storage site, a 36-inch (91-centimeter) 8-mile (13-kilometer), rather than a 14-mile (22-kilometer), brine disposal pipeline would be built to transport the brine into underground injection wells.  Thirty brine disposal wells would be spaced at 1,000-foot (300-meter) intervals along the ROW, but only 20 wells would operate at any one time.  Ten wells would be on standby or down for routine maintenance.  For information regarding the specifics of development at these two sites (see sections 2.4.3 and 2.4.1).  A 5-mile (9-kilometer) road rather than an 11-mile (18-kilometer) road would be constructed along the brine disposal pipeline for brine well construction and maintenance.  Five miles (9 kilometers) of parallel 7.5 kilovolt power lines would extend along the brine disposal pipeline to power the injection wells.

### 2.4.5 Richton Storage Site

The Richton salt dome is located in northeastern Perry County, MS, 18 miles (29 kilometers) east of Hattiesburg and 3 miles (4.8 kilometers) northwest of the town of Richton.  This proposed new site would consist of 16 new caverns with a combined capacity of up to 160 MMB.  The maximum drawdown rate would be 1.1 MMBD.

The Richton site would encompass approximately 238 acres (96 hectares) and would include a new 0.2 mile (0.3 kilometer) access road from Route 42.  In addition, a surrounding security buffer would be created by clearing an area of 109 acres (44 hectares) 300 feet (91 meters) beyond an outer security fenceline for line-of-sight surveillance (see figure 2.4.5-1).  The area would be cleared of undergrowth, scrub, shrub, and any trees, and would be managed as an open field.  To do this, DOE might purchase additional land or make agreements with owners of abutting lands.  DOE would construct 16 new, 10-MMB caverns, 7 raw water injection pumps, 4 brine injection pumps, 2 brine ponds, 5 oil injection pumps, and numerous onsite buildings.  The caverns would be arranged in three rows (two rows of five and one row of six), extending south to north.  This proposed layout appears in figure 2.4.5-2.

Raw water would be drawn from the Leaf River through a 42-inch (107-centimeter) pipeline that would traverse approximately 10 miles (16 kilometers).  The pipeline would run due south from the proposed site, across the Plantation Pipeline ROW, to a point on the river.  A RWI would be constructed on a 1.07-acre (0.44-hectare) site and would house four 2,500-horsepower raw water injection pumps and auxiliary structures.  Another seven 2,500-horsepower RWI pumps would be installed at the Richton site.  The raw water pipeline would be co-located for about 6 miles (9 kilometers) of the ROW with the brine disposal pipeline and the crude oil fill pipeline.  A 2.3 mile (3.7 kilometer) access road would be constructed from Old Augusta Road to the RWI structure.  The RWI pipeline is illustrated in figure 2.4.5-3.

DOE would build two dual-purpose brine and crude oil pipelines to Pascagoula (see figure 2.4.5-3).  Each pipeline would be used to transport brine and crude oil for specific periods of construction and operation.  During construction the 88-mile (142-kilometer) 16-inch (41-centimeter) pipeline would be used to transport crude oil to the site to provide blanket oil for cavern development, and the 48-inch (122-centimeter) 87-mile (140-kilometer) pipeline would be used to transport brine from the site to Pascagoula and then out to the Gulf of Mexico along a 48-inch (112-centimeter) 13-mile (20-kilometer) offshore pipeline to the brine diffuser.  The coordinates of the offshore diffuser would be 30°09’06”N and 88°33’39”W.  Once construction of all the caverns had been completed, the 16-inch (41-centimeter) pipeline would transport the smaller volumes of brine associated with operation (cavern filling) to the 48-inch (122-centimeter) offshore brine pipeline and the 48-inch (122-centimeter) pipeline would transport crude oil to and from the site.

Crude oil also would be transported to and from the Richton SPR facility through a 36-inch (91-centimeter), 116-mile (186-kilometer) pipeline to the Capline Complex in Liberty, as illustrated in figure 2.4.5-3. Near this connection, DOE would construct four 0.4-MMB oil storage tanks, support facilities, and an electrical substation, which would require a site of approximately 66 acres (27 hectares) (see figure 2.4.5-4). At the midpoint of the pipeline route, DOE would construct a midpoint pump station consisting of three, 2,000-horsepower, diesel-powered pumping units on a 1.7-acre (0.7-hectare) site.

A new DOE-owned and -operated terminal/tank farm would be built adjacent to an existing dock that DOE would acquire and operate. These facilities would be located on the Naval Station Pascagoula Base Realignment and Closure site located on the north side of man-made Singing River Island, which lies just south of the main port of Pascagoula. This site of 63 acres (26 hectares) would contain four 0.4-MMB oil storage tanks, support facilities, and an electrical substation. The dock would be refurbished and the only in-water construction would be the installation of pilings. Figure 2.4.5-5 illustrates the proposed facilities.

Two 138-kilovolt power lines would be built to a substation at the site, from local utility lines at a point 11 miles (18 kilometers) south. The parallel power line would require a 150-foot (46-meter) ROW. These power lines would run approximately 1 mile (1.6 kilometers) north to pass directly adjacent to the RWI, and then share the ROW with the RWI intake pipeline for the remaining 10 miles (16 kilometers) to the site. A short 0.05-mile (0.08-kilometer) connection would be made to the RWI substation from these power lines.

### 2.4.6 Stratton Ridge Storage Site

The Stratton Ridge salt dome is located in Brazoria County, TX, 3 miles (4.8 kilometers) east of Clute and Lake Jackson and 6 miles (9.7 kilometers) north of Freeport, as illustrated in figure 2.4.6-1. This proposed new site would consist of 16 new caverns with a combined capacity of up to 160 MMB. The drawdown rate would be up to 1.0 MMBD.

The proposed site encompasses approximately 269 acres (109 hectares) in the south-central portion of the salt dome. In addition, a surrounding security buffer would be created of 102 acres (41 hectares) by clearing an area 300 feet (91 meters) beyond an outer security fenceline for line-of-sight surveillance. The land would be cleared of undergrowth, scrub, shrub, and any trees, and be managed as an open field. To do this, DOE might purchase additional land or make agreements with owners of abutting lands. Although there is some cattle ranching in the vicinity of Stratton Ridge, the economy of the area centers on the petrochemical industry. Fifty-seven brine and crude oil storage caverns with an approximate total volume of about 150 MMB are currently operated at the Stratton Ridge salt dome by Dow, British Petroleum, Conoco, and Occidental.

DOE would construct 16 new, 10-MMB-capacity caverns, 7 raw water injection pumps, 4 brine injection pumps, 2 brine ponds, 5 oil injection pumps, and numerous onsite buildings. DOE would construct a 0.7 mile (1.1 kilometer) site access road from Route 523 to the site. Offsite construction would include an RWI structure of 0.54 acres (0.22 hectares) on a construction footprint of 1.07 acres (0.43 hectares) on the ICW. The layout of the caverns appears in figure 2.4.6-2. A 0.7-mile (1-kilometer) access road would be built.

The RWI structure would be located 8 miles (13 kilometers) southwest of the site on the south side of the ICW, and it would contain four 2,500-horsepower raw water lift pumps. DOE would construct a 0.25 mile (0.4 kilometer) access road to the RWI structure. A 6-mile (10-kilometer) 42-inch (107-centimeter) raw water pipeline would be used to transport raw water from the ICW to the site for cavern solution mining and oil drawdown. The pipeline would have a throughput capacity sufficient to solution-mine caverns at a rate of 1.0 MMBD, and it would provide adequate water for drawdown.

A 10-mile (16-kilometer), 48-inch (122-centimeter) brine disposal pipeline would carry the brine to a depth of 30 feet (9 meters) into the Gulf of Mexico (see figure 2.4.6-3). Diffuser ports would be located on the final 4,000 feet (1,200 meters) of the pipeline. The 7-mile (11-kilometer) onshore portion of the pipeline would share the ROW with the RWI pipeline described earlier. The 3-mile (5-kilometer) offshore portion of the pipeline would lie perpendicular to the coast to take advantage of ocean currents for maximizing diffusion. Its terminus would be located at coordinates 28°56'36"N and 95°13'18"W.

A 42-inch (107-centimeter) 37-mile (60-kilometer) crude oil pipeline would be built to a proposed terminal/tank farm in Texas City adjacent to the existing Bryan Mound-Texas City pipeline (see figure 2.4.6-3). This tank farm would interconnect with an abutting BP facility via two proposed 30-inch (76-centimeters), 3-mile (4-kilometer) pipelines. It would contain four 0.4-MMB oil storage tanks, support facilities, and an electrical substation and would occupy a 39-acre (16-hectare) site. A cross-connection would also be made to the existing crude oil pipeline from Bryan Mound to Texas City. This configuration would allow oil fill and crude oil transfers between the Stratton Ridge and Bryan Mound sites. Figure 2.4.6-4 illustrates the proposed tank farm at Texas City.

An existing 138-kilovolt power lines run along the north eastern boundary of the site and would be directly connected to a site substation that would be built adjacent to these existing power lines. Dual 34.5-kilovolt power lines would be built from the site substation to the RWI adjacent to the RWI pipeline along a 6-mile (10-kilometer) 60-foot (18-meter) ROW. The portion of the dual 34.5 kilovolt power lines that pass through the Brazoria National Wildlife Refuge would be constructed underground rather than along poles.

## 2.5 EXPANSION AT EXISTING SPR SITES

This draft EIS considers the expansion of two existing SPR storage sites, Bayou Choctaw, LA, Big Hill, TX as well as the potential expansion of West Hackberry, LA. The location of each facility is illustrated in figure 2.5-1. Storage capacity at Big Hill would be expanded by between 72 and 108 MMB; Bayou Choctaw would be expanded by 20 or 30 MMB; and West Hackberry would be expanded by 15 MMB or not at all. The specific amount of expansion would depend on the alternative that DOE selects.

### 2.5.1 Bayou Choctaw Expansion Site

Bayou Choctaw occupies a 356-acre (144-hectare) site in Iberville Parish, LA, about 12 miles (19 kilometers) southwest of Baton Rouge, as illustrated in figure 2.5.1-1. The Mississippi River is located about 4 miles (6.4 kilometers) east of the salt dome and the Port Allen Canal, an extension of the ICW, is about 0.25 miles (0.4 kilometers) to the west. The general area is swampy with an elevation ranging from less than 5 feet (1.5 meters) to more than 10 feet (3 meters) above mean sea level.

The existing storage facility consists of six caverns with approximately 12.5 MMB capacity each (see figure 2.5.1-2). Combined storage capacity is 76 MMB with a drawdown rate of 515 MMBD. Raw water is supplied from an intake facility on Cavern Lake to the north of the site. The lake has a surface area of approximately 12 acres (5 hectares) and it is connected by canal to the ICW. Brine is disposed of through underground injection wells south of the storage site. DOE would expand the storage capacity of the Bayou Choctaw facility by 20 MMB by developing two new 10-MMB caverns on the existing DOE property or to 30-MMB by also acquiring one existing 10-MMB commercial cavern from Petrologistics Olefins that is already located within the site boundary. The existing cavern currently stores ethane or ethylene, but it would be emptied and filled with brine before transfer of ownership to DOE. The new and acquired caverns would be connected to the existing RWI, crude oil distribution, electrical, storage facility control and monitoring, and brine disposal systems. The current RWI system's capacity would be increased to 0.615 MMBD to accommodate increasing the oil drawdown rate to 0.590 MMBD. The impellers on the RWI pumps would be refitted and 750-horsepower drivers would be added to the system.

The brine disposal system also would be upgraded by installing 3,000 feet (900 meters) of brine pipeline to six new injection wells located 3,000 feet (900 meters) south of the existing brine injection well area on a 96-acre (39-hectare) site to meet the increased storage capacity at the site. The system upgrades are designed to meet the increased brine disposal requirements during cavern development, drawdowns, and filling events. The current brine disposal rate is limited by underground injection permits to 0.11 MMBD; therefore, increasing the storage capacity would not increase the brine disposal rate. A new brine disposal filtration system would be installed. The existing crude oil distribution system would meet all of the drawdown requirements for an expanded site. No offsite oil pipeline enhancements would be required. Onsite expansion would include installation of new 12-inch (30-centimeter) pipelines connecting the expansion caverns to the existing crude oil distribution system.

General construction on the site would include a new heat exchanger to accommodate the increased flow rate, new 12-inch (30-centimeter) brine headers, 16-inch (41-centimeter) crude oil headers, and 4-inch (10-centimeter) string flush piping with all necessary block and control valves. New 12-inch (30-centimeter) firewater pipelines with hydrants and monitors would be installed. A 0.5-mile (0.7-kilometer) access road would be built for the new caverns, an existing road would be upgraded, and a replacement bridge constructed.

### 2.5.2 Big Hill Expansion Site

Big Hill is located in Jefferson County, TX, 17 miles (27 kilometers) southwest of Port Arthur, as shown in figure 2.5.2-1. The existing site occupies approximately 250 acres (101 hectares). It is 70 miles (113 kilometers) east of Houston. The surrounding area is predominantly rural with agricultural production as the primary land use. Oil and gas production is the other major economic activity in Jefferson County.

The existing Big Hill facility, illustrated in figure 2.5.2-2, consists of 14 crude oil storage caverns with a combined capacity of 170 MMB and a drawdown rate of 1.1 MMBD, a brine disposal system, an RWI system, and a crude oil distribution system. The site also has various support facilities including a heliport; diesel oil storage; various laydown yards; maintenance yard; and control, service, and administration buildings. The caverns are located in the center portion of the salt dome and are arranged in two rows of five caverns and one row of four caverns. Each cavern is located at a depth of 2,200 to 4,200 feet (670 to 1,300 meters) and has a maximum width of about 200 feet (61 meters).

DOE proposes to expand the Big Hill facility by up to 108 MMB of new storage capacity and increase the drawdown rate to 1.5 MMBD. However, DOE may expand the existing Big Hill SPR facility by 72, 80, 96, or 108 MMB by constructing 6, 7, 8, or 9 new 10 or 12 MMB caverns. For each expansion scenario, DOE would acquire approximately 147 acres (60 hectares) of land directly north of the existing site. An overview of the 108 MMB expansion is shown in figure 2.5.2-2. A security buffer of 59 acres (24 hectares) would be created by clearing an area 300 feet (91 meters) beyond an outer security fence on this acquired land. This area would be cleared of undergrowth, scrub, shrub, and any trees, and would be managed as an open field. The area where the expansion would take place is currently owned by Sabine Pass Terminal, although British Petroleum retains mineral rights. Neither of these companies currently has any operations on the site. Unocal has developed two 0.5-MMB liquid petroleum gas storage caverns just north of the proposed storage area. There are no other operators on the Big Hill salt dome.

Because Big Hill is an SPR facility, any site expansion could take advantage of the existing infrastructure. Nevertheless, the increased storage capacity and drawdown rate would require that all of the major systems be expanded or upgraded. Construction necessary to expand the facility would include preparing the site, solution mining the new storage caverns, constructing a new crude oil distribution pipeline, upgrading the existing brine disposal pipeline, and upgrading the RWI pumps. The existing anhydrite-settling pond, which is 55 to 65 percent full of solids, could not handle the increased brine flow from the new caverns, and a new settling pond would be added. The replacement pond would be constructed adjacent to the existing pond. Because the new pond would be connected to the existing underground pipeline network, construction would be limited primarily to the pond itself.

The new caverns would tie into the existing RWI system, with only minor upgrades necessary. New RWI pumps and five additional raw water injection pumps would be installed to handle the increased demand for raw water.

The existing brine disposal pipeline would have adequate capacity to handle the increased flow, but approximately 7,000 feet (2,100 meters) of the existing line would need to be replaced because of corrosion from existing activities. To meet the new drawdown rate of 1.5 MMBD, DOE would construct a 30-inch (76-centimeter), 23-mile (40-kilometer) crude oil pipeline to the Sun terminal at Nederland, TX. This pipeline would parallel the existing pipeline ROW. Figure 2.5.2-1 shows the pipeline route. DOE would install two crude oil injection pumps and motors at Big Hill. Expansion also would require installing security measures, as outlined in section 2.3.5.

### 2.5.3 West Hackberry Expansion Site

West Hackberry occupies a 565-acre (228.6 hectares) site in Cameron and Calcasieu Parishes in southwestern LA, as shown in figure 2.5.3-1. The site is located approximately 20 miles (32 kilometers) southwest of the city of Lake Charles and 16 miles (26 kilometers) north of the Gulf of Mexico. Hackberry, a local unincorporated town of approximately 1,500 people, and the Calcasieu ship channel, are approximately 4 miles (6.4 kilometers) east of the site. The Sun terminal in Nederland, TX, which serves as the oil supply and distribution terminal, is about 40 miles (64 kilometers) west of the site.

The SPR storage facility consists of 22 caverns with a combined capacity of 227 MMB (see figure 2.5.3-2). Raw water is supplied from the ICW, approximately 4 miles (6.4 kilometers) north of the SPR storage site. The raw water pipeline crosses Black Lake en route from the RWI structure to the storage facility. The maximum drawdown rate is 1.3 MMB. The site is connected to the Sun terminal through a 43-mile (69-kilometer) crude oil pipeline and to the Lake Charles meter station through a 14-mile (23-kilometer) crude oil pipeline.

DOE would acquire three privately owned existing 5-MMB capacity caverns that are located adjacent to the existing site. These three existing caverns would add 15 MMB of storage capacity and 53 acres (21 hectares) to the existing SPR site. In addition, DOE would purchase 240-acres (97-hectares) of abutting land to the west, as illustrated in figure 2.5.3-1. The maximum drawdown rate would remain at its current rate of 1.3 MMBD. The caverns currently are not in use; they are filled with brine. They are arranged in one row that runs roughly north-south on the west side of the existing facility. Expansion would not require significant upgrades to the RWI facility, crude oil distribution capabilities, or the brine disposal system. Only minor construction would take place to connect the acquired caverns to the SPR storage site. An overview of the site and the expansion area is shown in figure 2.5.3-2.

New onsite pipelines would connect the acquired caverns to the existing onsite water, brine, and crude-oil systems. The existing electrical system and the existing storage facility control and monitoring system would be adequate to handle the increased demand created by the expansion. Both systems would be connected to the expansion site. In addition DOE would construct a 0.5-mile (0.9-kilometer) access road to the acquired caverns. The expansion also would require the installation of security measures, as outlined in section 2.3.5, and would include a 27-acre (11-hectare) security buffer around the acquired caverns.

## 2.6 NO-ACTION ALTERNATIVE

Under the no-action alternative, the SPR would not be expanded, and it would continue to operate with a 727-MMB capacity. No expansion sites or new sites would be constructed, and DOE would violate the requirements of EPACT.

## 2.7 ALTERNATIVES ELIMINATED FROM DETAILED STUDY

As required by EPACT Section 303, DOE limited its review of potential new SPR sites and expansion sites to (1) sites that DOE addressed in the 1992 draft EIS and (2) sites proposed by a state where DOE had previously studied a site. DOE eliminated from consideration the alternative locations in Louisiana, Texas, New Mexico, and Virginia identified during public scoping because the sites were not technically feasible and would violate the mandate of EPACT Section 303.

DOE eliminated the alternative of expanding capacity at Bryan Mound, TX, an existing SPR site, because the salt dome has no available capacity for additional storage caverns. While the 1992 draft EIS addressed the potential new salt dome sites at Cote Blanche, LA, and Weeks Island, LA, DOE's preliminary review of these sites for this draft EIS concluded that they are no longer viable due to the sale of the DOE's Weeks Island crude oil pipeline and its subsequent conversion to natural gas transmission.

In addition, DOE considered several alternative pipeline alignments for most storage sites to minimize impacts to wetlands. Other alternative pipeline alignments that DOE eliminated from detailed consideration because they would affect more wetlands are described in Appendix B Floodplains and Wetlands Assessment. DOE also considered, but dismissed from detailed analysis the alternative of using water from the ICW for the Richton storage site because of the significant length of new pipeline (over 100 miles [161 kilometers]) that would be required.

## 2.8 COMPARISON OF ALTERNATIVES

CEQ NEPA regulations (40 CFR Part 1500.2(e)) direct Federal agencies to use the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment. Analyses of alternatives are the heart of an EIS. CEQ regulations (40 CFR 1502.14) state:

> *Based on the information and analysis presented in the sections on the Affected Environment (Sec. 1502.15) and the Environmental Consequences (Sec. 1502.16), it* [an EIS] *should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public.*

The following sections discuss the potential environmental impacts of the proposed seven alternatives, including the no-action alternative, across 10 resource areas:

- Environmental risks and public and occupational safety and health;
- Land use;
- Geology and soils;

- Air quality;
- Water resources;
- Biological resources;
- Socioeconomics;
- Cultural resources;
- Noise; and
- Environmental justice.

Table 2.8-1, at the end of the chapter, describes the potential impacts for each alternative with three expansion sites, which would be Bayou Choctaw, Big Hill, and West Hackberry, and for the no-action alternative. (See table 2.2.3-1 for further detail on the alternatives.)

Table 2.8-2, at the end of the chapter, addresses the difference between the alternatives in the first table, which have three expansion sites, and the remaining alternatives, which have just two expansion sites. In other words, the second table focuses on the differences associated with not expanding West Hackberry and increasing the expansion capacity at Big Hill. (It does not address Bayou Choctaw because the same expansion capacity would be developed under both sets of alternatives.)

The second table does not address the Clovelly alternative because Clovelly (without Bruinsburg) would be developed only with three expansion sites. The second table also does not repeat the discussion of the no-action alternative.

### 2.8.1 Environmental Risks and Public and Occupational Safety and Health

For this analysis, DOE considered risk as both the likelihood (or chance) of occurrence and the potential consequences. While accidental releases can occur during long-term storage, the risk of an oil spill generally is dominated by transfer activities. Furthermore, the maximum quantity filled occurs with the initial fill. This initial-fill activity also represents the greatest incremental chance of spills of all the potential for a spill associated with current imports into the United States because subsequent drawdowns and refills would just replace a transfer of oil from interrupted imports. This analysis focuses on the likelihood of an oil spill during initial-fill activities.

The risks from oil spills would be similar across alternatives because the risks are primarily a function of the amount of oil transferred into SPR caverns, which would be similar across alternatives. The predicted number of oil spills would be approximately 16 spills during initial site fill. Based on historical spill statistics, the predicted oil spills would likely be low volume (less than 100 barrels).

The potential consequences of such infrequent, low-volume, accidental releases of oil would be minor. The releases generally would result in localized soil contamination at the storage sites and terminal locations, which would be contained and cleaned up. Elevated concentrations of oil constituents occurring in the water column and on the water surface immediately after a spill would decrease over time because of dispersion, dilution, and degradation. The rate of concentration decline would depend on the size and flushing rate of the water body affected, as discussed below. Although there is a low probability of an accidental brine discharge, the consequences of a release could be significant if the release was large and/or it migrated into a sensitive aquatic system or plant community. A large release of oil could result in mortality for plants and animals through chemical toxicity, physical smothering, respiratory interference, food and habitat loss, and inhalation or ingestion. Impacted communities can take decades to recover from a large release. A release of brine could cause significant and sometimes fatal physiological trauma to plants and animals, especially bird eggs, fish eggs, and fish larvae. While the spills would result in some air contaminants, the contaminants would be released so infrequently and in such small quantities that they would be readily dispersed in the atmosphere and would have little effect on ambient air quality along site boundaries.

The brine spill risk also would be low. The risks would be similar across alternatives because the risks are primarily a function of the amount of brine disposed of, which would be similar across alternatives. The total number of brine spills predicted would be 96 to 103 for each alternative. Based on historical data, however, these spills would mostly be of low volume (less than 50 barrels). Higher-volume brine spills, while possible, are very unlikely based on SPR experience. Unless the spills were large or sustained, neither of which is predicted, the brine contaminants would be diluted and dispersed into the surrounding area and waterbodies by rain; soils and vegetation affected by changes in the mineral concentrations would quickly recover; and any impacts of changes in mineral concentrations on shallow groundwater and air quality would be small. While unlikely, a large discharge of brine into a sensitive aquatic system or plant community could have significant effects as discussed above.

The risk of chemical spills and fire would be small and similar across alternatives given the identical activities for each alternative, excluding the no-action alternative. The occupational injuries also would be small and similar across alternatives. For example, the rate of lost workdays due to injuries at new and expanded sites would be similar to the rate at existing SPR sites, which is 0.83 workdays per 200,000 worker hours. This rate is much lower than the Bureau of Labor Standards average of 5.3 workdays per 200,000 worker hours.

### 2.8.2 Land Use

The analysis of land use addresses land-use conflicts, visual resources, prime farmland, and coastal zone management. Each of these four topics is addressed below.

**Possible Land Use Conflicts**

The regulations for implementing the National Environmental Policy Act require agencies to discuss possible conflicts between the proposed action and the objectives of Federal, state, and local land use plans, policies, and controls (40 CFR 1502.16(c)). Each of the proposed alternatives would require the commitment of land for the development and operation of new and expansion sites and their infrastructure. The total area would range from a high of 4,494 acres (1,820 hectares) for the Richton alternative with three expansion sites to a low of 693 acres (281 hectares) for Clovelly. Tables 2.8-1 and 2.8-2 identify the area required for the other alternatives.

The proposed new storage sites and their infrastructure generally would be located in rural areas where they would not conflict with surrounding land uses. At Clovelly and the expansion sites, the new facilities would be similar to existing facilities and therefore land use would not change substantially. No substantial land-use conflicts would arise for the Chacahoula and Clovelly alternatives. For the other alternatives, the following conflicts would arise for their infrastructure development:

- For the Bruinsburg 160 MMB alternative, the crude oil pipeline to Peetsville, MS, would cross the Natchez Trace National Scenic Trail and the Natchez Trace Parkway along an existing power line ROW. (All proposed pipelines would be underground except where they cross levees.) The expansion of the ROW would require clearing vegetation and would slightly expand the existing land use of the ROW. The same pipeline would travel through private property contained within the proclamation boundary of the Homochitto National Forest for 6.8 miles (11 kilometers). (The proclamation boundary defines an area where the Forest Service may purchase land from willing sellers to expand the forest without further Congressional authorization.) About 5.6 miles (9 kilometers) would parallel an existing highway in a new corridor. While this would be a new land use, other land uses in the new ROW are unlikely to be substantively affected. The remainder of the pipeline through the proclamation area would be in an existing ROW.

- For the Clovelly 80 or 90 MMB/Bruinsburg 80 MMB alternatives, the crude oil pipeline to Jackson, MS, would cross the Natchez Trace National Scenic Trail and Natchez Trace Parkway along an existing power line ROW, as discussed above. No pipeline for this site would cross the Homochitto National Forest proclamation area for these alternatives.

- For the Richton alternative, the pipeline to Liberty, MS, would cross the Percy Quin State Park for about 0.5 miles (0.7 kilometers) in a new ROW. If this alternative is selected, DOE would work with the State of Mississippi to re-align the pipeline to cross the park in an existing ROW where feasible.

- For the Stratton Ridge alternative, approximately 3 miles (4.8 kilometers) of the RWI pipeline, brine disposal pipelines, and two power lines would cross the Brazoria National Wildlife Refuge and a privately owned land in the refuge's proclamation area in the same new ROW. In addition, 4.7 miles (7.6 kilometers) of the crude oil pipeline would cross the refuge in an existing pipeline ROW. If this alternative is selected, DOE would work with the U.S. Fish and Wildlife Service (USFWS) to reduce these land use conflicts, such as by placing the power line underground.

**Visual Resources**

Construction activities at new SPR storage sites would result in temporary visual impacts and long-term changes in the existing landscape. These new facilities would appear industrial in nature and would conflict with surrounding natural vegetation. The impacts, however, would be minor because the new facilities would not be visible from residential or commercial areas and the sites would have limited public access. Expansion of the existing SPR facilities would not provide a large visual contrast with the existing landscape because of the existing industrial land use at these sites.

The construction of pipelines, power lines, and other infrastructure would have only minor visual impacts, with three exceptions:

- The development of the Bruinsburg 160 MMB or 80 MMB site would have a visual impact on the historic Civil War landscape, as noted below in section 2.8.8.

- As discussed under land use conflicts above, the ROWs for several alternatives would cross a national parkway, national scenic trail, national forest proclamation area, state forest, or national wildlife refuge. These ROWs would affect the views in these corridors. DOE would attempt to preserve the natural landscapes in these settings by using existing ROWs where feasible, placing pipelines underground, and otherwise working with other agencies to minimize the impacts.

- For the Stratton Ridge alternative, the RWI would be located along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. Recreational sightseers visiting the refuge might be sensitive to change in the visual quality, even though the RWI would be outside the refuge.

**Farmland**

SPR development activities would cause farmland conversion by shifting the use of land to nonfarm uses. Any prime or unique farmlands located on proposed SPR storage sites, RWI facilities, and oil distribution terminals would be permanently converted to nonfarm uses because the potential use of that land for agricultural purposes would be lost. The construction of pipelines and power lines would temporarily prohibit agricultural use of farmland within the construction easement during the construction period of up to six to ten weeks at any specific location.

To assess these potential impacts, DOE, in consultation with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), scored all of the individual sites and all of the alternatives using the farmland conversion impact rating. This scoring system is specified in the Farmland Protection Policy Act regulations (7 CFR Part 658). It considers a wide variety of factors related to potential farmland conversion impacts, including the amount of prime or unique farmland that would be converted; the amount of statewide and locally important farmland; the use of the land and nearby land; the distance to urban built-up areas and urban support services; on-farm investments; and compatibility with existing agricultural use. Under the regulations, "sites receiving a total score of less than 160 need not be given further consideration for protection and no additional sites need to be evaluated" (40 CFR 658.4(c)(2)). While all alternatives would affect farmlands, each alternative had a score below 160 out of 260 possible points and therefore needs not be given further consideration for protection.[1]

**Coastal Zone Management**

The Bruinsburg, Chacahoula, Richton, and Bayou Choctaw sites are outside the coastal zone, but some of their associated infrastructure, as well as the expansion site and infrastructure of Big Hill and the expansion site of West Hackberry would be in coastal zones. The Clovelly and Stratton Ridge sites also are in the coastal zone. The Clovelly 80 MMB/Bruinsburg 80 MMB alternative and the Clovelly 90 MMB/Bruinsburg 80 MMB alternative would have the same components in the coastal zone as the individual Clovelly and Bruinsburg alternatives. DOE consulted with the coastal zone management agencies for all three states regarding compliance with the Federal Coastal Zone Management Act. The agencies preferred that DOE coordinate its consistency determination for the selected alternative through the U.S. Army Corps of Engineers (USACE) during the Section 404 wetlands permitting process. USACE would then forward the determination to the coastal zone management agencies, which would conduct a consistency review and either object or concur with DOE's determination. This process satisfies the requirements of the Federal Coastal Zone Management Act.

### 2.8.3 Geology and Soils

Local subsidence, limited to the area above the proposed storage caverns, would range from about 2 to 6 feet (0.7 to 2 meters) over 30 years for any of the alternatives. These depressions on dry land might cause minor ponding in the area overlying the caverns. Depressions in wetland areas would increase the zone of saturation closer to the surface or the depth of any standing water. The new caverns would be designed to not jeopardize the structure or integrity of existing caverns on the salt domes.

### 2.8.4 Air Quality

The proposed action would generate low emissions of criteria pollutants. Emissions levels would be below levels of concern, including below conformity determination thresholds in the ozone nonattainment areas at Bayou Choctaw, Big Hill, and Stratton Ridge. At the Stratton Ridge site, the conformity review conducted for this draft EIS estimates that the maximum emissions of volatile organic compounds would be slightly below the threshold that triggers a full conformity determination. Thus, if the Stratton Ridge

[1] The location of some of the proposed sites and their infrastructure changed slightly since DOE consulted with NRCS. Additional consultations to incorporate the new information were not feasible for inclusion in this draft EIS. Nonetheless, the nature of these minor changes would not increase the score for any site and its infrastructure to be greater than 160 points.

site were selected, DOE would conduct an additional conformity review using the final site design to determine if the current estimate is sufficiently conservative and would not be exceeded.

The greatest source of greenhouse gas emissions for SPR expansion are carbon dioxide associated with construction equipment and motor vehicles and methane from cavern leaching. During construction, the maximum annual average greenhouse gas emissions associated with any alternative would be less than 0.22 million tons of carbon dioxide equivalents. The emissions during SPR operations would be smaller, about one-third as much as during construction.

### 2.8.5 Water Resources

**Surface Water**

The proposed facilities would withdraw water from nearby surface water bodies for use in cavern solution mining. Two of the proposed new sites (Chacahoula and Stratton Ridge) and two expansion sites (Big Hill and West Hackberry) would withdraw water from the ICW. The proposed new Bruinsburg site would withdraw water from the Mississippi River. Two new sites (Clovelly and Richton) and one expansion site (Bayou Choctaw) would withdraw water from local surface water bodies other than the ICW. With the exception of the Richton alternative, the water withdrawal would represent a small amount of the average available water from river flows or water bodies for all alternatives except the Richton alternative because the rivers and water bodies are large. For the new Richton site, the flow rate of the Leaf River is highly variable and there would be a potential for withdrawing a significant fraction of the total river flow during drought periods. This withdrawal could exceed the minimum in-stream flow levels established by the Mississippi Department of Environmental Quality during periods of low flow in the Leaf River.

Brine from the solution mining of the salt caverns or from filling caverns with oil would be discharged into the Gulf of Mexico from the proposed SPR facilities, with the exception of Bruinsburg, Bayou Choctaw, and West Hackberry, where brine would be injected into deep subsurface aquifers via injection wells. All of the proposed brine diffuser locations in the Gulf of Mexico would be in waters of similar depths along the coastline (i.e., 30 feet [9 meters]), with placement at a depth that does not affect navigation. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand for all alternatives with brine discharge into the Gulf of Mexico) would occur from the discharge, but the increase would be within natural salinity variation. However, brine discharged through the proposed Chacahoula diffuser may tend to pool at the sea bottom due to flow restrictions. The bottom of the Gulf of Mexico slopes gently seaward at all of the proposed diffuser locations except for Chacahoula, which is located in close proximity to a shoal area (Ship Shoal). Brine plume movement at Chacahoula would be restricted due to the bathymetry resulting from the presence of the shoal area.

All alternatives would involve the construction of multiple pipelines that would cross a variety of surface water bodies. The construction activities would cause temporary and minor erosion and sedimentation. Only the Bruinsburg, Richton, and Stratton Ridge pipelines would cross areas with state programs (e.g., wellhead protection areas) to protect against contamination of particular drinking water (surface or groundwater) sources. Even though the Bruinsburg, Richton, and Stratton Ridge alternatives involve pipelines that would pass through protected drinking water areas, no alternative would be likely to contaminate a drinking water source.

The effects of a brine or oil discharge into surface water were discussed above under Environmental Risks and Public and Occupational Safety and Health.

**Groundwater**

As previously mentioned, brine from Bruinsburg, Bayou Choctaw, and West Hackberry would be injected into deep saline aquifers via injection wells. West Hackberry would use an existing injection system; Bayou Choctaw would use existing and proposed new injection wells; and at Bruinsburg, DOE would construct new injection wells.

The potential for brine to leak into shallow water source aquifers is very low for all sites. Brine injection wells would be sealed and pressure tested to assure that leakage would not occur. DOE also would implement a shallow groundwater-monitoring program at each site to ensure protection of groundwater quality. Additionally, each site has confined aquifers that are separated by impermeable strata, so impacts to groundwater associated with the disposal of brine by deep well injection would be minimal. At Bayou Choctaw, the proposed receiving formation for injection of brine is below any aquifers containing fresh or slightly saline water. The West Hackberry expansion would use the existing SPR brine disposal facilities, which DOE has previously assessed and determined would not result in adverse impacts to groundwater. Based on well logs at Bruinsburg, DOE is uncertain whether the Sparta formation alone would have adequate capacity to handle the proposed brine injection volumes and rates; therefore, if this alternative is selected, DOE would consider developing injection wells in two formations. Brine injected into these aquifers at Bruinsburg would travel further downgradient into increasingly saline portions of the aquifers, and away from the portions of the aquifers that constitute current or potential sources of fresh water.

**Floodplains**

A substantial portion of the proposed storage sites and associated infrastructure of each alternative would be located in the 100-year and 500-year floodplain. Between 56 acres (23 hectares) under the Clovelly alternative and 276 acres (112 hectares) under the Bruinsburg alternative of the 100-year floodplain would be permanently affected. Between 27 acres (11 hectares) under the Chacahoula, Clovelly, and Richton alternatives and 216 acres (87 hectares) under the Stratton Ridge alternative of the 500-year floodplain would be permanently affected. The amount of onsite construction would vary by site, with the greatest amount of floodplain disturbance at Stratton Ridge and Bruinsburg. Offsite pipeline construction would affect floodplains only during construction, and areas would be brought back to grade following construction. Pipeline construction associated with the Chacahoula project crosses the largest area of floodplains.

Because most of the infrastructure on the affected floodplains would be built below ground, the impacts would be lessened. The main impacts on flood storage and flooding attenuation would result from constructing some aboveground structures and placing fill at the new cavern facilities at Chacahoula, Bayou Choctaw, Stratton Ridge, and Big Hill. These fill areas, however, would be insignificant in comparison the total areas of the floodplains where they are located. The Chacahoula, Richton, Stratton Ridge, and Big Hill sites are located in floodplains that extend over hundreds of acres in coastal basins. The Bruinsburg and Bayou Choctaw sites also are located in an extensive floodplain area associated with the Mississippi River. Thus, fill areas developed as part of the proposed action at these sites would have insignificant impact on the flood storage capacity or hydraulic function of the related floodplains.

DOE would comply fully with applicable local and state guidelines, regulations, and permit requirements regarding floodplain construction. In general, DOE would be required to evaluate the impact of placing fill or structures in the 100-year floodplain and 500-year floodplain and to demonstrate that the proposed fill/structures would not increase the base flood elevation.

Based on the factors discussed above and in detail in sections 3.6 and in appendix B, DOE expects that overall impacts to floodplain hydraulic function, and to lives and property, would not be significant.

### 2.8.6 Biological Resources

**Plants, Wetlands, and Wildlife**

Each alternative would result in the clearing, grading and filling of a variety of upland and wetland communities. For each alternative, the ROWs would result in temporary impacts on wetlands within the construction easement and permanent impacts within the permanent ROW from converting forested and scrub-shrub wetland communities to emergent wetlands. For all filling and permanent conversion of wetlands, DOE would complete a wetland delineation, secure a jurisdictional determination, and secure Clean Water Act Section 404/401 permits from USACE for all impacts to jurisdictional wetlands. DOE would prepare a wetland compensation plan to mitigate the impacts to jurisdictional wetlands, as described in appendix B, section B.4.

Table 2.8-3 summarizes the wetland impacts by alternative. As presented in table 2.8-3, fill includes the dredging or filling of a wetland; conversion is the conversion of one wetland type to another type (e.g., forest wetlands to emergent wetlands), and temporary disturbance includes short-term construction activities in wetlands.

**Table 2.8-3: Impacts on Wetlands**

| Alternative | Storage and Expansion Sites and Ancillary Facilities | | All ROWs | |
|---|---|---|---|---|
| | Filled Wetlands Acres | Permanent Conversion Acres | Temporary Easement Acres | Permanent Easement Acres |
| Bruinsburg | 150 | 25 | 306 | 211 |
| Chacahoula | 175 | 220 | 1,222 | 867 |
| Clovelly | 49 | 7 | 122 | 60 |
| Clovelly 80 MMB/ Bruinsburg 80 MMB | 86 | 23 | 398 | 253 |
| Clovelly 90 MMB/ Bruinsburg 80 MMB | 86 | 23 | 398 | 251 |
| Richton | 90 | 9 | 907 | 527 |
| Stratton Ridge | 277 | 80 | 288 | 181 |

1 acre = 0.405 hectares

The Clovelly alternative would affect the fewest acres of wetlands because the new site would be developed at an existing crude oil storage and distribution facility and no new off-site infrastructure or pipelines would be required. The relative impacts on wetlands (fill, conversion, and temporary disturbance) associated with the Clovelly 80/Bruinsburg 80 MMB, Clovelly 90/Bruinsburg 80 MMB, and Bruinsburg 160 MMB alternatives would be approximately the same compared to each other. Up to 39 acres of relatively rare and ecologically important bald cypress forested wetlands would be filled or converted at Bruinsburg under the Clovelly 80 MMB/Bruinsburg 80 MMB, the Clovelly 90 MMB/ Bruinsburg alternatives, and up to 103 acres under the Bruinsburg alternative. The impacts on wetlands under the Stratton Ridge alternative would involve filling and converting up to 258 acres of relatively rare and ecologically important bottomland hardwood forest at the Stratton Ridge site.

The Richton alternative would result in almost double the amount of wetland impacts from fill, conversion, and temporary disturbance (over 1,500 acres [619 hectares]) than the Bruinsburg alternative.

The majority of the wetland impacts associated with the Richton alternative would result from the long ROWs, over 200 miles, and the associated impacts from the clearing within the ROW.  The Chacahoula alternative would have the most acres of wetlands affected by fill, conversion, and temporary disturbance (over 2,400 acres [970 hectares]).  Up to 339 acres (137 hectares) of relatively rare and ecologically important bald cypress forested wetlands would be filled or converted at Chacahoula, and the majority of each ROW would pass through the extensive wetlands located throughout southern Louisiana. Appendix B presents a detailed discussion of the wetlands associated with each site and alternative.

The effects of a brine or oil discharge into surface water was discussed above under Environmental Risks and Public and Occupational Safety and Health.

**Threatened and Endangered Species**

With the exception of the Clovelly alternative, where no Federally listed threatened, endangered, or candidate species would be affected, each alternative may affect one or more Federally listed species. Two aquatic species may be affected under the Bruinsburg alternative; two terrestrial species may be affected under the Chacahoula alternative; and a single aquatic species may be affected under both the Clovelly 80 MMB/Bruinsburg 80 MMB alternative and the Clovelly 90 MMB/Bruinsburg 80 MMB alternative.  Two terrestrial and three aquatic species may be affected under the Richton alternative, and a single terrestrial species may be affected under the Stratton Ridge alternative.  The following summarizes the impacts by alternative:

<u>Bruinsburg</u>

- Fat Pocketbook Mussel, Federally endangered, may be affected by the Bruinsburg ROW in-stream construction in Coles and Fairchild creek.
- Pallid Sturgeon, Federally endangered, may be affected by the in-river construction and operation of the Bruinsburg RWI structure.

<u>Chacahoula</u>

- Bald Eagle, Federally threatened, may be affected by the development and operation of the Chacahoula site and construction along the Chacahoula ROWs.  Potential foraging, roosting, and nesting habitat may be impacted.
- Brown Pelican, Federally endangered, may be affected by the construction along the Chacahoula ROW to LOOP.  Roosting habitat may be affected.

<u>Clovelly</u>

- No Federally listed species would be affected.

<u>Clovelly 80 MMB/Bruinsburg 80 MMB</u>

- Pallid Sturgeon, Federally endangered, may be affected by the in-river construction and operation of the Bruinsburg RWI structure.

Clovelly 90 MMB/Bruinsburg 80 MMB

- Pallid Sturgeon, Federally endangered, may be affected by the in-river construction and operation of the Bruinsburg RWI structure.

Richton

- Gopher Tortoise, Federally threatened, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and individuals.

- Black Pine Snake, Federal candidate, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and individuals.

- Yellow Blotched Map Turtle, Federally endangered, may be affected by the in-water construction and operation of the Richton RWI structure. A loss of habitat, and impingement of and entrainment of early life stages or altering the hydrologic regime in the Leaf River may occur.

- Gulf Sturgeon, Federally endangered, may be affected by the in-water construction and operation of the Richton RWI structure. The RWI may adversely affect designated critical habitat and may adversely affect the population through impingement of and entrainment of early life stages or altering the hydrologic regime in the Leaf River.

- Pearl Darter, Federal candidate, may be affected by the in-water construction and operation of the Richton RWI structure. The RWI may result in a loss of habitat, impinge and entrain pearl daters in early life stages, or alter the hydrologic regime in the Leaf River.

Stratton Ridge

- Bald Eagle, Federally threatened, may be affected by the development and operation of the Stratton Ridge site. Construction along the Stratton Ridge ROWs may affect potential foraging, roosting, and nesting habitat.

In accordance with Section 7 of the Endangered Species Act, DOE has consulted with the USFWS and has identified the Federally listed species that the proposed action would not affect and the Federally listed species that the proposed action may affect. Upon the selection of an alternative, DOE would continue consultations with USFWS in accordance with Section 7.

**Special Status Area**

The Chacahoula alternative would not affect special status areas. The Bruinsburg, Clovelly 80 MMB/ Bruinsburg 80 MMB, and Clovelly 90 MMB/Bruinsburg 80 MMB alternatives would involve a ROW crossing the Natchez Trace Parkway. In addition, the crude oil ROW to Peetsville under the Bruinsburg alternative would pass through the proclamation area of the Homochitto National Forest. The Clovelly alternative would be located adjacent to the Gulf ICW to Clovelly Hydrologic Restoration project, but would not affect the project. The Richton alternative would involve a ROW crossing the Percy Quin State Park. The Stratton Ridge alternative would involve two ROWs that would pass through the Brazoria National Wildlife Refuge. The impacts on the special status areas would include temporary and permanent changes in the vegetative communities along the construction and permanent ROWs, respectively.

For issues involving the Natchez Trace Parkway, the Homochitto National Forest, the Brazoria National Wildlife Refuge, and Percy Quin State Park, DOE would coordinate with the National Park Service, the U.S. Forest Service, the USFWS, and the State of Mississippi to minimize the impacts to important natural resources.

**Essential Fish Habitat**

The Chacahoula, Richton, and Stratton Ridge alternatives would require developing new offshore brine disposal systems. The Bruinsburg alternative would use brine injection wells; the Clovelly alternative would use LOOP's existing offshore brine diffusion system; and the Clovelly 80 MMB/Bruinsburg 80 MMB alternative and the Clovelly 90 MMB/Bruinsburg 80 MMB alternative would use a combination of new brine disposal wells at Bruinsburg and the existing offshore brine diffusion system at Clovelly. The underwater construction of an offshore brine pipeline and diffuser would pass through EFH and would temporarily increase suspended sediments and drive marine species from the area. The operation of new brine diffusers plus the existing brine diffusers associated with the Clovelly, Clovelly 80 MMB/ Bruinsburg 80 MMB, and Clovelly 90 MMB/Bruinsburg 80 MMB alternatives, as well as the existing offshore diffuser at Big Hill would cause minor increases in the salinity concentrations. The estimated salinity concentrations would increase by up to 4.7 parts per thousand around the diffusers and would affect EFH. Some marine species may avoid the areas with increased salinity concentrations; however, the increase in the salinity concentration would be within the normal salinity concentration range of the Gulf of Mexico. Appendix C discusses the brine plume modeling that DOE completed and appendix E describes the impacts associated with offshore construction and brine diffusion, including brine pooling, on EFH.

### 2.8.7 Socioeconomics

The proposed action would require a peak construction work force of approximately 230 to 550 employees at the new storage site or combination of sites and infrastructure, plus another 250 to 350 employees for the expansion sites and their infrastructure. The operations workforce would be about 75 to 100 employees at each site and about 25 additional employees at each expansion site. This employment would create positive local economic benefits under all alternatives.

While the proposed storage sites and infrastructure generally are located in or near rural communities, they are close (e.g., 20 to 45 miles [32 to 72 kilometers]) to more populated urban areas. Most workers would come from these relatively close areas. In-migration to the areas near the storage sites would be small relative to the regional population. Thus, the proposed action would create no noticeable increase in competition for labor, traffic, or demand for housing and public infrastructure and services.

### 2.8.8 Cultural Resources

The proposed action would have the potential to damage or destroy archaeological sites, Native American cultural sites, or historic buildings or structures or to change the characteristics of a property that would diminish qualities that contribute to its historic significance or cultural importance. Native American archaeological sites have been recorded or may be present at most of the proposed new sites, including Chacahoula (underwater), Clovelly (underwater), Richton, Stratton Ridge, and all three proposed expansion sites. The proposed pipeline corridors for Chacahoula are near major streams and tributaries, which are high-sensitivity areas for both Native American archaeological sites and historic sites such as plantations. Also, the Richton and Stratton Ridge pipelines would pass near or through historically and archaeologically sensitive areas. Where possible, damage to these resources would be avoided. Where avoidance is not possible, DOE would undertake mitigation measures, such as, data recovery from an archaeological site or detailed documentation of a building or structure.

SPR development at the Bruinsburg site could result in potential adverse effects on the historic setting of the Civil War landing of the Union Army in Mississippi and an associated route of troop movements in an area that could become eligible for the National Register of Historic Places as a core study area. The floodplain where the Bruinsburg storage caverns would be developed is the site where the Union Army, under General Grant, disembarked after crossing the Mississippi River on April 30, 1863, to begin the invasion of Mississippi that culminated in the surrender of Vicksburg on July 4, 1863. A portion of the Bruinsburg site is likely to contain archaeological remains of troop presence. Remains of at least one of the ships that sank during the invasion are likely to lie northwest of the facility boundary. The historic Bruinsburg Road is reportedly still visible on the floodplain and along the route of the climb up to the escarpment.

Construction activities on the floodplain where storage caverns would be built might affect remains associated with the troop landing or prehistoric sites and would affect the setting and feeling of the troop-landing site. Construction activities on the escarpment where the rest of the storage site facilities would be built could affect remains associated with the historic line of the march of the Vicksburg campaign or prehistoric sites.

Several measures could mitigate the effects of altering the setting at the troop-landing site, which is already changed from the original site because the river channel moved westerly and the town of Bruinsburg was abandoned. The mitigation measures could include improved access for history students to the area by the access road to the new facility, possibly including construction of a viewpoint on the descent of the escarpment. In addition, another mitigation measure might be financial support to the National Park Service interpretive program. Currently, access is possible only by special permission from the private landowner; interpretive signs are posted only along public roads, not at the actual site. Damage or destruction of archaeological remains associated with the landing and troop movements would be mitigated through avoidance, if possible, or data would be recovered if damage or destruction of the remains were not avoidable. The current conceptual design for the site, with most buildings and other surface structures on the escarpment, would minimize the effect on the landing area.

### 2.8.9 Noise

Noise from constructing the proposed storage sites would be audible to the closest receptors for the proposed new and expansion storage sites. The estimated noise levels, however, would have minor impacts because the noise levels would be only slightly greater than the estimated ambient noise levels. The construction noise impacts along the pipelines and at other infrastructure locations also would be small. The level of noise from operations and maintenance activities would be lower than from construction activities. At several proposed storage sites, the noise levels would not be audible, that is, they would be lower than estimated ambient noise levels.

### 2.8.10 Environmental Justice

The potentially affected populations for each alternative include low-income, Black or African American, Native American or Alaska Native, Asian, and Hispanic or Latino populations. The Stratton Ridge alternative also includes Native Hawaiian or Other Pacific Islander populations. None of these populations would have impacts that appreciably exceed the impacts to the general population. Furthermore, none of the populations would be affected in different ways than the general population, such as by having unique exposure pathways, unique rates of exposure, or special sensitivities or by using natural resources differently. Thus, there would be no disproportionately high and adverse impacts to minority or low-income populations.

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Environmental Risks and Public and Occupational Safety and Health | Possible oil spills during initial fill. 16 oil spills predicted.<br><br>Possible brine spills during the solution mining of caverns and fill. 96 brine spills predicted.<br><br>Most oil, brine, or hazardous materials spills would be small and occur at storage sites where they would be controlled and kept from sensitive areas. Project lifetime risks would be low.<br><br>Low likelihood of fire.<br><br>Number of occupational injuries (0.83 workdays per 200,000 worker hours) would be less than similar industries, based on SPR experience. | Same impacts as under Bruinsburg alternative. | Same impacts as under Bruinsburg alternative. | Same impacts as under Bruinsburg alternative. | Same impacts as under Bruinsburg alternative. | Same impacts as under Bruinsburg alternative. | Same impacts as under Bruinsburg alternative. | No impact. |
| Land Use:<br>Land Use Conflicts | 3,470 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.<br><br>Potential minor conflict where pipeline would cross Natchez Trace National Scenic Trail and Natchez Parkway in an expanded existing ROW and where pipeline would cross 6.8 miles of proclamation area of Homochitto National Forest. | 2,884 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.<br><br>No potential land-use conflicts. | 693 acres committed for alternative. Most acreage would be for storage site, which would be within an existing private facility.<br><br>No potential land-use conflicts. | 1,757 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.<br><br>Potential minor conflict where Bruinsburg pipeline would cross Natchez Trace National Scenic Trail and Natchez Trace Parkway in existing ROW. | 2,257 acres committed for alternative. Same land use conflicts as under Clovelly 80 MMB/Bruinsburg 80 MMB alternative. | 4,494 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.<br><br>No potential land-use conflicts. | 2,191 acres committed for alternative. Most acreage would be for pipeline and power line ROWs.<br><br>Potential conflict where the pipelines and power lines would cross 3 miles and pipeline would cross 4.7 miles of Brazoria National Wildlife Refuge in existing and new ROWs, respectively. | No impact. |
| Land Use:<br>Visual Resources | Potential visual impacts due to changes in historic Civil War landscape. Potential changes in vegetation where Bruinsburg pipeline ROW would cross Natchez Trace National Scenic Trail, Natchez Trail Parkway, and proclamation area of Homochitto National Forest. | No substantial visual impacts because of limited changes in viewshed, limited access, and lack of proximity to areas with visual sensitivity. | No substantial visual impacts because of location in existing industrial area. | Potential visual impact due to changes in historic Civil War landscape. Potential changes in vegetation where Bruinsburg pipeline ROW would cross Natchez Trace National Scenic Trail and Natchez Trace Parkway. | Same visual impacts as under Clovelly 90 MMB/ Bruinsburg 80 MMB alternative. | Same visual impacts as Chacahoula. | Potential visual impact due to changes in vegetation and new power lines from ROW across Brazoria National Wildlife Refuge. Potential visual impacts from RWI across ICW from the Refuge. | No impact. |
| Land Use:<br>Farmland Conversion | Would not have a substantial impact in converting prime and unique farmland to non-agricultural use. Farmland impact score under Farmland Protection Act regulations (7 CFR Part 658) is below level where further consideration of farmland protection is required. | Same farmland conversion impact as under Bruinsburg alternative. | Same farmland conversion impact as under Bruinsburg alternative. | Same farmland conversion impact as under Bruinsburg alternative. | Same farmland conversion impact as under Bruinsburg alternative. | Same farmland conversion impact as under Bruinsburg alternative. | Same farmland conversion impact as under Bruinsburg alternative. | No impact. |

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Land Use: Coastal Zone Management | Some of the Bruinsburg infrastructure and Big Hill site and infrastructure and West Hackberry site and infrastructure would be in coastal zones.<br><br>DOE and the state coastal zone agency will use the Clean Water Act Section 404 wetlands permitting process to reach a determination on coastal consistency. | Same coastal zone management impacts as under Bruinsburg alternative<br><br>Same coastal zone determination process as under Bruinsburg alternative. | Clovelly site, some of the Bruinsburg infrastructure, Big Hill site and infrastructure, and West Hackberry site would be in coastal zones.<br><br>Same coastal zone determination process as under Bruinsburg alternative. | Clovelly site, Big Hill site and infrastructure, and West Hackberry site would be in coastal zones.<br><br>Same coastal zone determination process as under Bruinsburg alternative. | Same coastal zone management impacts as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative.<br><br>Same coastal zone determination process as under Bruinsburg alternative. | Some of Richton infrastructure, Big Hill site and infrastructure, and West Hackberry site would be in coastal zones.<br><br>Same coastal zone determination process as under Bruinsburg alternative. | Stratton Ridge site and infrastructure, Big Hill site and infrastructure, and West Hackberry site would be in coastal zones.<br><br>Same coastal zone determination process as under Bruinsburg alternative. | No impact. |
| Geology and Soils | Potential minor surface subsidence (2.6 to 6.1 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. | Potential minor surface subsidence (1.8 to 6.4 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. | Potential minor surface subsidence (5 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. | Potential minor surface subsidence (2.8 to 6.4 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. | Potential minor surface subsidence (1 to 3 feet at Bruinsburg salt dome and 2.1 to 4.9 feet at Clovelly salt dome, over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. | Potential minor surface subsidence (1 to 3 feet at Bruinsburg and slightly more than 2.1 to 4.9 feet at Clovelly salt dome, over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. | Potential minor surface subsidence (2.6 to 6.1 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. | No potential subsidence, except possibly from future outside development of Chacahoula and Stratton Ridge salt domes. |
| Air Quality | Low airborne emissions from construction activities would not exceed National Ambient Air Quality Standards.<br><br>Emissions levels would be below levels of concern, including below conformity determination thresholds in the ozone nonattainment areas at Bayou Choctaw and Big Hill.<br><br>Low emissions of greenhouse gases from construction equipment and motor vehicles. | Same air quality impacts as under Bruinsburg alternative. | Same air quality impacts as under Bruinsburg alternative. | Same air quality impacts as under Bruinsburg alternative. | Same air quality impacts as under Bruinsburg alternative. | Same air quality impacts as under Bruinsburg alternative. | Same as Bruinsburg, except that emission levels would be below the conformity determination threshold in the ozone nonattainment areas at Stratton Ridge. Since estimated levels are only slightly below level that triggers a full conformity review, DOE would conduct additional analysis if Stratton Ridge were selected. | No impact. |
| Water Resources: Surface Water | Construction activities would cause temporary and minor erosion and sedimentation. DOE would secure an Erosion and Sediment Control Permit and NPDES stormwater permit for construction activities. No significant water quality problems would result.<br><br>Construction and operation would potentially affect 35 waterbodies for Bruinsburg site and infrastructure and 12, 4, and 3 water bodies for the expansions at Bayou Choctaw, Big Hill, and West Hackberry, respectively. | Same erosion and sedimentation impacts as under Bruinsburg alternative.<br><br>Chacahoula site and infrastructure would potentially affect 18 waterbodies. Same waterbodies for expansion sites as under Bruinsburg alternative. | Same erosion and sedimentation impacts as under Bruinsburg alternative.<br><br>Clovelly site and infrastructure would potentially affect 4 water bodies and a small amount of dredging and filling of existing canals would be required at Chacahoula. Same water bodies for expansion sites as under Bruinsburg alternative. | Same erosion and sedimentation impacts as individual Clovelly and Bruinsburg alternatives, but the disturbance footprint at each site would be smaller.<br><br>Clovelly 80 MMB/Bruinsburg 80 MMB and Clovelly site and infrastructure would potentially affect 16 waterbodies. Same water bodies for expansion sites as under Bruinsburg alternative. | Same erosion and sedimentation impacts as Clovelly 80 MMB/Bruinsburg 80 MMB alternative.<br><br>Same water bodies affected as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative. | Same erosion and sedimentation impacts as under Bruinsburg alternative.<br><br>Richton site and infrastructure would potentially affect 63 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative. | Same erosion and sedimentation impacts as under Bruinsburg alternative.<br><br>Stratton Ridge site and infrastructure would potentially affect 17 waterbodies. Same water bodies for expansion sites as under Bruinsburg alternative. | No impact unless Chacahoula or Clovelly were developed by a commercial entity. |

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Water Resources: Surface Water (continued) | DOE would secure a Section 404 permit and Section 401 Water Quality Certificate for construction activities in jurisdictional waterbodies. | Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies. | Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies. | Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies. | Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies. | Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies. | Same requirements as under Bruinsburg alternative for construction activities in jurisdictional waterbodies. | |
| | There would be a potential for significant water quality consequences if a brine or oil release occurred and it traveled into a waterbody. The risk of such a release is small based on the history of existing SPR facilities. | Same spill risk as under Bruinsburg alternative. | Same spill risk as under Bruinsburg alternative. | Same spill risk as under Bruinsburg alternative. | Same spill risk as under Bruinsburg alternative. | Same spill risk as under Bruinsburg alternative. | Same spill risk as under Bruinsburg alternative. | |
| | Bruinsburg RWI would withdraw 50 million gallons/day for 4 to 5 years from Mississippi River, which is a small fraction of its flow. | Chacahoula RWI would withdraw 50 million gallons/day for 4 to 5 years from the ICW, a tidally influenced waterbody. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient. | Clovelly RWI would withdraw 50 million gallons/day for 4 to 5 years from a tidal canal in network of interconnected canals at LOOP complex. Withdrawal would not significantly change flow or volume of water in the canal system, but may cause a slight upstream migration of the salinity gradient. | Clovelly and Bruinsburg RWIs would have a similar but impact as Clovelly RWI and Bruinsburg RWI, except withdrawals would occur for a shorter duration. | Similar impact from RWI as under Clovelly 80MMB/ Bruinsburg 80 MMB alternative, except that water withdrawal would have a slightly longer duration. | Richton RWI would withdraw 50 million gallons/day for 4 to 5 years from the Leaf River, which would be about 2 percent of average flow rate. Withdrawal would potentially exceed the 7-day, 10 year low flow rate, which is the minimum instream flow allowed by Mississippi. Historical data show that Leaf River flow would be sufficient to meet the water demand about 99 percent of the time. During low flow years, flow could be below the minimum instream flow for up to 15 percent of the time. DOE would secure a Beneficial Use of Public Waters Permit from Mississippi. | Stratton Ridge RWI would withdraw 42 million gallons/day for 4 to 5 years from ICW, a tidally influenced waterbody. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient. | |
| | Big Hill and West Hackberry expansions would use existing RWIs from ICW without changing existing conditions. Bayou Choctaw would withdraw 25 million gallons/day from Cavern Lake, which is fed by the ICW, for up to 3 years. Withdrawals would not significantly alter the flow or volume of water, but may cause a slight upstream migration of the salinity gradient. | The impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be the same as under Bruinsburg alternative. | The impact from water withdrawal for the Bayou Choctaw, Big Hill, and West Hackberry expansions would be the same as under Bruinsburg alternative. | Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be the same as under Bruinsburg alternative. | Impact from water withdrawal would be similar as under Clovelly 80MMB/Bruinsburg 80 MMB alternative, except that the brine discharge for Clovelly would have a slightly longer duration. | Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative. | Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be the same as under Bruinsburg alternative. | |

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Water Resources: Surface Water (continued) | No discharge from Bruinsburg to Gulf of Mexico. Brine would be injected underground. | Chacahoula site would discharge brine into Gulf of Mexico for up to 3 years. Discharge would be located in a trough to the north of Ship Shoal, an important fishing area. Brine plume would typically not affect Ship Shoal although a minor salinity increase may occur under some ocean conditions. DOE would secure a National Pollutant Discharge Elimination System permit from Louisiana. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge but the increases would be within natural salinity variation. | Clovelly site would discharge brine into Gulf of Mexico using an existing brine diffuser system and within existing National Pollutant Discharge Elimination System permitted limits. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge, but the increase would be within natural salinity variation. | Clovelly site would have a similar impact to the brine discharge from the Clovelly alternative, except that discharge would have a shorter duration. | Same brine discharge impact as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative, except that discharge would have a shorter duration. | Richton site would discharge brine into Gulf of Mexico using up to 75 diffusers. DOE would secure an NPDES discharge permit from the Mississippi DEQ. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge, but the increases would be within natural salinity variation. | Stratton Ridge site would discharge brine into the Gulf of Mexico using up to 75 diffusers. DOE would secure a National Pollutant Discharge Elimination System permit from Texas for the brine discharge. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge but the increases would be within natural salinity variation. | |
| | Big Hill expansion would discharge brine into Gulf of Mexico using existing brine diffusers and within existing NPDES permitted limits. Small increases in salinity levels (modeling indicated a maximum of 4.7 parts per thousand) would occur from the discharge, but increase would be within natural salinity variation. | Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative. | Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative. | Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative. | | Impact of Big Hill brine discharge would be the same as under Bruinsburg alternative. | Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative. | |
| Water Resources: Groundwater | Bruinsburg pipelines would cross multiple areas with programs protecting against contaminating groundwater that is used as a source of drinking water (source water protection areas); however, risk of groundwater contamination from pipeline spills is low. | Chacahoula pipelines would not cross source water protection areas. | Existing pipelines at Clovelly do not cross source water protection areas. Shallow groundwater at Clovelly is not potable. Any discharge to groundwater would have little impact on water use in area. Relatively impermeable clay/silt layer overlays the aquifer system. | Impacts to groundwater are similar to those discussed for Bruinsburg alternative and Clovelly alternative, except that the number of brine injection wells at Bruinsburg would be reduced from 60 to 30. | Impacts to groundwater would be same as under Clovelly 80/Bruinsburg 80 MMB alternative. | Richton pipelines would be constructed through and adjacent to several groundwater protection areas; however, risk of groundwater contamination from pipeline spills is low. | Stratton Ridge pipelines would be constructed through and adjacent to several areas serving public water systems or important to groundwater recharge; however, risk of groundwater contamination from pipeline spills is low. | No impact. |
| | Bruinsburg, Bayou Choctaw, and West Hackberry would use deep-aquifer brine injection. These sites have confined aquifers separated by impermeable strata. The proposed brine injection wells would be permitted by U.S. Environmental Protection Agency and/or appropriate state agency. | Bayou Choctaw and West Hackberry use deep-aquifer brine injection. These sites have confined aquifers separated by impermeable strata. The proposed brine injection wells would be permitted by U.S. Environmental Protection Agency and/or appropriate state agency. | Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative. | | | Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative. | Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative. | |

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Water Resources: Groundwater (Continued) | At Bruinsburg, the total disposal capacity of the proposed injection formations and the pressure build-up likely to occur as a result of brine injection are currently unknown. If DOE were to select this alternative, the total disposal capacity and pressure build-up would be determined during the development of the detailed design. | | | | | | | |
| Water Resources: Floodplains | Construction of Bruinsburg storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 276 acres of 100-year floodplain and 48 acres of 500-year floodplain. Buildings at Bruinsburg would not be in floodplain. Wellheads, well pads, and roads would involve placing fill or infrastructure in a floodplain. DOE would comply with floodplain protection requirements during design and construction so that the base flood elevation and downstream land uses would not be significantly affected. | Construction of Chacahoula storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 171 acres of 100-year floodplain and 27 acres of 500-year floodplain, much of which would be filled. Some interior areas of the storage site would not be filled and would retain their flood storage capacity. The entire storage site at Chacahoula is located in a vast floodplain that extends to the Gulf of Mexico. Site floodplain requirements and impacts would be same as under Bruinsburg alternative. | Construction of Clovelly storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 56 acres of 100-year floodplain and 27 acres of 500-year floodplain. All of the Clovelly site would be located in the floodplain, but the facility would be built on an elevated platform that would place much of the infrastructure above the base flood elevation. Administrative buildings would be located offsite and out of the floodplain. Site floodplain requirements and impacts would be same as under Bruinsburg alternative. | Construction of the Clovelly and Bruinsburg storage sites, three expansion storage sites, RWIs, and other facilities except ROWs would affect 136 acres of 100-year floodplain and 48 acres of 500-year floodplain. Site floodplain requirements and impacts would be same as under Bruinsburg alternative. | Same floodplain impacts as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative. | Construction of Richton storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 98 acres of 100-year floodplain and 27 acres of 500-year floodplain. Site floodplain requirements and impacts would be same as under Bruinsburg alternative. | Construction of Stratton Ridge storage site, three expansion storage sites, RWIs, and other facilities except ROWs would affect 159 acres of 100-year floodplain and 213 acres of 500-year floodplain. Site floodplain requirements and impacts would be same as under Bruinsburg alternative. | No impact. |
| | ROWs for the Bruinsburg site and three expansion sites would temporarily affect 48 miles of 100-year floodplain and 7 miles of 500-year floodplain. Floodplain would not be permanently affected by the ROWs because no aboveground fill or structures would be placed in the floodplain after construction is complete. | ROWs for the Chacahoula site and three expansion sites would temporarily affect 109 miles of 100-year and 3 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative. | ROWs for the Bruinsburg site and three expansion sites would temporarily affect 18 miles of 100-year floodplain and 3 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative. | ROWs for the Clovelly-Bruinsburg alternative, including three expansion sites would temporarily affect 55 miles of 100-year and 7 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative. | | ROWs for the Bruinsburg site and three expansion sites would temporarily affect 45 miles of 100-year floodplain and 6 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative. | ROWs for the Stratton Ridge site and three expansion sites would temporarily affect 59 miles of 100-year and 11 miles of 500-year floodplain. ROW floodplain impacts would be same as under Bruinsburg alternative. | |

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Biological Resources: Plants, Wetlands, and Wildlife | Construction of Bruinsburg storage site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 150 acres of wetlands including 85 acres of relatively rare and ecologically important bald cypress forest for the storage site area. Security buffer at Bruinsburg, West Hackberry, and Big Hill storage sites would cause a permanent conversion of 25 acres of forested and scrub-shrub wetlands to emergent wetlands.<br><br>Proposed ROWs for Bruinsburg and three expansion sites would affect 211 acres of wetlands within the permanently maintained easement and 306 acres within the temporary construction easement.<br><br>Wetlands in the permanently maintained easement would be converted to emergent wetlands and would be periodically maintained to suppress woody species. Wetlands within the temporary construction easement would be cleared during construction, but would re-establish within 5-25 years depending on the type of wetland affected. | Construction of Chacahoula site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 175 acres of wetlands including 126 acres of ecologically and economically important bald cypress forest for the storage site area. The clearing of an additional 213 acres of bald cypress and other forested wetlands for security at Chacahoula and the expansion sites would be a permanent conversion to emergent wetlands or open water.<br><br>Proposed ROWs for Chacahoula and three expansion sites would affect 867 acres of wetlands within the permanently maintained easement and 1,222 acres within the temporary construction easement.<br><br>The nature of the wetland impacts would be same as under Bruinsburg alternative. | Construction of Clovelly storage site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill or dredge 49 acres of disturbed and relatively low value wetlands. It would cause a permanent conversion of 7 acres of forested and scrub-shrub wetland to emergent wetlands for security and other clearing at Clovelly, Big Hill, and West Hackberry.<br><br>Proposed Clovelly site does not require pipeline or power line ROW construction. The proposed ROWs for three expansion sites would affect 60 acres of wetlands within the permanently maintained easement and 122 acres within the temporary construction easement.<br><br>The nature of the wetland impacts would be same as under Bruinsburg alternative. | Construction of the Clovelly and Bruinsburg storage sites, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 86 acres of wetlands, including up to 39 acres of relatively rare and ecologically important bald cypress forest for the site storage area at Bruinsburg. It would cause a permanent conversion of 23 acres of forested and scrub-shrub wetland to emergent wetlands for security and other clearing at Clovelly, Big Hill, and West Hackberry.<br><br>Proposed ROWs for Clovelly-Bruinsburg and the three expansion sites would affect 251 acres of wetlands within the permanently maintained easement and 398 acres within the temporary construction easement.<br><br>The nature of the wetland impacts would be same as under Bruinsburg alternative. | Same wetlands impacts as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative. | Construction of Richton storage site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 90 acres of wetlands, including 34 acres of disturbed low value emergent wetlands at the Pascagoula terminal site. Security buffer at Richton, Big Hill, and West Hackberry storage sites would cause a permanent conversion of 9 acres of forested and scrub-shrub wetlands to emergent wetlands.<br><br>The proposed ROWs for Richton and the three expansion sites would affect 527 acres of wetlands within the permanently maintained easement and 907 acres within the temporary construction easement.<br><br>The nature of the wetland impacts would be same as under Bruinsburg alternative. | Construction of Stratton Ridge storage site, three expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 277 acres of wetlands, including up to 258 acres of relatively rare and ecologically important bottomland hardwood for the site storage area. Security buffer at Stratton Ridge, West Hackberry, and Big Hill storage sites would cause a permanent conversion of 80 acres of forested and scrub-shrub wetlands to emergent wetlands.<br><br>The proposed ROWs for Stratton Ridge and the three expansion sites would affect 181 acres of wetlands within the permanently maintained easement and 288 acres within the temporary construction easement.<br><br>The nature of the wetland impacts would be same as under Bruinsburg alternative. | No impact. |

**Table 2.8-1:  Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Biological Resources: Plants, Wetlands, and Wildlife (continued) | Impact from permanent filling of wetlands and permanent conversion would be a potentially adverse affect because of the impact size and the regional importance of the forested wetlands, but would be mitigated.  DOE would complete a wetland delineation, secure a jurisdictional determination, and secure Section 404/401 permits for all impacts to jurisdictional wetlands.  DOE would develop a comprehensive plan to further avoid and minimize wetland impacts and to mitigate for unavoidable impacts to jurisdictional wetlands by creating, restoring, or preserving wetlands, contributing an in-lieu of fee, or purchasing credits from a mitigation bank. | The impact from the permanent filling of wetlands and permanent conversion would be the same as under Bruinsburg alternative. | The impact from permanent filling of wetlands and permanent conversion would be relatively moderate because the wetlands have already been disturbed by past development, have been invaded by tallow tree, and they are not regionally important.  DOE would undertake the same wetland activities as under the Bruinsburg alternative. | The impact from the permanent filling of wetlands and permanent conversion would be the same as under Bruinsburg alternative. | | The impact from ROWs is a potentially adverse affect because of the size of the impact (over 600 acres) to palustrine forested and scrub-shrub wetlands.  The impact would be mitigated.  DOE would undertake the same wetland activities as under Bruinsburg alternative. | The impact from the permanent filling of wetlands and permanent conversion is a potentially adverse affect because of the size of the impact and the regional importance of the forested wetlands.  Some of the forested wetlands at the Stratton Ridge site have relatively low ecological value because of invasion by exotic plants and animals.  DOE would undertake the same wetland activities as under Bruinsburg alternative. | |

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Biological Resources: Threatened and Endangered Species | Proposed ROW for Bruinsburg may affect the fat pocketbook mussel, a Federally endangered species, which may be present in Coles and Fairchild Creeks. Proposed RWI for the Bruinsburg site may affect the pallid sturgeon, a Federally endangered species that lives in the Mississippi River because of the potential for impingement and entrainment of juveniles. DOE would initiate formal Section 7 consultation with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if project may adversely affect these species.<br><br>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species. | Proposed site storage area for the Chacahoula site and all proposed ROWs may affect the Bald Eagle, a Federally threatened species that is proposed for de-listing, by removing potential foraging, roosting, and nesting habitat. Proposed ROW for the crude oil pipeline to Clovelly may affect the brown pelican, which is a Federally endangered species. The brown pelican has roosting habitat near the proposed ROW. DOE would initiate formal Section 7 consultation with USFWS and prepare a Biological Assessment, and implement conditions of Biological Opinion if project may adversely affect these species.<br><br>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species. | Proposed Clovelly site would not affect any Federally listed species.<br><br>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species. | Bruinsburg RWI may affect the pallid sturgeon in the same way as under Bruinsburg alternative, but the fat pocketbook mussel would not be affected because Bruinsburg 80 MMB proposed pipelines and shorter brine pipeline would not cross waterbodies inhabited by the mussel.<br><br>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species. | Same as Clovelly 80 MMB/ Bruinsburg 80 MMB alternative. | The proposed storage site, ROWs, and RWI may affect the Federally threatened gopher tortoise and the Federal candidate black pine snake. Potential impacts include loss of habitat or individuals from the construction. Proposed RWI may affect the Federally endangered yellow blotched map turtle and Gulf sturgeon, and the Federal candidate pearl darter. The adverse affect may occur because of the potential for impingement and entrainment of early life stages and because the withdrawal could change the hydrological regime preferred by these species. RWI would be located within the segment of the Leaf River, which is designated as critical habitat for the Gulf sturgeon. According to historical flow records, about 27 percent of the time, the withdrawal would exceed the minimum instream flow recommended by Mississippi to protect freshwater fisheries. DOE would initiate formal Section 7 consultation with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if project may adversely affect a listed species or designated critical habitat.<br><br>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species. | The proposed site storage area for the Stratton Ridge site, ROWs, and RWI may affect the Bald Eagle, a Federally threatened species that is proposed for de-listing, by removing potential foraging, roosting, and nesting habitat. The Bald Eagle has not been reported within the corridor. DOE would initiate formal Section 7 consultation with USFWS and prepare a Biological Assessment, and implement conditions of Biological Opinion if project may adversely affect these species or designated critical habitat.<br><br>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any Federally listed species. | No impact. |

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Biological Resources: Special Status Areas | The pipeline ROW to the Peetsville terminal would cross Natchez Trace Parkway, which is managed by the National Park Service (NPS). The proposed ROW follows existing utility and road corridors and is already disturbed. DOE would coordinate with the NPS to minimize the impacts to important natural resources.<br><br>Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas. | No special status areas would be affected by this alternative. | Clovelly site would be located adjacent to the Gulf ICW to Clovelly Hydrologic Restoration project, but would not affect the project.<br><br>Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status sites. | No special status areas would be affected by this alternative. | No special status areas would be affected by this alternative. | Pipeline to Liberty terminal would pass through 0.5 miles of the Percy Quin State Park. DOE would coordinate with the state park to select a route that would minimize the impacts to important natural and recreational resources.<br><br>Bayou Choctaw, Big Hill, and West Hackberry expansions would not affect any special status areas. | Crude oil pipeline ROW to Texas City and RWI, brine, and power line ROW would each pass through a portion of the Brazoria National Wildlife Refuge. RWI would be located across the ICW from the refuge. RWI construction and operations may affect sensitive wildlife and migrating birds that inhabit or stop at the refuge. DOE would coordinate with the USFWS and negotiate a final route and construction approach that minimizes the impact to natural resources. DOE would bury the power line through the refuge and use noise attenuation, down-shielded and low mast lighting at RWI to minimize impacts.<br><br>Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas. | No impact. |
| Biological Resources: Essential Fish Habitat | Big Hill expansion would cause minor salinity changes from the brine discharge to a small area of EFH in the Gulf of Mexico (modeling indicated a maximum increase of 4.7 parts per thousand). Impact to EFH would be minimal because it represents a very small fraction of the total EFH in the Gulf of Mexico and the managed species are generally tolerant of wider salinity changes than the predicted increase due to the brine discharge. | Chacahoula and Big Hill would have EFH impacts similar to Bruinsburg alternative. Chacahoula would discharge brine near Ship Shoal, an important fishing area. A small salinity increase may be experienced at Ship Shoal. Brine discharge pipeline construction would disturb 1,470,000 square feet of sediment that is EFH. | Clovelly and Big Hill expansion sites would have EFH impacts same as the impacts from Big Hill under Bruinsburg alternative. | Similar impact as under the Clovelly alternative, except that the brine discharge for the Clovelly and Bruinsburg alternative would have a shorter duration. | Similar impact to the Clovelly 80 MMB/Bruinsburg 80 MMB alternative, except that the brine discharge would have a slightly longer duration. | Richton and Big Hill expansion sites would have EFH impacts same as the impacts from Big Hill under Bruinsburg alternative. Brine pipeline construction would disturb 1,062 square feet of sediment that is EFH. | Stratton Ridge and Big Hill expansion sites would have EFH impacts same as the impacts from Big Hill under Bruinsburg alternative. Brine disposal pipeline construction would disturb 320,000 square feet of sediment that is EFH. | No impact. |
| Socioeconomics | Peak construction workforce of 474 for Bruinsburg site and its infrastructure.<br><br>Peak construction workforce of 100 to 350 employees at expansion sites.<br><br>Operations and maintenance workforce of 75 to 100 employees at Bruinsburg site and an additional 25 employees at each expansion site. | Peak construction workforce of 445 for Chacahoula and its infrastructure.<br><br>Same expansion site workforce as under Bruinsburg alternative.<br><br>Same operations and maintenance workforce as under Bruinsburg alternative. | Peak construction workforce of 238 for Clovelly and its infrastructure.<br><br>Same expansion site workforce as under Bruinsburg alternative.<br><br>Same operations and maintenance workforce as under Bruinsburg alternative. | Peak construction workforce of 548 for Clovelly and Bruinsburg and their infrastructure.<br><br>Same expansion site workforce as under Bruinsburg alternative.<br><br>Same operations and maintenance workforce as under Bruinsburg alternative, except that there would be 75 to 100 employees at both Clovelly and Bruinsburg. | Same as Clovelly 80 MMB/ Bruinsburg 80MMB.<br><br>Same expansion site workforce as under Bruinsburg alternative.<br><br>Same operations and maintenance workforce as under Clovelly 80 MMB/ Bruinsburg 80 MMB alternative. | Peak construction workforce of 499 for Richton and its infrastructure.<br><br>Same expansion site workforce as under Bruinsburg alternative.<br><br>Same operations and maintenance workforce as under Bruinsburg alternative. | Peak construction workforce of 431 for Stratton Ridge and its infrastructure.<br><br>Same expansion site workforce as under Bruinsburg alternative.<br><br>Same operations and maintenance workforce as under Bruinsburg alternative. | No impact; additional economic impact would not be generated. |

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Socioeconomics (continued) | Positive local economic benefits from increased employment. Small in-migration relative to regional population. No noticeable increase in competition for employment, traffic, or demand for housing or public infrastructure or services. | Similar socioeconomic impacts as under Bruinsburg alternative. | Similar socioeconomic impacts as under Bruinsburg alternative. | Similar socioeconomic impacts as under Bruinsburg alternative. | Similar socioeconomic impacts as under Bruinsburg alternative. | Similar socioeconomic impacts as under Bruinsburg alternative. | Similar socioeconomic impacts as under Bruinsburg alternative. | |
| Cultural Resources | Adverse effects to archaeological remains of Civil War activity at Bruinsburg, which could be mitigated. Residual (after mitigation) adverse effects on setting of Civil War landing area and march route.<br><br>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated. | Likely adverse effects to Native American and historic sites along Chacahoula pipeline routes, which could be mitigated.<br><br>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated. | Unlikely residual adverse effects at Clovelly.<br><br>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated. | Same as Bruinsburg and Clovelly alternatives together. | Same as Bruinsburg and Clovelly alternatives together. | Adverse effects to Native American archaeological sites within Richton facility boundary, which could be mitigated. Likely adverse effects to Native American archeological sites along Richton pipelines, which could be mitigated. Possible residual effects to feeling and setting of historic districts along pipelines and at terminal.<br><br>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated. | Adverse effects to Native American archaeological sites at Stratton Ridge facility and along pipelines, which could be mitigated. Possible residual effects to any historic settings along pipelines.<br><br>Possible effects to Native American sites at Big Hill, Bayou Choctaw, and West Hackberry, which could be mitigated. | No impact. |
| Noise | Noise from construction activities at the new and expansion sites would be audible, but the impacts would be minor.<br><br>Noise from operations and maintenance activities would be audible only at the expansion storage sites, where the impacts would be minor.<br><br>Noise from construction and operations and maintenance activities at the pipelines, terminals, and other infrastructure would have minor impacts. | Similar noise impacts as under Bruinsburg alternative, except that noise from operations and maintenance activities at the new site would be audible, but the impacts would be minor. | Similar noise impacts as under Bruinsburg alternative. | Similar noise impacts as under Bruinsburg alternative. | Similar noise impacts as under Bruinsburg alternative. | Similar noise impacts as under Chacahoula alternative. | Similar noise impacts as under Chacahoula. | No impact. |

**Table 2.8-1: Comparison of Impacts for Alternatives with Three Expansion Sites and No-Action Alternative**

| Resource | Bruinsburg | Chacahoula | Clovelly | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge | No-Action |
|---|---|---|---|---|---|---|---|---|
| Environmental Justice | The potentially affected populations include low-income, Black or African American, Native American or Alaska Native, Asian, and Hispanic or Latino populations. None of these populations would have impacts that appreciably exceed the impacts to the general population, or would be affected in different ways than the general population. Thus, there would be no disproportionately high and adverse impacts to low-income or minority populations. | Same environmental justice impacts as under Bruinsburg alternative. | Same environmental justice impacts as under Bruinsburg alternative. | Same environmental justice impacts as under Bruinsburg alternative. | Same environmental justice impacts as under Bruinsburg alternative. | Same environmental justice impacts as under Bruinsburg alternative. | Same noise impacts as under Bruinsburg alternative, except that the potentially affected communities also include Native Hawaiian or Other Pacific Islander communities. | No impact. |

## Table 2.8-2: Comparison of Impacts for Alternatives with Two Expansion Sites

| Resource | Bruinsburg | Chacahoula | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge |
|---|---|---|---|---|---|---|
| Environmental Risks and Public and Occupational Safety and Health | An increase of less than 0.1 predicted oil spills from the value presented in Table 2.8-1.<br><br>An increase of 7 more predicted oil spills than presented in Table 2.8-1.<br><br>No other notable changes. | * | * | A decrease of less than 0.2 predicted oil spills from the value presented in Table 2.8-1.<br><br>* | * | * |
| Land Use:<br>Land Use Conflicts | A decrease of 81 acres from the value presented in Table 2.8-1.<br><br>No change in land use conflicts as presented in Table 2.8-1. | * | * | * | * | * |
| Land Use:<br>Visual Resources | No notable change from Table 2.8-1. | * | * | * | * | * |
| Land Use: Farmland | A decrease of 120 acres of converted farmland from the value presented in Table 2.8-1. | * | * | * | * | * |
| Land Use:<br>Coastal Zone Management | The coastal zone associated with West Hackberry would not be affected. | * | * | * | * | * |
| Geology and Soils | No notable change from Table 2.8-1. | * | * | * | * | * |
| Air Quality | No notable change from Table 2.8-1. | * | * | * | * | * |
| Water Resources: Surface Water | The three water bodies at West Hackberry would not be affected by construction activities. | * | * | * | * | * |
| Water Resources: Groundwater | No additional risk to the sole-source aquifer from increased brine disposal at West Hackberry. | * | * | * | * | * |
| Water Resources: Floodplains | No notable change from Table 2.8-1. | * | * | * | * | * |
| Biological Resources: Plants, Wetlands, and Wildlife | A decrease of 5 acres of affected wetlands from the value presented in Table 2.8-1. | * | * | * | * | * |
| Biological Resources: Threatened and Endangered Species | * | * | * | * | * | * |
| Biological Resources: Special Status Areas | No notable change from Table 2.8-1. | * | * | * | * | * |
| Biological Resources: Essential Fish Habitat | No notable change from Table 2.8-1. | * | * | * | * | * |

## Table 2.8-2: Comparison of Impacts for Alternatives with Two Expansion Sites

| Resource | Bruinsburg | Chacahoula | Clovelly 80 MMB/ Bruinsburg 80 MMB | Clovelly 90 MMB/ Bruinsburg 80 MMB | Richton | Stratton Ridge |
|---|---|---|---|---|---|---|
| Socioeconomics | A construction workforce at West Hackberry would not be required. No increase in operations and maintenance workforce at West Hackberry. No local economic benefits from increased employment. | * | * | * | * | * |
| Cultural Resources | No possible effects to Native American sites at West Hackberry. | * | * | * | * | * |
| Noise | No notable change from Table 2.8-1. | * | * | * | * | * |
| Environmental Justice | No notable change from Table 2.8-1. | * | * | * | * | * |

* Same impacts as under Bruinsburg alternative.

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# Chapter 3  Affected Environment and Potential Impacts

## 3.1 INTRODUCTION

This chapter describes the affected environment and potential environmental impacts associated with the Proposed Action and Alternatives.  The following resources are addressed:

- Section 3.2 Environmental Risks and Public and Occupational Safety and Health,
- Section 3.3 Land Use,
- Section 3.4 Geology and Soils,
- Section 3.5 Air Quality,
- Section 3.6 Water Resources,
- Section 3.7 Biological Resources,
- Section 3.8 Socioeconomics,
- Section 3.9 Cultural Resources,
- Section 3.10 Noise, and
- Section 3.11 Environmental Justice.

Most resource sections follow a standard organization.

- First is a description of the methodology and pertinent background information, including relevant Federal and state regulations.

- Next is a discussion of common impacts, that is, the potential impacts that would be the same or similar across the proposed sites.  Discussing common impacts streamlines the document by reducing duplicative analysis across multiple sites.

- Then each proposed site and the no action alternative are analyzed in the following order:  (1) the proposed new sites:  Bruinsburg, Chacahoula, Clovelly, Clovelly and Bruinsburg, Richton, and Stratton Ridge; (2) the proposed expansion sites:  Bayou Choctaw, Big Hill, and West Hackberry; and (3) the no action alternative.

- The analysis of each site and associated infrastructure in organized in two parts:  description of the affected environment and analysis of the potential impacts.

The sections for a few resource areas, namely Environmental Risks and Public and Occupational Safety and Health, Socioeconomics, Noise, and Environmental Justice, are organized in a slightly different manner to simplify the presentation, while still distinguishing the methodology, affected environment, and potential impacts.

The potential impacts described in this chapter include direct and indirect impacts.  Direct impacts, as defined by the Council on Environmental Quality (CEQ) at 40 CFR 1508.8, are those impacts “which are caused by the action and occur at the same time and place.”  Indirect impacts are those impacts “which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.”  Both direct and indirect impacts include those impacts “resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.”

Chapter 4 analyzes cumulative impacts.

## 3.2 ENVIRONMENTAL RISKS AND PUBLIC AND OCCUPATIONAL SAFETY AND HEALTH

The development of an additional storage site and expansion of existing SPR sites would change the potential for accidents associated with construction, operations, and maintenance activities.  Greater activity levels typically increase risks; however, in some cases existing pipelines and other equipment would be replaced or modified, and these changes could reduce the potential for spills or the size of spills from this equipment.

This chapter analyzes the potential impacts associated with five categories of accidents at the proposed new or expansion SPR sites:

- Oil spills,
- Brine spills,
- Hazardous material spills,
- Fires, and
- Occupational (worker) injuries.

Section 3.2.1 summarizes the approach for this analysis, including a review of past accidents at existing SPR sites and how those experiences can be used to predict future incidents at the new and expansion sites.  Section 3.2.2 then describes the expected future risks associated with these accidents, including the likelihood of the accidents occurring and the potential consequences if they do occur.

### 3.2.1 Methodology

Risk analysis is a process for identifying and determining both the likelihood of occurrence and the potential consequences of undesirable events including spills of materials such as oil and brine.  Risk analyses allow decisionmakers to consider both the potential severity of such an event and its likelihood of occurrence, not just the upper bound consequences, no matter how unlikely they may be.  The key concept is:

*Risk considers both likelihood (or chance) of occurrence and potential consequences.*

For this draft EIS, DOE examined the likelihood of such events occurring at the new and expanded SPR sites based on the historical frequency of occurrence at the existing SPR sites as well as in other oil distribution activities.  The following sections review the historical frequency of oil spills, brine spills, hazardous material spills, fires, and occupational injuries.  The information in these sections is then used in section 3.2.2 to assess the likelihood and consequences of such accidents at the candidate SPR expansion sites.

#### 3.2.1.1 Oil Spills

Oil spills associated with the proposed SPR expansion could occur during marine transport of the crude oil to the United States, transfer of the oil to marine terminals from tankers, and transfer from the terminals to the SPR storage sites through pipelines.  If drawdown of SPR crude oil is required, the crude oil is again transported by pipeline to a terminal; from the terminal, the oil can enter the pipeline distribution system or be loaded onto ships or barges for transport to refineries.  Thus, crude oil spills can occur during the fill or refill of storage caverns, as well as during drawdown and distribution.

When drawdown is required, the SPR site would need to be refilled.  The crude oil spill risks of refill would be comparable to those of fill.  Drawdown itself is complicated because the SPR crude oil is a replacement for imported oil.  Drawdown and distribution result in shifts between transportation modes as the supply source changes from imports to the caverns, but roughly the same amount of oil is handled in each case.

While accidental releases can occur during long-term storage, the risk of a spill generally is dominated by transfer activities.  Furthermore, the maximum quantity filled occurs with the initial fill.  This initial-fill activity also represents the greatest incremental chance of spills of all the potential for a spill associated with current import activities because subsequent drawdowns and refills basically would just replace a transfer of oil from an import activity.  This analysis focuses on the likelihood of an oil spill during initial-fill activities.  Because it is not possible to predict how often or when a cavern would be drawn down and refilled, DOE did not attempt to provide quantitative estimates of the number and size of oil spills during operations (although section 3.2.2.1 does discuss the types of impacts that would occur if an oil spill did occur, including spills from operations).

Historic oil spill rates can be used as a reasonable indicator of the probable chance of accidental oil releases to the environment resulting from operations at an SPR site.  Historic data might result in a higher or more conservative estimate of the likelihood of an oil spill because these statistics do not consider improvements in technology, spill control procedures, and operating procedures.  New regulations, technology, and updated procedures could significantly reduce the chance of future spills.

The historic rates of oil spills during fill or refill for each of the proposed new and expansion storage sites are summarized in the following separate sections addressing spills from vessels, bulk transfer from terminals, pipelines, and storage sites.  Spills from vessels, terminals, and storage sites are a function of the storage site capacity (generally as a surrogate for activity levels), and spills from pipelines are a function of both site capacity and pipeline length.  The rates derived below are then applied to the particulars of each new and expansion site in section 3.2.2.1 to predict the number and size of spills associated with the proposed action.

***Vessels***

The Minerals Management Service of the U.S. Department of the Interior has maintained an oil spill database of U.S. tanker spills since the 1970s.  Using that database, the Minerals Management Service estimated oil-spill occurrence, normalized as a function of the volume of oil handled (Anderson and LaBelle 2000).  Only spills greater than 1,000 barrels were addressed because of the likelihood that larger spills probably would be identified and reported, and they are more likely to persist and cause impacts than smaller spills.  Based on reviewing the annual Minerals Management Service data, DOE observed that rates for crude oil spills from tankers in U.S. waters have decreased significantly over time.

Minerals Management Service data on spills from international transportation of crude oil during the period 1974 to 1985 are described in the 1992 SPR expansion draft EIS (DOE 1992a).  That draft EIS reports rates of 0.090 spills per 100 million barrels transported in offshore waters and 0.040 spills per 100 MMB transported in harbors or at piers.  For U.S. waters, the spill rate in harbors and at piers is higher than the spill rate in offshore waters.  Using 1985 to 1999 data from the Minerals Management Service, the rates are 0.044 spills per 100 MMB in harbors and at ports and 0.029 spills per 100 MMB in offshore waters, or a combined rate of 0.073 spills per 100 MMB from tankers (Anderson and LaBelle 2000).  DOE used the combined rate of 0.073 spills per 100 MMB in this draft EIS analysis.

***Terminals***

The 1992 draft EIS estimates a rate of 3.3 spills per 100 MMB from terminal transfer operations.  This rate is based on the total number of U.S. oil spills from marine transfer operations and the total volume of crude oil and refined petroleum products imported and transferred during 1983 to 1986. This estimate has been revised based on the number of crude oil shoreline spills from the U.S. Coast Guard database and the total waterborne commerce for crude petroleum during 1999 to 2001. During that period, there were 967 shoreline spills and approximately 15.6 percent of all spills were of crude oil, so the revised estimate is 151 crude oil shoreline spills and 11,746 million barrels of crude oil in waterborne commerce, or 1.29 spills per 100 MMB. DOE uses the rate of 1.29 spills per 100 MMB in this analysis.

***Pipelines***

The U.S. Department of Transportation (DOT) Office of Pipeline Safety maintains a database of reportable pipeline accidents. Reportable accidents are those with gross loss greater than or equal to 50 barrels (2,100 gallons); any fatality or injury; a fire or explosion not intentionally set; highly volatile liquid releases with gross loss of 5 or more barrels; or total costs greater than or equal to $50,000 (DOT 2005). During 1996 to 1999, there were 312 reportable crude oil pipeline accidents. Most of those accidents involved spills of 2,100 gallons (7,900 liters) or more. For that same period, there were 145 crude oil pipeline spills of 10,000 gallons (38,000 liters) or more, of which 33 were more than 100,000 gallons (380,000 liters) (Cutter Information Corp. 2001). According to the Bureau of Transportation Statistics, 1,330.9 billion ton-miles (1,900 ton-kilometers) of crude oil were transported by pipelines in the United States during this period (DOT 2005a).

In a more recent period, 2000 to 2003, the Office of Pipeline Safety reported a total of 225 crude oil pipeline accidents, and the Bureau of Transportation Statistics reported a movement of 1,131.5 billion ton-miles (1,700 billion ton-kilometers) of crude oil through pipelines. These data correspond to accident rates of 0.23 accidents per 100 million ton-miles (150 million ton-kilometers) transported for 1996 to 1999 and 0.20 accidents per 100 million ton-miles transported for 2000 to 2003. Based on a conversion factor of 7 barrels per ton (6.3 barrels per metric ton), the spill rate would be about 0.0028 accidents per 100 million barrel-miles for the 2000 to 2003 period. This rate is somewhat higher than the spill rate for pipelines estimated in the 1992 draft EIS (DOE 1992a), which was 0.0021 spills per 100 million barrel-miles. For this draft EIS, DOE uses the higher rate of 0.0028 spills per 100 million barrel-miles for analysis.

***Storage Sites***

Onsite spills typically are identified quickly, and they are likely to be contained, limiting the potential for reportable spills (i.e., those that enter waterways). During 2001 to 2004, there were 6 reportable oil spills from the existing SPR storage sites, none of which were greater than 10 barrels. The oil spills were reported to the appropriate agencies and cleaned up with no observable environmental damage, according to the annual Environmental Reports published by DOE. A substantially lower number of oil spills per year occurred in the 2001 to 2004 period than in previous years. For example, in an earlier period (1987 to 1990) described in the draft EIS (DOE 1992a), a total of 33 spills occurred at the existing SPR storage sites. Three of these spills exceeded 100 barrels and 25 of the 33 spills were less than 10 barrels. Furthermore, the amount of oil received by SPR during 2001 to 2004 was 69.3 MMB more than was received during 1987 to 1990, showing a large decrease in spills per amount received (EIA 2005). The oil spill rate decreased from 42.3 spills per 100 MMB of crude oil received in 1987 to 1990 to 4.3 spills per 100 MMB of crude oil received in 2001 to 2004. The rate of 4.3 spills per 100 MMB was used in this analysis.

#### 3.2.1.2 Brine Spills

Table 3.2.1-1 summarizes data on brine spills from 22 years of operational experience at the existing SPR sites. The table also identifies the percentage of the brine spilled as a fraction of the total brine volume

**Table 3.2.1-1: Reportable Brine Spills from Pipeline Systems at Existing SPR Sites**

| Year | Total Spills | Volume Transferred in Pipeline System (MMB) | Number of Spills per MMB of Brine Transferred | Volume Spilled (barrels) | Percentage of Total Throughput Spilled |
|---|---|---|---|---|---|
| 1982 | 43 | 558 | 0.077 | 2,792 | 0.0005 |
| 1983 | 44 | 816 | 0.054 | 1,632 | 0.0002 |
| 1984 | 17 | 558 | 0.031 | 1,975 | 0.0004 |
| 1985 | 16 | 464 | 0.035 | 607,000 | 0.1308 |
| 1986 | 7 | 87 | 0.081 | 1,734 | 0.0019 |
| 1987 | 22 | 212 | 0.104 | 608 | 0.0003 |
| 1988 | 12 | > 6.3 | NA | 586 | 0.0001 |
| 1989 | 17 | 591 | 0.029 | 825,512 | 0.1395 |
| 1990 | 12 | 439 | 0.027 | 74,650 | 0.017 |
| 1991 | 7 | 415 | 0.017 | 7,230 | 0.002 |
| 1992 | 9 | 11 | 1.23 | 302 | 0.003 |
| 1993 | 6 | 33 | 0.182 | 370 | 0.001 |
| 1994 | 2 | 15 | 0.133 | 90 | 0.0006 |
| 1995 | 3 | 29 | 0.103 | 825 | 0.0028 |
| 1996 | 5 | 80 | 0.062 | 30 | 0.00004 |
| 1997 | 0 | 38 | 0 | 0 | 0 |
| 1998 | 2 | 14 | 0.143 | 39 | 0.0003 |
| 1999 | 0 | 18 | 0 | 0 | 0 |
| 2000 | 0 | 18 | 0 | 0 | 0 |
| 2001 | 1 | 21 | 0.048 | 0.12 | 5.60 x 10-7 |
| 2002 | 2 | 53 | 0.038 | 13 | 3.9 x 10-6 |
| 2003 | 0 | 47 | 0 | 0 | 0 |
| Total | 227 | 4,523 | 0.050 | 1,525,388 | 0.033 |

MMB = million barrels

Source: DOE Site Environmental Reports for 1982 to 2003

transferred in the pipeline systems. Very large spill volumes occurred in 1985 and 1989, and a sizable spill occurred in 1990. Two spills accounted for almost all of the volume spilled in 1985 (one very large and one large), and no environment impacts were observed from either of these spills. In 1989, the one very large spill originally affected 8 acres (3.2 hectares) of marsh, but strong regrowth was seen in less than one year (Boeing Petroleum Services Inc. 1990b and 1990c). In 1990, a large spill directly into the Gulf of Mexico caused no adverse environmental impacts (Bozzo 1991).

#### 3.2.1.3 Hazardous Material Spills

As discussed in section 2.3.10, spills of hazardous materials from SPR sites must be reported and recorded under several Federal and state laws and regulations, as well as SPR site operating procedures. The type and size of hazardous material spills recorded at existing SPR sites for the years 2003 and 2004 (the most recent years for which data are available) are presented in table 3.2.1-2. As shown, the spills of hazardous materials at existing SPR sites have been infrequent and small. Nine spills have occurred at three of the existing sites and none at the other existing site (Bryan Mound) during the two-year period.

**Table 3.2.1-2: Existing SPR Site Spills Other than Crude Oil and Brine from 2003 to 2004**

| Material | Site | Quantity | Description |
|---|---|---|---|
| Lubricating oil | Big Hill | 10 gallons | Spill occurred during transfer of material from bulk storage to 30-gallon day tank; spill was contained and cleaned up. |
| Diesel fuel | West Hackberry | 3 gallons | Spill occurred from day tank of emergency diesel generator. |
| Battery acid | Bayou Choctaw | 2 gallons | Spill occurred in truck maintenance area from overturned truck battery; spill occurred on concrete pad and was remediated. |
| Hydraulic oil | West Hackberry | 4 gallons | Contractor truck hydraulic hose failed causing release of hydraulic oil onto the ground; cleanup complete. |
| Hydraulic fluid | Bayou Choctaw | 0.5 gallons | Release occurred when a seal came off the manlift drive motor; the area was cleaned up immediately. |
| Raw sewage | Big Hill | Several gallons | Sewage Lift Station #4 overflowed small amount of sewage into sump area and surrounding grass. Pump auto selector switch and station high-level alarm failed to operate properly. |
| Hydraulic fluid | Big Hill | 0.5 gallons | Contractor forklift leaked hydraulic fluids onto surrounding soil. |
| Hydraulic fluid | Bayou Choctaw | 0.5 gallons | Hydraulic fluid leaked when onsite O-ring manlift blew out, causing spill onto building, 401 parking lot; spill cleaned up and new O-ring installed. |
| Brine pit sludge | Bayou Choctaw | 2 gallons | A vacuum-box truck in use for brine pond clean up leaked pit sludge on the roadway outside of the entrance gate. |

1 gallon = 0.0037854 cubic meters

Source: SPR Nonreportable Spills (DOE 2003b, 2004h)

This experience suggests that each of the candidate new sites could have one spill a year (9 spills divided by 4 sites divided by 2 years). Most of these spills could be expected to be in the 0.5- to 4-gallon (1.9- to 15-liters) range, although they could be as large as 10 gallons (38 liters). Larger or more frequent spills, or both, are certainly possible, but they are not considered likely based on the limited volumes of hazardous materials at the sites.

#### 3.2.1.4 Fires

Table 3.2.1-3 summarizes reportable fire incidents for the existing SPR sites and terminals from 1992 to 2004. The table summarizes the circumstances of the incident and the SPR operator response. Reportable fire incidents at SPR sites and terminals include electrical fires, vehicle fires, crude oil fires, ignition of combustible gas, and other incidents for which SPR operator response and reporting was required. Several of the reported incidents resulted in minor injuries to SPR site workers or subcontractors or damage to operating equipment. None of the reported incidents resulted in environmental impacts or any long-term impacts to SPR site operations. One incident, an electrical switchgear fire at the St. James Terminal in 1994, required operation of the primary and backup

**Table 3.2.1-3: Reported Fire Incidents at Existing SPR Sites and Terminals**

| Site | Year | Incident | Response |
|---|---|---|---|
| Big Hill | 1992 | Before pipeline repair work, gas tests taken inside the pipe at the drain point and at the repair point showed that no combustible gas was present. Welding began within 15 minutes of the gas test; after approximately 4 inches of weld, a flash occurred inside the pipe. Root cause: combustible gas collected in the line after the gas test was performed. | The operator used the wheel fire extinguisher to ensure no fire was in the underground piping. Maintenance workers installed a nitrogen packer to prevent reoccurrence. Job Safety Analysis was revised to include the use of a pipe balloon during all welding operations on the inside of pipes regardless of whether gas has been detected. |
| Bayou Choctaw | 1992 | A rental, portable centrifugal pump was in use to pump brine from the northern pond into the southern pond. Site security personnel observed that one of the pump tires was on fire. Root cause: electrical short circuit. | Operations personnel extinguished the fire using a fire extinguisher. New procedures were developed to inspect rental equipment. |
| Bryan Mound | 1993 | Shift supervisor entered control room and saw smoke pouring out of the Realflex meter system enclosure. A pre-alarm sounded and the operator manually activated the halon system; control room building was evacuated. Root cause: when replacement actuator was first installed it was powered with 115 VAC rather than 24 VAC because updated, as built drawings were not provided to allow the actuator to be connected correctly. | Emergency Response Team responded with fire truck. Two personnel using self-contained breathing apparatus investigated the control room. Library was purged of out-of-date drawings and procedures were reinforced so that correct as-built drawings must be furnished as soon as possible after any configuration change and task should not be closed until drawings have been completed and verified. |
| St. James Terminal | 1994 | Subcontractor reported loud noise and smoke coming from switchgear building. The switchgear appeared to be arcing from the load side to the line side, causing extensive heat, which in turn created fire. Root cause: misalignment of main incoming breaker; attributed to lack of adequate SPR-wide maintenance procedures and lack of adequate supervision by technical experts who could verify that existing maintenance procedures were performed and performed correctly; also, a lack of adequate ground-fault protection built into original switchgear design. | Site Emergency Response Team extinguished the fire after all power was confirmed de-energized. Incident caused site to be without commercial power to operate main line crude oil booster pumps. The main site's (350-kilowatt) emergency generator along with the site's spare (169 kilowatt) emergency generator was used to power the facility. Team identified 16 corrective action items. With the completion of all such items, probability of recurrence reduced. |
| Bayou Choctaw | 1995 | While attempting to check power on an actuator for a valve, a bolt of fire came from the rear of actuator. Electrician received minor burns. Incident most likely result of conductive contamination on wire insulation that reduced the insulating properties of the conductor, allowing the initial flash. Root cause: design of actuator power terminals and insulating barrier; terminals extend above insulating barrier. | Operations personnel locked out 480-volt actuator supply voltage at motor control center. New safety equipment was provided for electricians to test voltage of actuators. New procedures were established for electricians and instructions provided on how to clean wires of contamination. |

**Table 3.2.1-3: Reported Fire Incidents at Existing SPR Sites and Terminals**

| Site | Year | Incident | Response |
|---|---|---|---|
| Bayou Choctaw | 1998 | During grinding activities associated with out-of-service pipeline demolition, a vapor flash and loud noise occurred inside and around opening of pipe that previously was cold cut. Worker who experienced ear pain was examined by doctor and released. Direct cause was insufficient low explosive level (LEL) gas monitoring. Monitoring was performed only before task start up and not during the task performance to take into account changing conditions. Root cause: lack of clarity in safe work procedure. | Demolition work immediately shutdown pending a worksite investigation. Work resumed after investigation complete and corrective action taken. Safe work procedure revised to require that hot work tasks and related precautions be specifically identified. With completion of the corrective action, probability of this type of event recurring is reduced. |
| Bryan Mound | 1999 | Supervisor observed oil and white smoke coming from a flange on crude oil line. Contractor was in process of tightening bolts on the flange when apparent flash occurred and oil started coming out of the flange. About 6 gallons of crude oil estimated to have leaked out of the flange were confined in construction excavation. Personnel evacuated with no injuries. Root cause: contractor using a propane torch to apply heat shrink to the flange weld caused flash. Records do not indicate that LEL readings were taken within 30 minutes of commencement of hot work, as required by hot work permit. | Emergency Response Team responded with a fire truck and cooled the pipe with water from the fire truck. The oil in the excavation was covered with foam. Nitrogen was injected into the crude oil line upstream of the flange location to extinguish, inert, and cool the inside of the line. Continuous gas monitoring was implemented for all pipe tie-in work to ensure that any combustible gas is immediately detected and hot work shut down before ignition or an unsafe condition occurs. |
| West Hackberry | 2002 | Subcontractor operated track hoe fitted with special equipment for clearing trees. Heavy brush caught fire outside the site perimeter fence. No injuries were associated with the incident. Root cause: a pinhole leak apparently developed in the hydraulic hose allowing hydraulic fluid to spray directly onto the exhaust manifold, which ignited. | Track hoe operator was unable to extinguish fire with fire extinguisher. Site fire truck arrived on scene and used combination of water and dry chemical to extinguish the fire. West Hackberry fire department provided support. |
| Big Hill | 2003 | A small fire in the battery box caused a subcontractor bulldozer operator to jump off vehicle, causing a back injury. Fire was caused by aerosol can of starter fluid contacting battery. Operator required transport to local hospital for treatment. Root cause: subcontractor did not complete equipment checklist and did not maintain protective battery cover. | Personnel in the area immediately extinguished the fire with a dry chemical fire extinguisher. The established site operator and subcontractor procedures for equipment inspection were reviewed and reinforced. |
| Big Hill | 2004 | While an employee was drilling a hole in a swinging gate frame constructed of tubular steel, the drill bit penetrated the gate frame, and apparently flammable vapors trapped inside the tubing were released and ignited, causing a flash fire. Employee received first and second degree burns. Root cause: a biological material contaminant located inside the gate frame tubing at the time of assembly by shipbuilding and repairing industry. | The biological containments had not been previously identified at SPR sites. A lessons-learned notice was issued to all sites concerning this previously unknown hazard. |

emergency generators at the St. James terminal, although no interruption in SPR site drawdown operations resulting from the incident was reported. The reportable fire incidents summarized in table 3.2.1-3 were subject to first response by the SPR site operators and Emergency Response Team, incident reporting, investigation, and root-cause analysis. Corrective actions were implemented for the reported incidents to reduce the probability of reoccurrence.

In 1978, during the workover of a well, a very large well pad fire caused a severe injury and one death. The non-burning oil spilled into Black Lake and was contained and recovered. Subsequent monitoring found that oil contamination was restricted to a small portion of Black Lake (NOAA 1992).

#### 3.2.1.5 Occupational Injuries

To analyze the potential impacts of expanding the SPR on the number of occupational injuries, DOE obtained the incident rate of worker injuries and illnesses at existing SPR facilities and at comparable industrial facilities. DOE also obtained information regarding the safety and health management systems of the contractor currently operating the SPR.

### 3.2.2 Impacts Common to All Alternatives

This section uses the historical accident rates described earlier to estimate the likelihood of new accidents associated with the proposed action. Included in the discussion is a projection of the possible consequences associated with each type of accident, if they were to actually occur.

#### 3.2.2.1 Oil Spills

Table 3.2.2-1 presents the estimated number of oil spills associated with initial filling operations at each of the proposed new and expansion sites. With increased volumes moving in drawdown and refill operations, the overall potential for spills would increase proportional to the amount of drawdown and refill. A total drawdown and total refilling of the site is expected to be an extreme case for the activity in a single year. The values in table 3.2.2-1 represent a reasonable upper bound of the number of oil spills anticipated during any year of SPR storage site operation. Moreover, as stated above, only the initial fill activity would be a new activity when looking at overall oil distribution activities. Subsequent drawdown and refills would be replacements for import-related transfer activities.

**Table 3.2.2-1: Oil Spill Predictions by Site for Initial Fill**

| SPR Site | New Site Capacity/ Generation | Pipeline Length (miles) | Predicted Number of Oil Spills per Given Capacity | | | | |
|---|---|---|---|---|---|---|---|
| | | | Vessel | Terminal | Pipeline | Storage Site | Total |
| **Bruinsburg**[a] | | | | | | | |
| Pipeline to Peetsville | 160 MMB | 38 | 0.12 | 2.06 | 0.17 | 6.88 | 9.2 |
| Pipeline to Anchorage | 160 MMB | 109 | 0.12 | 2.06 | 0.49 | 6.88 | 9.6 |
| **Chacahoula**[a] | | | | | | | |
| Pipeline to St. James Terminal | 160 MMB | 22 | 0.12 | 2.06 | 0.10 | 6.88 | 9.2 |
| Pipeline to Clovelly | 160 MMB | 53 | 0.12 | 2.06 | 0.24 | 6.88 | 9.3 |
| **Clovelly** | | | | | | | |
| Pipeline from LOOP | 120 MMB | 25 | 0.09 | 1.55 | 0.08 | 5.16 | 6.9 |
| **Clovelly 80 or 90 MMB and Bruinsburg 80 MMB**[a] | | | | | | | |
| Pipeline to Vicksburg | 80 MMB | 31 | 0.06 | 1.03 | 0.07 | 3.44 | 4.6 |
| Pipeline to Jackson | 80 MMB | 54 | 0.06 | 1.03 | 0.12 | 3.44 | 4.7 |
| Pipeline from LOOP | 80 MMB | 25 | 0.06 | 1.03 | 0.06 | 3.44 | 4.6 |
| Pipeline from LOOP | 90 MMB | 25 | 0.07 | 1.16 | 0.06 | 3.87 | 5.2 |
| **Richton**[a] | | | | | | | |
| Pipeline to Pascagoula | 160 MMB | 88 | 0.12 | 2.06 | 0.39 | 6.88 | 9.5 |

**Table 3.2.2-1: Oil Spill Predictions by Site for Initial Fill**

| SPR Site | New Site Capacity/ Generation | Pipeline Length (miles) | Predicted Number of Oil Spills per Given Capacity | | | | |
|---|---|---|---|---|---|---|---|
| | | | Vessel | Terminal | Pipeline | Storage Site | Total |
| Pipeline to Liberty | 160 MMB | 116 | 0.12 | 2.06 | 0.52 | 6.88 | 9.6 |
| **Stratton Ridge** | | | | | | | |
| Pipeline to Texas City | 160 MMB | 38 | 0.12 | 2.06 | 0.17 | 6.88 | 9.2 |
| **Bayou Choctaw** | | | | | | | |
| Pipeline to St. James | 20 MMB | 37 | 0.01 | 0.26 | 0.02 | 0.86 | 1.2 |
| Pipeline to St. James | 30 MMB | 37 | 0.02 | 0.39 | 0.03 | 1.29 | 1.7 |
| **Big Hill** | | | | | | | |
| Big Hill 72 | 72 MMB | 17 | 0.05 | 0.93 | 0.03 | 3.1 | 4.1 |
| Big Hill 80 | 80 MMB | 17 | 0.06 | 1.03 | 0.04 | 3.44 | 4.6 |
| Bill Hill 84 | 84 MMB | 17 | 0.06 | 1.08 | 0.04 | 3.61 | 4.8 |
| Big Hill 96 | 96 MMB | 17 | 0.07 | 1.24 | 0.05 | 4.13 | 5.5 |
| Big Hill 108 | 108 MMB | 17 | 0.08 | 1.39 | 0.05 | 4.64 | 6.2 |
| **West Hackberry** | | | | | | | |
| West Hackberry | 15 MMB | 0 | 0.01 | 0.19 | — | 0.65 | 0.85 |

Notes:

[a] Oil spill predictions are not cumulative. The oil spill predictions are based on the total storage capacity of the site traveling through one pipeline.

MMB = million barrels

1 mile = 1.6093 kilometers

As shown in table 3.2.2-1, initial fills are estimated to cause anywhere from two oil spills at Bayou Choctaw up to almost 10 oil spills at Bruinsburg, Chacahoula, Richton, or Stratton Ridge, (i.e., any of the sites with an expected addition of 160 MMB in capacity). Most of these spills would be expected at the storage sites, with a smaller number of spills at the associated terminals. The number of oil spills associated with shipping vessels and pipeline operations is predicted to be less than one in every case. Based on historic spill statistics, which account for measures used to contain spills that do occur, the majority of the predicted oil spills would be of low volume. For example, the spills from storage sites would be expected to be less than 100 barrels based on a review of the spills that have occurred to date at the SPR sites.

The potential consequences of such infrequent, small accidental releases of oil are expected to be minor. They could result in localized soil contamination at the storage sites and terminal locations, which would be contained and cleaned up. At the same time, such small oil spills would result in some contaminants migrating into the air, including volatile components (such as toluene and benzene) and sulfur compounds (predominantly mercaptans and hydrogen sulfide gas). While such air contaminants can have toxic effects to both wildlife and people through inhalation (Park and Holiday 1999), they are expected to be released from SPR operations so infrequently and in such small quantities that they would be readily dispersed in the atmosphere and have little effect on ambient air quality along site boundaries.

The impacts of spilled oil on surface water resources or wetlands would vary depending on the amount of oil introduced and the characteristics of the receiving environment. Again, these impacts associated with the proposed action are not expected to be significant because any resulting oil spills in these areas are expected to be infrequent and small. Nevertheless, if a large spill were to occur, the immediate impact would be the presence of a layer or slick of oil floating on the water surface. This slick would pose the potential for damage to physical assets and for negative health effects to wildlife, domestic animals, or people that come into contact with it through dermal exposure to toxic compounds in the oil (Park and Holiday 1999). Where the slick reaches vegetated wetland and shore areas, the oil would adhere to vegetation. Within a short time after any significant spill, DOE's emergency response procedures would be in operation, acting to contain the oil slick to a limited area and remove as much oil as possible from the environment. Under normal conditions only relatively small amounts of oil would be expected to escape this response action and remain uncontained in the environment.

Wind, waves, and currents would work to disperse any such uncontained oil, breaking up oil slicks into droplets or smaller slicks dispersed over a wide area (assuming a sufficiently large receiving water body). As mentioned, volatile components of the oil would evaporate, leaving behind heavier components that would begin weathering or breaking down into degradation products through a series of physical and chemical processes. Some of these products would be denser than water and sink into the water column and to the floor of the water body. Some components of the oil would oxidize to water-soluble compounds, and then dissolve into and disperse within the water column, posing potential health risks to wildlife and people through ingestion and bio-uptake. Many of the heavy oil components may only partially oxidize, forming tar balls. These dense spheres would sink to the bottom of the water column and could linger in the environment, collecting in bottom sediments. Some oil components could be removed from the water column through biodegradation and bio-uptake. Biodegradation would be more rapid in warm, nutrient-rich environments. In high-energy environments, oil-water emulsions can be formed through the action of waves or strong currents. Because of their tendency to sink to the bottom of the water column, oil-water emulsions also tend to sink to the bottom of the water column, and they could remain in the environment for months or years (EPA 2006).

Where oil spill response efforts contain and remove most spilled oil from the surface water environment, the impacts described earlier would be expected to occur at very limited levels. These impacts would be more pronounced in smaller, low-energy water bodies where little dispersion or dilution could take place and the effects of any uncontained oil would be concentrated in a smaller area. Oil remaining in rivers with strong flow or tidal flushing and in estuaries or the Gulf of Mexico, would disperse more rapidly, resulting in milder impacts over a wider area.

In some cases, the DOE oil spill response effort may involve the use of chemical dispersants. Dispersants remove spilled oil from the water surface by causing the oil to partially break down into products that are soluble in the water column or denser than water and sink. This could reduce impacts associated with the surface oil slick, and prevent the movement of floating oil into sensitive surface environments (marshes, shoreline areas). On the other hand, the use of chemical dispersants could increase the impacts of spilled oil on subsurface aquatic environments and organisms. Areas where dispersants were used on spilled oil would exhibit elevated concentrations of oil components, including toxic compounds, in the water column, and deposition of dense, insoluble oil components on the water-body floor. The decision on dispersant use is driven by an analysis of this trade-off, and identification of the course that would lead to the least environmental impact.

#### 3.2.2.2 Brine Spills

Table 3.2.2-2 presents the expected number of brine spills associated with the cavern construction and initial fill at each site evaluated in this draft EIS. These estimates were developed using the volume of oil that would be handled during initial fill at each site, the SPR experience that 7 MMB of brine are generated for every 1 MMB of storage capacity formed within a cavern, and the historic brine spill rate described in section 3.2.1.2.

**Table 3.2.2-2: Predicted Number of Brine Spills by Site for Cavern Construction and Initial Fill**

| SPR Site | Brine Generation[a] | Source of Spill | Pipeline Length (miles) | Predicted Number of Brine Spills[b] |
|---|---|---|---|---|
| Bruinsburg | 1,120 MMB | Brine pipeline | 14 | 56 |
| Chacahoula | 1,120 MMB | Brine pipeline | 59 | 56 |
| Clovelly | 840 MMB | Brine pipeline | 0 | 42 |
| Clovelly 80 MMB and Bruinsburg 80 MMB | 1,120 MMB assumes even split | Bruinsburg brine pipeline | 8 | 28 |
| | | Clovelly brine pipeline | 0 | 28 |
| Clovelly 90 MMB and Bruinsburg 80 MMB | 1,190 | Bruinsburg brine pipeline | 8 | 28 |
| | | Clovelly brine pipeline | 0 | 30 |
| Richton | 1,120 MMB | Brine pipeline | 100 | 56 |
| Stratton Ridge | 1,120 MMB | Brine pipeline | 10 | 56 |
| Bayou Choctaw | 140 to 210 MMB | Brine pipeline | 1 | 7 to 10 |
| Big Hill | 560 to 756 MMB | Brine pipeline | 1 | 28 to 38 |
| West Hackberry | 15 MMB[c] | Brine pipeline | Unknown | <1 |

Notes:

[a] Brine generation calculated as new oil storage capacity multiplied by seven
[b] During the entire construction period
[c] Brine discharge associated with initial fill

1 mile = 1.6093 kilometers

As shown in table 3.2.2-2, initial cavern creation and fill activities at each site are predicted to cause anywhere from less than one brine spill at West Hackberry to up to 56 brine spills at Bruinsburg, Chacahoula, Richton, and Stratton Ridge. Based on historic spill statistics and measures that would be in place to detect and stop brine spills when they occur, these estimated brine spills most likely would be of low volume (less than 50 barrels). Higher-volume brine spills, while possible, are very unlikely based on SPR experience.

If a brine spill occurs, its impacts would depend on the size of the spill and the characteristics of the receiving environment. Spills to surface soils could result in those soils having greatly increased salt concentrations that prohibit the growth of vegetation in affected areas. Unless the spills are large or sustained, neither of which is predicted for the proposed action, the brine contaminants would be flushed away by rain and affected soils and vegetation would quickly recover.

Brine spills also could affect groundwater and air quality, although these impacts associated with the proposed action would be expected to be small considering the predicted frequency and magnitude of spills. In particular, shallow aquifers could experience small plumes of elevated salinities that would migrate readily along with the groundwater flow and dilute to normal levels some distance from the spill source. In addition, surface spills could result in emissions of nonmethane hydrocarbons to the air, but such emissions could be expected to be small, temporary, and of little consequence to air quality.

The impacts of brine spills to surface waters and wetlands would depend largely on the characteristics of the resources affected. A brine spill would result in the elevation of chloride concentrations to well above natural levels. Chloride concentrations could range to nearly the level of undiluted brine (greater than 200 parts per thousand) near the point of introduction of the brine. Chloride levels would decrease with distance from the spill site and over time, and through the actions of dilution, dispersion, and flushing in the receiving water body.

Although chloride is essential to life, at high concentrations it is toxic to most organisms. Chloride concentrations could exceed the acute and chronic toxicity criteria for aquatic life near the point of a spill immediately after the spill occurred. With time after a brine spill, chloride concentrations in the receiving water body gradually would return to normal (pre-spill) levels. The time required for return to normal levels would be site-specific and depend largely on the degree of flushing in the receiving waters.

The impacts of brine spills on surface water and wetland, and the rate of chloride dissipation in those resources, have been measured and observed in the aftermath of previous brine spills. These observations provide an indication of the likely impacts of brine spills resulting from the proposed SPR expansion. A very large brine spill occurred at Bryan Mound in 1989. Brine from that spill reached surrounding surface waters including the ICW. No impacts to surface water, sediment quality, or biota were observed in the ICW despite the significant volume of brine released to this water body. In the ponds and the moderately drained marshland affected by the spill, chloride concentrations in surface waters and sediments initially were elevated, but they returned to normal (pre-spill) levels within two months. In the poorly drained marshland affected by the spill, chloride concentrations returned to normal within four months. The decay of organic matter in some ponds caused temporarily depressed levels of dissolved oxygen and increased temperatures (Boeing Petroleum Services Inc. 1990b, 1990c).

#### 3.2.2.3 Hazardous Material Spills

As discussed in section 3.2.1.3, the proposed action would be expected to result in one hazardous material spill per year at each of the candidate new sites. Most of these spills would be expected to be in the 0.5- to 4-gallon (1.9- to 15-liters) range, although they could be as large as 10 gallons (38 liters).

The potential environmental consequences of a spill depend on the type of hazards posed by the material, the amount of the spill, and the location of the spill. In general, the spills are expected to be infrequent and generally involve small quantities of materials spilled onsite that are relatively easily remediated or contained onsite, and therefore, they would have negligible impact on the environment. This is demonstrated through the Annual Environmental Reports covering spills at each of the existing sites (DOE 2004f).

Pesticides and herbicides are used in limited and controlled quantities at the existing SPR sites. An accident scenario would involve the spill of 1 or 2 gallons (3.8 to 7.6 liters) of a pesticide compound during manual application. In a spill, protection of aquatic systems would be a high priority because pesticides and herbicides used on site (e.g., Rodeo® by Monsanto) are highly toxic to fish. Pesticides and herbicides also might adhere to sediments; however spills of 1 or 2 gallons (3.8 to 7.6 liters) of pesticide or herbicide would require relatively uncomplicated and localized cleanup. Minor impacts to plant life would occur only in the immediate vicinity of the spill. Because contaminated soil would be collected and disposed of offsite at an approved disposal facility, no long-term impacts on groundwater or surface water would be expected.

Fire protection chemicals (e.g., aqueous film-forming foam) are stored in relatively large quantities at the existing SPR sites. In a fire, any aqueous film foam released would be captured in collection ponds that border each fixed fire-control system, thus preventing the compound from reaching groundwater or surface water. These collection ponds are generally large enough to retain one discharge. Releases outside of the containment could occur in high winds or storms when the chemicals could be blown out of the containment area. In addition, if rainwater overfills the collection ponds, a release to surface water could occur. For portable fire-control systems, the largest spill scenario would involve spills of 55 gallons (210 liters) or less. Such a spill would be contained before it could reach surface water or groundwater.

While aqueous film foam does not pose a risk to human health, it exhibits varying degrees of aquatic toxicity and has a high biochemical and chemical oxygen demand. If allowed to flow freely into groundwater or surface water, it could cause severe environmental consequences. These materials also contain fluorocarbon **surfactants** (5 percent or less) that are not biodegradable. If discharged to adjacent surface water, it could result in temporary oxygen depletion in those waters in addition to inducing toxic effects in some aquatic species (DOE 1989). The most serious accident at an SPR site involving aqueous film foam occurred in 1986 at the West Hackberry site when 5,000 barrels of oil flowed into a nearby lake. The foam was used to blanket the oil on the lake. The combination of the oil spill and the foam blanket resulted in the death of 100 to 200 fish in the area (Bozzo 1991).

An accident involving ammonium bisulfite could result from a storage tank rupture. This spill scenario could involve up to 5,000 gallons (18,927 liters) of the material. Any spill likely would be contained by the brine ponds that border the ammonium bisulfite storage areas. If a tank rupture occurred simultaneously with high winds or storms, ammonium bisulfite could be blown outside of the pond area or rainwater might overfill the collection ponds. In this case, an ammonium bisulfite spill could have a temporary impact on adjacent onsite vegetation. A small area could be burned, but the vegetation likely would consist of a grass that would recover quickly. As brine released into the Gulf of Mexico is required to have oxygen content, it is possible that a spill of ammonium bisulfite into the pond could necessitate aerating the brine pond before continuing disposal. If the brine is released unaerated at the same time that a transient anoxic area is present at the diffuser location, the anoxic situation could be exacerbated. In addition, there could be releases of ammonia or sulfur gas from the surface of the brine (Personal Communication, 1991). The onsite Emergency Response Teams are trained in proper protection in handling ammonium bisulfite spills, and therefore, no adverse effects on workers would be anticipated from spill response activities. In dermal exposure, if exposed skin were immediately flushed with water, recovery likely would occur quickly. Ammonium bisulfite is not acutely toxic, and no long-term impacts of a spill would be anticipated.

Other hazardous materials (e.g., cleaning agents) at existing SPR sites are stored in 55-gallon (one barrel) quantities or less, so any spills of such materials likely would be small and contained without causing significant or long-term environmental contamination. Fuels such as diesel fuel and gasoline and some lubricating oils are stored in larger quantities, and any spills of these materials would cause impacts similar to those described for oil spills. Laboratory reagents generally are stored in smaller quantities, generally in indoor locations, and so, they are unlikely to reach outdoor areas if spilled.

#### 3.2.2.4 Fires

In 1990, DOE performed an independent reevaluation of SPR drawdown-critical or mission-essential systems and facilities to identify needed upgrades to the SPR fire protection program and assess the need for new fixed-fire protection systems. The study indicated that there were no “eminent-danger” scenarios when a credible fire event could adversely affect the mission of SPR. The SPR fire protection program is designed to limit fire risk to the lowest practical limit (Edwards 1991b). The information presented in section 3.2.1.4 demonstrates that historic occurrence of fires since 1992 has, indeed, been low.

Nevertheless, a potential exists for fires to occur at the SPR expansion sites and proposed new sites. The 1990 DOE reevaluation identified three potential fire scenarios: a well-pad accident, a tank fire, and a pump fire. Although the possible consequences of each of these fire scenarios are potentially serious for damage to property, the probability of their occurrence is extremely small and the potential for offsite consequences is also very limited. The availability of automatically activated and manually activated fire protection and shutdown systems and the actions of onsite Emergency Response Teams likely would extinguish fires before severe consequences occurred. Also, as discussed in section 3.2.1.4, serious fire events are expected to be very rare.

The environmental consequences of fires may include short-term exceedance of ambient air quality standards, including standards for particulate emissions; short-term releases of toxic air pollutants (e.g., fluoranthrene and pyrene); and potential stormwater and surface water contamination from runoff of the materials that is burning, products of incomplete combustion, and firefighting agents such as foam.

##### *3.2.2.4.1 Well-Pad Accident*

The caverns used for oil storage are maintained under pressure, and therefore, a well-pad accident could result in severe onsite consequences with respect to fire. The only reportable fire at an SPR site that resulted in a fatality occurred in 1978 at the West Hackberry site. It was caused by a well-pad accident. As part of a workover procedure, contractors were pulling casing out of a well. After pulling 14 joints of casing out of the hole, the mud in the casing began flowing from the top of the casing into the hole. The mud and a packer, previously set in the lower sections of the casing, were forced up from the inside of the casing to the surface by pressure from below. Workers on the rig could not control the flow of the mud from the casing. The flow continued unchecked until the packer blew out of the casing followed by a flow of oil. An oil mist formed from the flow of oil was drawn into the air manifold intakes of the diesel engine on the rig and nearby diesel engines, causing them to overspeed. An explosion and fire occurred while two employees were still attempting to shut down the rig engine; both men were severely burned, and one later died from his injuries (DOE 1978).

The immediate cause of the accident appeared to be a poor packer seat in the casing. In addition, employees failed to follow the written workover procedure (e.g., depressurize the well before workover). Also, there was an inadequate safety valve on the rig, and the site was in the construction phase so that the full complement of emergency response equipment was not yet on the site. Since the time of this accident, new policies and procedures have been implemented to prevent similar occurrences in the future (DOE 1978).

##### *3.2.2.4.2 Tank Fire*

The crude oil surge tank at Big Hill has a double-deck, open-top, floating-pontoon roof design. It is equipped with a manually activated foam system for protection of the roof-to-shell seal area. Any involvement of this tank with a fire ordinarily would occur in the seal area. The initial response to any such incident would include determining the extent of the tank fire and activating the fixed-foam system (Boeing Petroleum Services, Inc. 1989).

As unlikely as it is, if the tank became fully involved in a fire, the possibility of a “boil over” exists. This could occur as heavy residuals that might contain water or water-oil emulsion accumulate and begin sinking toward the tank bottom. The result of the super-heated residuals contacting the water could result in a boil over. The contents of the tank then could erupt into extremely violent and quickly expanding steam-oil froth, sending a fireball hundreds of feet (meters) into the air, and project burning oil over the sides of the tank for several hundred feet (meters) in each direction (Boeing Petroleum Services, Inc. 1989). While this description is specific to the tank at Big Hill, similar scenarios would apply to any new or expansion site with a storage tank at the facility, a tank farm, or marine terminal.

To extinguish a fully involved tank, foam applications would be applied from ground level. In the example of a tank with a 100-foot (30-meter) diameter, a minimum application rate of about 790 gallons (3000 liters) per minute of foam would be required for about 55 minutes; such an application would require about 43,000 gallons (160,000 liters) of foam. In such a scenario, activation of the raw water injection system would release large amounts of slightly saline water at the Big Hill site that potentially could reach the groundwater or surface water in the site vicinity (Boeing Petroleum Services Inc. 1989).

#### *3.2.2.4.3 Pump Fire*

The pump pad areas at the SPR sites have many flanges, valves, and gaskets that often are manually controlled, and therefore, they offer the potential for human error. For example, valves may be left in the wrong orientation or bolts or screws may be left loose. Such error can lead to leaks or fires (Edwards 1991a).

Pumps operated at SPR sites generally can be shut off from a variety of locations. In a situation of a leak from a pump or other equipment, after a pump is shut down or the area of the leak is isolated, the likelihood of a fire is dramatically decreased as the source of additional fuel for a fire would no longer be available. The fire safety emergency shutdown system automatically shuts down any area where there is a leak or a fire. Specific areas of the SPR site also can be shutdown from the Operations Control Room or various locations around the site. For example, in a leak or a fire situation at a specific cavern during oil fill, all pumps and valves associated with that cavern and the pipelines leading to and from it, would be shut down remotely without any personnel entering the area of the leak or fire. Such mechanisms ensure that a leak or a fire can be contained quickly to the initial starting point and prevent potential injury during shutdown (Edwards 1991a). In an electrical power loss, manual shutdown of pumps and valves is also possible.

The crude oil pumps and related pumping facilities at existing SPR sites are protected by an automatic foam deluge system. These foam systems are subject to routine maintenance and testing, and they would significantly reduce the possibility of a major fire in the pump area. The foam deluge system would be activated by ultraviolet and infrared fire detectors. After they are activated, they can provide foam in a matter of seconds. The foam deluge would quickly suppress, extinguish, and blanket any pooled (two-dimensional) ground fire associated with any crude oil release. The foam deluge would contain but not extinguish three-dimensional fires associated with the pump seal or piping (Boeing Petroleum Services, Inc. 1989). Additional response activities would be needed to extinguish that type of fire. The probability of the occurrence of a pump fire is unlikely; as such a fire has never occurred on an SPR site. The onsite location of these pumps and redundant operational controls limit the potential for environmental impacts should a fire occur.

### 3.2.2.5 Occupational Injuries

Currently each SPR site operates under a centralized environmental management system that conforms to International Organization for Standardization (ISO) 14001. The SPR Contractor, DynMcDermott, voluntarily maintains certification to the ISO 14001 standard and has attained accreditation in the ISO 9001 Quality Management Program. In conjunction with these certifications, each SPR site, including the proposed expansion sites at Bayou Choctaw, Big Hill, and West Hackberry, has attained and maintained Occupational Safety and Health Administration (OSHA) Voluntary Protection Program Star Status and DOE Voluntary Protection Program Star Status since 1991 (DOE 2004g; OSHA 2006a; OSHA 2006b). The approval process for these programs requires applicants to submit a comprehensive application and undergo a rigorous OSHA onsite evaluation of their worksite and its safety and health management system.

All SPR sites exceeded OSHA Voluntary Protection Program Star status and achieved Star among Star status. The VPP STAR Program is designed for exemplary worksites with comprehensive, successful safety and health management systems. Companies in the Star Program have achieved injury and illness rates at or below the national average of their respective industries. Star participants are reevaluated every three to five years and incident rates are reviewed annually (OSHA 2004a). The reported Lost Workday Case Rate for the SPR sites was less than one workday lost (0.83 days) due to injury per 200,000 worker hours, as compared to the Bureau of Labor Statistics average of 5.3 days, the OSHA VPP Star Among Star level of 2.3, and the OSHA VPP Super Star level of 1.33 (NIST 2005.)

Based on this record, DOE expects that the proposed new and expansion sites would achieve OSHA and DOE VPP Certification and that proposed expansion sites would maintain certification and have lower rates of worker injury, illness, and lost work days than similar types of industrial facilities.

### 3.2.3 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that would occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained, and hence any additional environmental impacts such as those from spills of oil and brine would not occur. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site and if the proposed site were developed by a commercial entity for oil and gas purposes some spill risk would exist. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity, which could involve brine-spill risk. The onshore Clovelly Dome Storage system would continue to operate unchanged as a component of LOOP with the exception of any expansion that LOOP might undertake.

For the portions of the proposed storage site pipelines that follow existing ROWs, the risk of a spill associated with the No-Action alternative would be limited to spill risk that exists from the existing pipelines. For the portions of the pipeline in new ROW, the No-Action alternative would not have any spill risk. For the sites of terminals that are in developed petroleum storage areas it is possible that a commercial entity could develop those sites for storage and some spill risk would occur. For the terminal sites in undeveloped areas there would be no spill risk associated with the No-Action Alternative.

## 3.3 LAND USE

This land use analysis evaluates how SPR development might affect existing land characteristics and uses at each potential new and expanded SPR site and associated infrastructure in direct or indirect ways. The section is organized as follows: methodology, common impacts, affected environment and potential impacts for each site and its infrastructure, and the no-action alternative.

### 3.3.1 Methodology

DOE identified the existing land use conditions at each potential new or expanded SPR site and assessed potential land use impacts in the following four areas:

- Possible land use conflicts,
- Visual resources,
- Prime farmland, and
- Coastal zone management.

The approach to assessing each of these impact topics is discussed below.

The effects of Hurricanes Katrina and Rita on existing conditions are also noted in this section as appropriate. In August and September of 2005, these two hurricanes passed through the Gulf Coast region and affected environmental conditions in the vicinity of several existing and proposed new and expansion sites and their associated infrastructures in Louisiana, Mississippi, and Texas. To understand how the hurricanes affected existing conditions, DOE consulted with affected parties in these areas during the subsequent EIS scoping process and in meetings with other Federal, state, and local agencies. DOE assessed site observations following the hurricanes, reviewed information gathered from scoping, and conducted other research regarding changes in the affected environment from the hurricanes. In general, although the hurricanes caused extensive damage at and near some proposed facility locations, they did not change the character of the lands as rural and largely undeveloped. Thus, changes in the long-term uses of such lands as a result of the 2005 hurricanes are unlikely and not yet apparent.

#### 3.3.1.1 Possible Land Use Conflicts

To understand potential land use conflicts from SPR development, DOE assessed land uses for a 2-mile (3.2-kilometer) radius around each proposed new or expansion storage site, RWI structure, pipeline route, power line, road, and oil distribution terminal and tank farm. For each proposed storage site, DOE based the affected environment section on previous SPR site characterization studies (e.g., DOE 1979, 1992; Magorian and Neal 1990; Maggorian et al. 1991; Neal 1993; Sprehe 2003) and updated information from site visits and data evaluation conducted in late 2005 and early 2006. DOE examined the land vegetation and land use classification types that could be affected during the construction and operation of each proposed new or expansion storage site and the associated infrastructure. DOE assessed potential conflicts with residential and commercial land uses and areas with special designations such as U.S. Forest Service lands; wildlife refuges; wilderness areas; wild and scenic rivers; scenic areas, roads, or trails; and parks. As part of this analysis, DOE assessed potential constraints and management controls at the county or parish, state, and Federal levels. The only major land use controls that were identified in this analysis were requirements regarding coastal zone management, which are discussed as a separate topic below.

DOE's evaluation of the magnitude of the potential land use conflicts takes into account the amount of land potentially affected, the type of land use that would be affected, the duration of the potential impact, and the extent of the conflict. It also considers the actions that DOE would take as part of the proposed action to help avoid or reduce land use conflicts and other land use impacts, including the following:

- Placing new pipeline and power lines in existing ROWs to the maximum extent feasible;
- Avoiding specially designated areas and consulting with affected agencies to minimize effects on these areas;
- Burying pipelines except when crossing levees;
- Revegetating and restoring the land as quickly as possible and where feasible;
- Storing equipment and materials in established storage areas;
- Providing the public with a construction schedule;
- Establishing community liaisons to work with affected landowners and public to resolve problems;
- Providing effective and efficient access to work sites with minimum interference to public;
- Painting buildings and structures in appropriate colors; and
- Shielding affected areas from public view where feasible.

#### 3.3.1.2 Visual Resources

Any activity that introduces new or changed forms, lines, colors, and textures to the environment would have an impact on the visual character and quality of the area. DOE evaluated the potential visual impacts of the possible SPR activities by considering the types of site users and other project locations, amount of use, public interest in the particular visual landscapes, adjacent land uses, and the existence of specially designated areas, as described above. The construction and operation of each proposed new or expansion storage site, RWI structure, pipeline, power line, road, oil distribution terminal, and tank farm may cause contrasts with the existing landscape. For this analysis, DOE presumed that viewers would be more sensitive to visual contrasts on lands with special designations, such as national forests or wildlife refuges, which may be visited more often and serve a greater aesthetic or uniquely scenic purpose. The impact analysis also recognizes that throughout the region of influence for the various SPR storage sites, pipelines and industrial facilities are common, which would limit the contrast with the existing visual setting caused by SPR expansion.

#### 3.3.1.3 Prime Farmland

DOE's actions in selecting sites for SPR program expansion could result in the temporary or long-term loss of land having certain soil or other natural resource characteristics that are of high value. Prime farmland is a resource that could be lost or damaged by surface-disturbing activities or conversion of land from one use to another. The Farmland Protection Policy Act (7 USC 4201 to 4209; 7 CFR Part 658) seeks to minimize Federal programs' contribution to unnecessary and irreversible conversion of farmlands to nonagricultural uses. Compliance with this law requires DOE to identify and consider adverse effects of the proposed action on the preservation of farmland, appropriate alternative actions that would lessen adverse effects on farmlands, and as far as practicable, ensure that the proposed action would be compatible with state, local and private programs and policies to protect farmland.

To comply with the Farmland Protection Policy Act, DOE has consulted with the offices of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS) offices in Louisiana, Mississippi, and Texas to identify and evaluate prime farmlands that would be affected by SPR expansion. Using NRCS's rating system, DOE calculated farmland conversion impact scores for each proposed site and associated infrastructure and for each alternative considered in this draft EIS.

#### 3.3.1.4 Coastal Zone Management

The Coastal Zone Management Act (CZMA) was enacted in 1972 to encourage coastal states to develop comprehensive programs to manage and balance competing uses of and impacts to coastal resources. The CZMA emphasizes the primacy of state decision making regarding the coastal zone. Section 307 of the CZMA addresses the consistency requirements for both states and the Federal Government and allows states to manage coastal uses and resources and facilitate cooperation and coordination with Federal agencies. It requires Federal agency activities with reasonably foreseeable effects on any land or water use or natural resource of the designated coastal zone to be consistent, to the maximum extent practicable, with the enforceable policies of a coastal state's Federally approved coastal management program. The lead state agency that implements or coordinates a state's federally approved coastal management program is responsible for Federal consistency reviews. All three affected states in this EIS have primacy for the CZMA, and each has developed a Coastal Management Program.

DOE has consulted with the appropriate state agencies—namely the Louisiana Department of Natural Resources, Coastal Management Division; the Texas General Land Office, Coastal Resources Program; and the Mississippi Department of Marine Resources—to understand their concerns and issues regarding the proposed SPR sites and associated infrastructure that could be located in coastal zones. The consultation process with these agencies is still in progress. The agencies preferred that DOE coordinate its required coastal consistency determination for the selected alternative with both the applicable state agencies and with the USACE, which will have Clean Water Act Section 404 permitting responsibilities. The applicable state agencies in Texas, Louisiana, and Mississippi often use joint review processes with the USACE on permit applications affecting lands within the designated coastal zone. USACE will forward the determination to the coastal zone management agencies, which would conduct a consistency review and either object or concur with DOE's determination. This process satisfies the requirements of the Federal Coastal Zone Management Act.

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### 3.3.2 Impacts Common to Multiple Sites

The construction and operations and maintenance of a new or expanded SPR site and associated infrastructure would involve many similar activities across similar proposed locations. Using the methodology described above, DOE analyzed the likely impacts that might be common to all or most proposed new and existing storage sites and their infrastructure. Those impacts are discussed in this section. Additional site-specific impacts are discussed in sections 3.3.3 through 3.3.11.

#### 3.3.2.1 Possible Land Use Conflicts

***Storage Sites***

The use of land for SPR petroleum storage purposes at any of the new or expansion storage sites generally would preclude the future use of that land for other purposes. SPR land use at the storage sites would include establishment of a buffer around the storage sites (except at the Clovelly storage site) and other security measures. The buffer for each site would generally consist of a cleared area 300 feet (91 meters) beyond the outer security fenceline for line-of-site surveillance. SPR site access would be limited to those persons who require access for official SPR purposes. With the exception of the Clovelly site, which would share some facilities with LOOP operations, DOE would have exclusive use of the storage sites.

The proposed new Bruinsburg, Chacahoula, Clovelly, Clovelly-Bruinsburg combination, Richton, and Stratton Ridge storage sites would require construction of new petroleum storage facilities, as described in chapter 2. These sites have limited value for non-industrial purposes. Nonetheless, the potential conflicts for each proposed new site are analyzed in sections 3.3 through 3.8.

Expansion of storage capacity at Bayou Choctaw, Big Hill, and West Hackberry would require acquiring existing caverns or constructing new caverns. Because SPR storage facilities already exist on these salt domes, there would be no land use conflicts from expanding storage capacity. These sites have limited value for nonindustrial purposes. In addition, less construction would take place at the proposed expansion storage sites than at the proposed new storage sites because DOE would use existing support facilities and infrastructure. The likelihood of land use conflict at the existing storage sites is further limited because these sites are not located in or immediately adjacent to specially designated or protected areas, commercial areas, or residential areas. Thus, DOE does not expect land use conflict at the three expansion storage sites.

***Pipelines***

As described in chapter 2, all proposed new and expansion SPR sites, except Clovelly, Bayou Choctaw, and West Hackberry, would require new pipeline infrastructure for water, brine, or petroleum. The existing pipeline infrastructure in the Gulf Coast region is extensive, and pipelines generally result in limited land use conflicts if they are located in existing corridors or in rural areas away from population centers. Where feasible, DOE has proposed pipeline routes that are not near residential or commercial areas and would not cross lands with special designations or purposes. Maximum feasible use of existing ROWs would reduce possible land use conflicts because construction would be required only to widen an existing, maintained corridor, and any land use change would be limited to the construction period at that location and the expansion of the ROW. The width of pipelines easements would vary with the type of terrain the pipeline crosses (e.g., upland or wetland) and other characteristics. Construction easements would range from 50 to 100 feet (15 to 30 meters) for a single pipeline and 120 to 150 feet (30 to 46 meters) for multiple pipelines. Permanent easements would be 50 feet (15 meters) for one pipeline and 50 to 100 feet (15 to 30 meters) for multiple pipelines.

With the exception of pipelines crossing levees, DOE would bury pipelines. Buried pipelines would create some temporary surface disturbance and trenching, but in the long term, land use impacts would be limited. A pipeline ROW would preclude some land uses that would involve excavation or could otherwise damage the pipeline. Other uses, including recreation, hunting, and most agriculture would still be allowed. Pipelines would traverse levees aboveground, and these pipelines would be designed to have no effect on levee operation and would not pose land use conflicts.

Operations and maintenance activities associated with pipeline ROWs include inspections, mowing of nuisance vegetation along the pipeline ROW, and maintaining grass covers to prevent erosion. Section 2.3.10 describes these operations and maintenance activities. These activities generally would not create land use conflicts, except possibly where pipelines cross land with special designations for the Bruinsburg, Clovelly-Bruinsburg combination, Richton, and Stratton Ridge. These three situations are discussed in the site-specific sections below.

***Electric Power Lines***

The construction and operation of new electric transmission and distribution lines would be required for proposed new sites, but not the expansion sites. The ROWs would be relatively narrow, with a maximum width of 100 feet (30 meters). All new electric transmission poles and lines, with one exception, would be constructed along ROWs or roads that already exist or would be built to support new SPR pipelines; the general level of land use impact or conflict for these power lines would be low. The exception would be a 5.5-mile (8.6 kilometer) power line from the Bruinsburg site to the Grand Gulf substation would be in a new ROW by itself. This ROW would be through rural, largely forested habitat. The potential land use impacts may be higher where the power lines would cross lands with special designations or in residential areas. As described further below, this would occur for the proposed Bruinsburg, Clovelly-Bruinsburg combination, Richton, and Stratton Ridge sites.

***RWI Facilities***

DOE would construct new RWI systems for all potential new sites except Clovelly, where a RWI system already is located onsite. RWI systems would not affect any nearby specially designated or protected lands, residential areas, or commercial areas at the other new sites with the exception of the Stratton Ridge site. The proposed RWI site at Stratton Ridge would be located within and along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. Potential for land use conflicts associated with the construction and operations and maintenance of the Stratton Ridge RWI system is discussed in section 3.3.8.

The proposed expansion sites have existing RWI facilities. The facilities at Bayou Choctaw and Big Hill, however, would be upgraded if the sites were selected for expansion. Because the expansion of the RWI systems would not constitute a change in existing land uses, it would not constitute a conflict. The West Hackberry site would use the existing RWI system with no changes; therefore, it would not pose any land use conflicts.

The operation and maintenance of all new and expanded RWI systems are not expected to have long-term impacts on surrounding water that could affect commercial or recreational fishing. Sections 3.7 and 3.10 further discuss the potential impacts of the construction and operations and maintenance of the RWI systems on biological resources and noise.

***Brine Discharge***

Brine from Chacahoula, Clovelly, Richton, and Stratton Ridge would be discharged into the Gulf of Mexico. New brine disposal pipelines would be built for all new sites, except Clovelly where an existing system would be used. For Big Hill, the existing system would be upgraded.

Sections 3.6 and 3.7 address the potential for the construction and operation of the offshore brine disposal system to affect water quality, navigation, aquatic organisms, and commercial fishing operations. Any land use conflicts from this construction would be limited to the location of the offshore pipeline during the brief period for constructing that pipeline segment. Permanent land use conflicts would not arise because the brine pipelines and diffusion system would not limit access to the Gulf of Mexico or harm recreational or commercial resources. Thus, the site-specific land use analysis does not discuss offshore brine disposal land use conflicts.

Brine from Bruinsburg, including under the Clovelly-Bruinsburg alternatives, Bayou Choctaw, and West Hackberry would be disposed of in underground injection wells. New wells would be constructed for these sites, except West Hackberry. The new wells for the new sites would constitute a new land use, as is discussed in the site-specific analysis. For the Bayou Choctaw expansion site, DOE would build six new wells near an area with existing underground injection wells. This upgrading of existing systems at the expansion sites would not constitute a change in existing land uses.

***Terminals and Tank Farms***

New tank farms and other facilities at oil distribution terminals would be required at the following locations:

- Anchorage, LA, and Peetsville, MS, for the Bruinsburg site;
- Jackson, MS, for the Bruinsburg site as part of the Clovelly-Bruinsburg combination alternatives;
- Pascagoula, MS, and Liberty Station, MS, for the Richton site; and
- Texas City, TX, for the Stratton Ridge site.

The terminals at Anchorage, Liberty Station, Pascagoula, and Texas City would be located in existing industrial areas and therefore would not present a change in existing land uses. The terminals at Jackson and Peetsville would be located in rural areas where the terminals would represent new land uses but would not be likely to conflict with existing land uses. The potential land use conflicts for these terminals are discussed in the site-specific analyses below.

#### 3.3.2.2 Visual Resource Impacts

***Storage Sites***

SPR storage sites would include storage caverns created in large salt domes and a variety of support facilities and infrastructure. The layout of these facilities is illustrated in sections 2.3 and 2.4. While a large number of viewers would not see the storage site areas because public access would be limited, the sites would appear industrial in nature and contrast with surrounding natural vegetation.

Construction activities at new or expanded SPR storage sites might result in temporary visual impacts from new buildings, trenches, construction equipment emissions, access roads, night lighting, and dust. Construction activities would result in long-term changes to the existing landscape. Visual impacts also might arise from operations and maintenance of buildings and associated infrastructure, lighting, fencing, and cleared areas. Buildings and facilities at the SPR storage sites would generally be designed and constructed for their safety and functionality, not for their visual appeal. Because the potential new storage sites would generally not be observable from specially designated, commercial, or residential areas, there would be limited visual conflict and contrast. The Bruinsburg storage site, discussed in the site-specific analyses below, could have a higher magnitude of visual impacts because of its proximity to areas with higher visual sensitivity.

The expansion of Bayou Choctaw, Big Hill, and West Hackberry would not provide a large visual contrast with the existing landscape because of the existing industrial land use at these sites. In addition, because less construction would take place at the three existing SPR storage sites, the visual effects of such construction would be smaller in magnitude than the changes associated with the new sites. Also, none of the expansion storage sites is located in specially designated land, commercial, or residential areas.

***Pipelines***

The construction of pipelines and the operations and maintenance of pipeline ROWs would change the character of vegetation across the new or expanded ROWs. Where new pipelines would be built in developed areas, they would be located below public property such as roads and other ROWs. New or expanded ROWs would be cleared and grubbed, which would require removing and trimming of any trees and removing surface vegetation, rubbish, and existing structures. While these activities might result in visual contrasts with the existing landscape, the peak of impact would be during construction activities, which would last from six to ten weeks at any point along a pipeline. The contrast would be substantially reduced after construction is complete and the ROW is revegetated or otherwise restored. DOE would give all possible consideration to preserving trees in the ROW. DOE also would grade the ROW to facilitate laying the pipeline and would build temporary facilities such as roads and sand bridges for use during pipeline construction.

Operations and maintenance activities would involve the mowing of nuisance vegetation along ROWs, maintaining grass covers, or constructing and maintaining terraces, plugs, and bulkheads. These activities would cause visual contrasts with the landscape, which would be more substantial at close viewing range and would diminish with longer range. Views of pipelines and pipeline ROWs are quite common in this region, especially in Louisiana and Texas, which may limit the contrast with the existing visual setting caused by new pipelines. Overall, any visual contrast would be minimal, except possibly where the pipelines are in specially designated areas, such as parks. Pipelines associated with the proposed Bruinsburg, Bruinsburg portion of the Clovelly-Bruinsburg combination, Richton, and Stratton Ridge sites would traverse lands with such special designations. The potential visual impacts for these pipeline segments are discussed in the site-specific analyses below.

DOE would bury all pipelines except those traversing levees, which would minimize visual contrasts with the existing landscape. Pipelines would traverse levees aboveground, and these pipelines would add new characteristics to the views of the levees. When identifying proposed pipeline routes, DOE selected routes along existing pipeline ROWs, power line ROWs, and roads to the extent practicable. Expansion of existing ROWs would provide less contrast with the existing landscape because the incremental visual changes would be small.

The construction and operations and maintenance of new ROWs would result in a greater visual contrast with the existing landscape than the expansion of existing ROWs. The number of viewers who could observe the new pipeline ROWs would likely be limited because, with few exceptions, they would be located in rural areas. In the few instances where pipelines would cross developed areas, the long-term visual impacts would be small because these ROWs would follow existing ROWs such as roads.

***Electric Power Lines***

New electric power and lines would be required for the proposed new SPR sites. All new power lines, with one exception, would be constructed along existing ROWs or roads, or along ROWs or roads that would be built to support new pipelines. The exception would be the 5.4-mile (8.7-kilometer) power line from the Bruinsburg site to the Grand Gulf substation, which would be through rural, largely forested habitat. The new power lines might pose a visual contrast with the existing landscape. Relatively few people, however, are likely to view these power lines because the ROWs are located in rural areas that lack unique visual characteristics of special interest to the public. In general, the potential visual impacts associated with lines and poles in rural areas would be associated with a continuation of urbanization and development, and not directly associated with SPR development.

The power lines and poles associated with the Bruinsburg, the Bruinsburg portion of the Clovelly-Bruinsburg combination, and Stratton Ridge sites could interact with specially designated lands and therefore might have a greater potential visual impact, as discussed in the site-specific analyses.

***RWI Facilities***

A typical RWI structure would be a steel and concrete platform sufficiently elevated to withstand a 100-year flood. A fence with security lights would surround the entire structure. The construction and operations and maintenance of new RWI systems would contrast with the visual landscape of the water body and adjoining land. While they may constitute a change in the viewshed, RWI systems that are not located near specially designated lands, commercial, or residential areas would have few potential viewers. Of the new SPR sites, only the proposed RWI site for Stratton Ridge would have potential visual impact issues. It would be located within and along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. Potential visual impacts associated with this system are discussed in section 3.3.8.3 below.

Expanding the RWIs for existing facilities would provide little visual contrast, considering the present infrastructures and their existing impacts on the visual landscape. Because the West Hackberry site would use the existing RWI system, no additional visual impacts would occur there.

***Brine Discharge***

The brine from all new and expansion sites except Bruinsburg, the Bruinsburg portion of the Clovelly-Bruinsburg combination, Bayou Choctaw, and West Hackberry would be discharged into the Gulf of Mexico. The discharge would have little visual impact because the brine would not be visible. In addition, brine discharges are not expected to have substantial effects on nearby plants and fish, as discussed in section 3.7.

At the three SPR expansion sites—Big Hill, Bayou Choctaw, and West Hackberry—the existing brine discharge systems would be upgraded, which would not contrast greatly with the existing landscape and, therefore, would have a low level of visual impact.

The Bruinsburg brine discharge system would require the construction of 60 new underground injection wells offsite, each requiring 230 square feet (21 square meters) of land. For the Bruinsburg portion of the Clovelly-Bruinsburg combinations, 30 wells would be constructed. While there may not be a large number of viewers of the Bruinsburg well sites, they would appear industrial and would contrast with the existing viewscape.

***Terminals and Tank Farms***

The new tank farms and other terminal facilities at Anchorage, Pascagoula, and Texas City would be located in existing industrial areas and would provide little visual contrast to the existing landscape. Potential viewers of these facilities would not likely be visually sensitive to any changes in the viewshed. The new tank farms at Peetsville, Jackson, and Liberty Station would be located in rural areas. These new facilities would contrast with the existing forested and agricultural landscape, as discussed in the site-by-site analysis.

#### 3.3.2.3 Prime Farmland Impacts

SPR development activities would cause farmland conversion by shifting the use of land to nonfarm uses, with irretrievable losses occurring when the land is developed and committed to other uses for the long-term. Any prime or unique farmlands located on proposed SPR storage sites, RWI facilities, and oil distribution terminals would be permanently converted to nonfarm uses because the potential use of that land for agricultural purposes would be lost.

The construction of pipelines and power lines would temporarily prohibit agricultural use of farmland within the construction easement during the construction period of up to six to ten weeks at any specific location. With proper management practices, the impacts of new or expanded ROWs would be small and would not convert farmland to nonagricultural uses. These practices would include the following:

- Consultation with landowners and farms to address field access, irrigation, revegetation, timing, and other sensitive cropping issues;

- Stripping and segregating topsoil from subsoil when digging trenches and grading agricultural lands, and replacing the segregated topsoil after the trench is backfilled and the subsoil is restored to grade; and

- Restoring and returning land temporarily affected by construction to agricultural use.

DOE, in consultation with the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), scored all of the individual sites and all of the alternatives using the farmland conversion impact rating. This scoring system is specified in the Farmland Protection Policy Act regulations (7 CFR Part 658). It considers a wide variety of factors related to potential farmland conversion impacts, including the amount of prime or unique farmland that would be converted; the amount of statewide and locally important farmland; the use of the land and nearby land; the distance to urban built-up areas and urban support services; on-farm investments; and compatibility with existing agricultural use. Under the Farmland Protection Policy Act regulations, "sites receiving a total score of less than 160 need not be given further consideration for protection and no additional sites need to be evaluated" (40 CFR 658.4(c)(2)). All of the proposed new and expansion sites and all of the alternatives have scores less than 160 and need not be given further consideration for protection.[1] Thus, the site-by-site analysis below does not address farmland.

#### 3.3.2.4 Coastal Zone Management Impacts

For those sites and associated infrastructure that would be located in designated state coastal zones, DOE would be required to comply with the applicable parts of each state's Coastal Management Program. Coastal zone management is an important local and regional planning tool to limit the potential adverse effects on coastal resources. The types of problems that can occur from development within coastal resources include accumulation of contaminants and pollutants, coastal erosion, land loss, loss of wetlands, and a decline in the natural functioning of habitats and natural resource relationships. Use of lands for SPR purposes in coastal zones would not be expected to cause any major Coastal Management Program concerns, except for impacts on wetlands at some sites. Specific coastal zone management issues and processes relevant to the various SPR sites within coastal zones are identified in the site-specific discussions. The Bruinsburg and Bayou Choctaw sites and infrastructure are not located within designated coastal zones and therefore would not be affected by coastal management processes. The other sites and/or their infrastructure are located in coastal zones. See figures 3.3.2-1 through 3.3.2-3 below for maps showing the locations of designated coastal zone management areas for Louisiana, Mississippi, and Texas relative to the proposed storage sites and associated infrastructure.

### 3.3.3 Bruinsburg Storage Site

#### 3.3.3.1 Affected Environment

The Bruinsburg salt dome is located in Claiborne County, MS, about 3 miles (4.8 kilometers) east of the Mississippi River. See figures 2.4.1-1 through 2.4.1-3 in chapter 2. With about 70 percent of the land area in the County forested, timber production is an important regional land use. The hardwood forests also provide hunting and fishing opportunities. Agriculture is also an important industry in the County.

[1] The location of some of the proposed sites and their infrastructure changed slightly since DOE consulted with NRCS. Additional consultations to incorporate the new information were not feasible for inclusion in this draft EIS. Nonetheless, the nature of these minor changes would not increase the score for any site and its infrastructure to be greater than 160 points.

**Figure 3.3.2-1: Coastal Zone Management Areas in Louisiana**

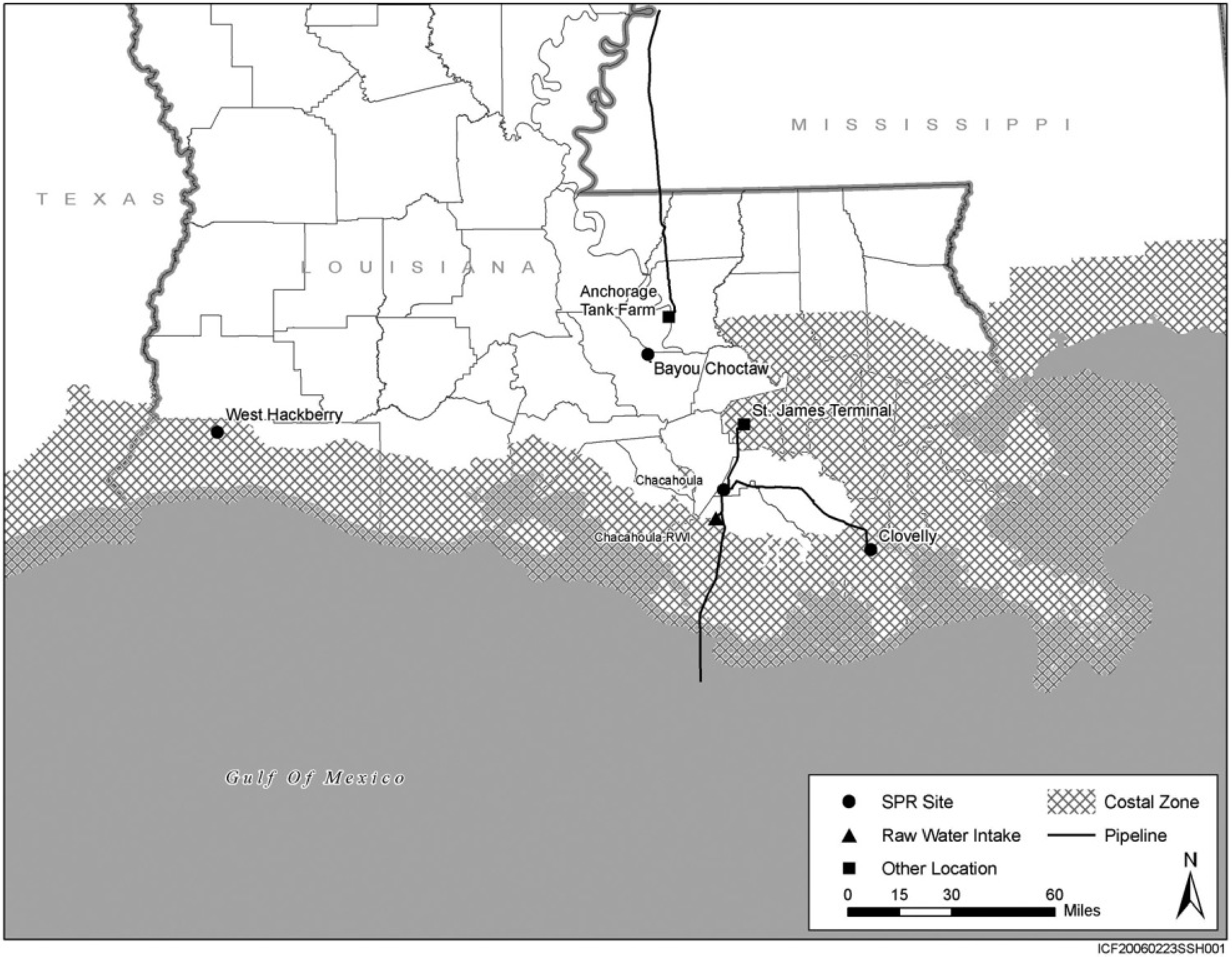


**Figure 3.3.2-2: Coastal Zone Management Areas in Mississippi**

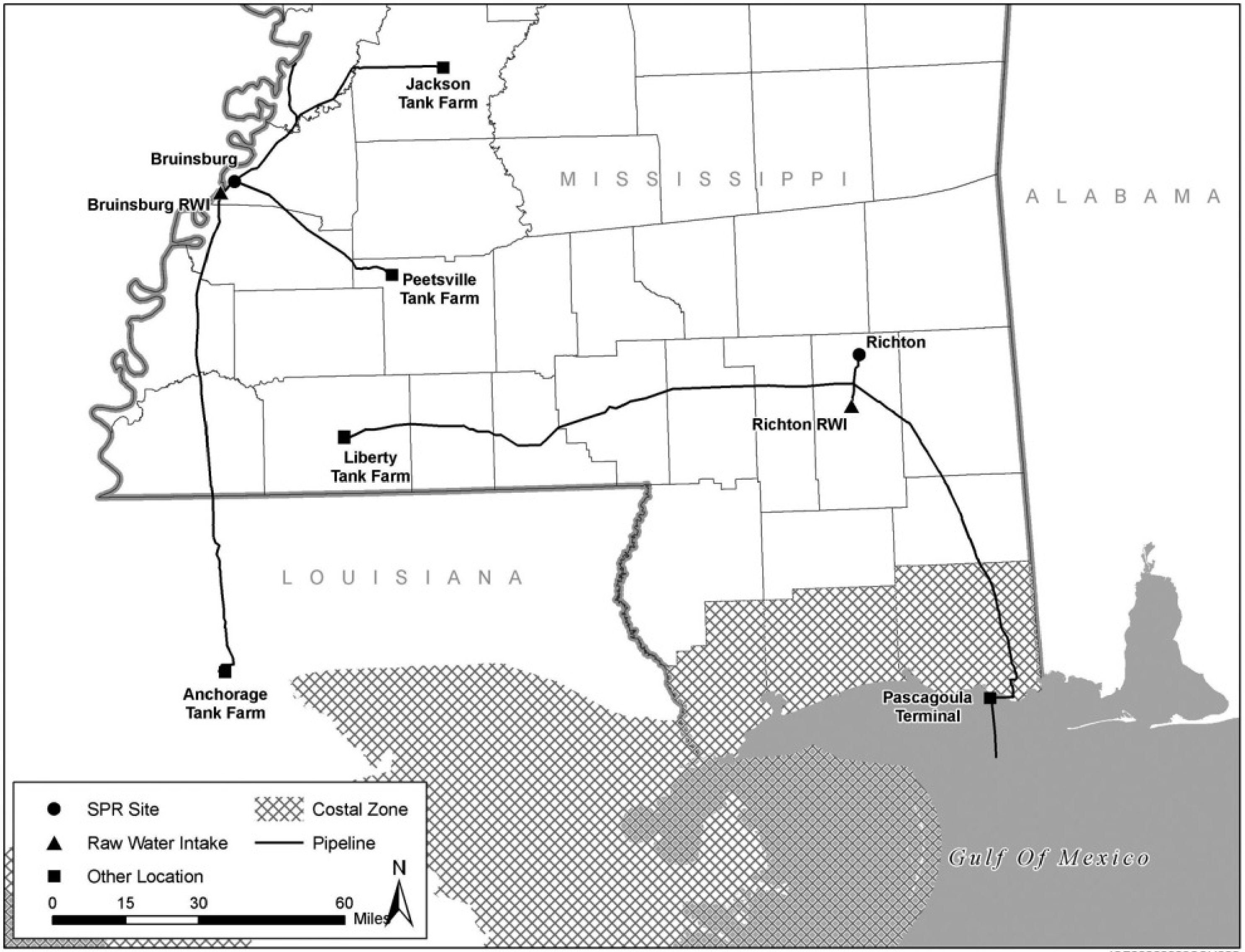
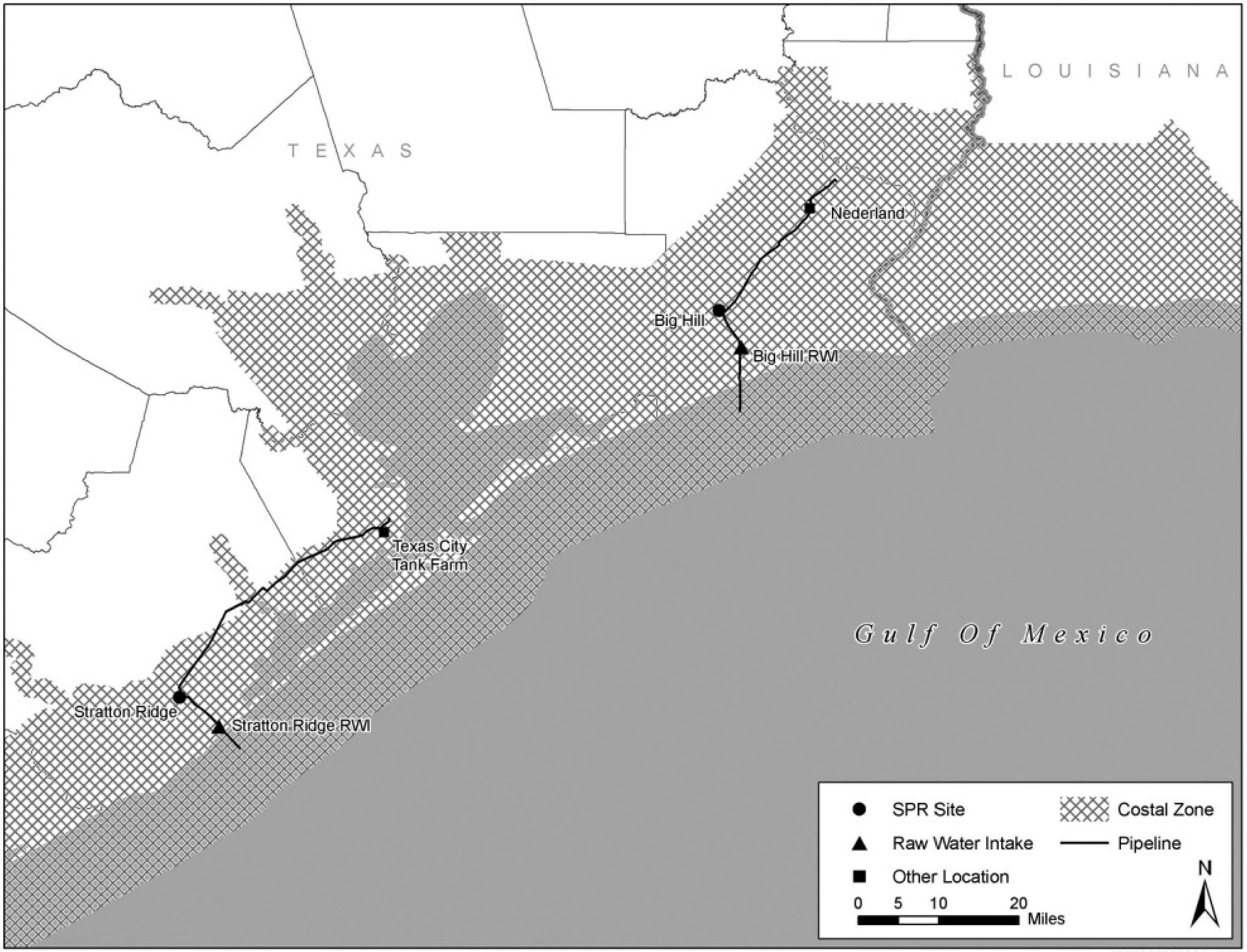


**Figure 3.3.2-3: Coastal Zone Management Areas in Texas**

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The potential Bruinsburg storage caverns would be located on a floodplain where the Union Army, under General Grant, disembarked after crossing the Mississippi River on April 30, 1863. The facilities for the storage site (e.g., administrative buildings, brine pond, pumps) would be located outside the floodplain in an area overlooking the caverns. Section 3.9 discusses further details on the historical nature of the site. The proposed storage site, which is privately owned, would consist of 364 acres (147 hectares) including a 300-foot (91-meter) security buffer. Nearly half of the site is cultivated for producing cotton, corn, hay, soybeans, and wheat. Hunting blinds for deer and other game species are distributed around the perimeter of the cotton fields. The remainder of the site is forested wetlands. It also has a barn and silo. Scattered residences are nearby, with the closest home approximately one-half mile (0.8 kilometers) from the proposed site. The Bruinsburg site would require the development of several pipelines and power lines, as described in section 2.4.1 (see figure 2.4.1-3). These pipelines and power lines would be located in mainly rural areas with some agricultural land and wetlands. The crude oil pipeline ROW to the Peetsville, MS, terminal would cross three special purpose areas:

- Natchez Trace National Scenic Trail is an ancient trail that connected portions of the Mississippi River to salt licks located in central Tennessee. The trail also was used by traders in the late 18th and early 19th centuries. The trail is managed by the National Park Service.

- The Natchez Trace Parkway, a 440-mile (710-kilometer) highway also is managed by the National Park Service.

- The Homochitto National Forest in the southwest Mississippi is managed by the U.S. Forest Service for a variety of recreational, wildlife, and forestry uses. The crude oil pipeline would travel through private property contained within the proclamation boundary of the National Forest.

The Winsor Ruins, a fire-damaged plantation house that is a well-known historic symbol of Mississippi, and prehistoric earthwork sites of potential cultural importance to the Choctaw, are located near the crude oil pipeline to Peetsville, MS. Section 3.9 discusses further details on the historical nature of this area.

Sixty brine disposal wells would be developed offsite on 73 acres (30 hectares) of undeveloped land along the Mississippi. A RWI system on the Mississippi River would be constructed about 4 miles (7 kilometers) east of the site. The water intake structure would be located in an agricultural and forested area, less than 2 miles (3.2 kilometers) from the small town of St. Joseph, LA, on the other side of the river.

The Bruinsburg site would require a new oil distribution terminal with aboveground storage tanks in Anchorage, LA, as shown in figure 2.4.1-5. The proposed 71-acre (28-hectare) terminal would be located south of the Exxon/Mobil and Placid Refineries. The existing land use for the area where the proposed facility would be located is row crop agriculture. Most of the area surrounding the proposed site is currently in industrial, agricultural, and some residential use. A second terminal would be constructed in Peetsville, MS, in a rural, partly forested area, as shown in figure 2.4.1-4. The proposed 71-acre (28-hectare) tank farm would be adjacent to an existing pipeline pump station. Managed forests and scattered rural housing surround the site.

The Bruinsburg area did not receive substantial damage from Hurricanes Katrina or Rita in 2005. The locations of the proposed Bruinsburg pipelines, RWI, and other infrastructure associated with the proposed SPR site were also outside the path of hurricane-force winds.

### 3.3.3.2 Potential Impacts

#### *3.3.3.2.1 Possible Land Use Conflicts*

The Bruinsburg area has no historical land uses associated with oil and gas development. Only a fraction of the land in the vicinity has been disturbed by railroads, roads, canals, and other infrastructure or development. Considering the nonindustrial and undeveloped nature of the area, the land proposed for potential development of the storage site and the underground injection wells could be used for various purposes. There are no specially designated lands or residential or commercial areas close to these proposed locations. There are no known plans for any significant new land uses in the area. While the proposed SPR storage and injection well sites are undeveloped, general land use patterns would not conflict with the construction or operation of these SPR facilities.

As discussed in the common impacts section 3.3.2 above, the construction and operation of pipelines and power lines would not conflict with existing land uses, save the following two exceptions:

- The crude oil pipeline to the Peetsville Terminal, MS, would cross the Natchez Trace National Scenic Trail and the Natchez Trace Parkway in an existing utility ROW. The expansion of the ROW would require clearing additional vegetation and would slightly expand the scope of the existing land use of the ROW.
    - Mitigation: If the Bruinsburg site were selected for expansion, DOE would coordinate with the National Park Service to obtain the proper ROW easements through the trail and parkway. DOE would work with the National Park Service to ensure that land use conflicts are minimized to the maximum extent practicable.
- The same pipeline would travel through private property contained within the proclamation boundary of the Homochitto National Forest for 6.8 miles (11 kilometers). Approximately 5.6 miles (9 kilometers) of the pipeline would go through a new corridor along highway 550 and the remainder would be along an existing power line ROW. Along these ROWs, vegetation would be cleared and trees would not be allowed to regrow within the 50-foot (15-meter) permanent easement. The remaining area affected by construction would be allowed to regenerate to natural habitat. The pipeline in the existing ROW would slightly expand the existing land use of the ROW. The new ROW along the highway would add a new land use.

The RWI structure would not create any land use conflicts. It would be located in a small undeveloped area with near agricultural and forested areas along the Mississippi River. While less than 2 miles (3.2 kilometers) from the town of St. Joseph, LA, the construction or operation of the structure would not create any land use conflicts because of the town’s distance across the Mississippi River.

The proposed new tank farm in Anchorage, LA, would be located on land currently used for row crop agriculture. The site, however, is adjacent to industrial area that already includes tank farms and a petroleum refinery. The construction and operation of the new terminal would create no substantive land use conflicts.

The proposed tank farm in Peetsville, MS, would be located in a rural, partly forested area. While the terminal would create a new land use, this use would not be likely to pose any substantive conflicts with existing land uses in the area.

#### *3.3.3.2.2 Visual Resources*

The development of the Bruinsburg storage site would have a visual impact on recreational sightseers or parties in the Civil War who may be sensitive to changes in the visual quality of the historic landscape. While the proposed storage site is not located in or near special status lands or developed areas, the area has historical significance. A portion of a historic road in or near the facility boundary may be still visible on the floodplain and along the route of on the escarpment. Section 3.9 discusses further details on the historic nature of this area. Construction and operations and maintenance could affect potential viewers who might be sensitive to changes in the existing landscape.

Visual impacts could be associated with the proposed crude oil pipeline to Peetsville, MS, which would cross the Natchez Trace National Scenic Trail, Natchez Trace Parkway, and the privately owned within proclamation boundary of the Homochitto National Forest. These special status and cultural areas may be frequented by sightseers who may be sensitive to changes in visual quality. Construction of the ROWs would cause temporary disruption to the landscape in the form of dust, emissions from construction equipment, and trenches. As part of the proposed action, the pipeline would be underground and DOE would attempt to preserve the natural landscape setting.

The RWI and brine disposal systems associated with the proposed Bruinsburg site are not located in or near special status or developed areas. Few potential viewers of those sites would be affected, and those viewers would be minimally affected because there are no special visual attributes of public interest in the area.

The terminal in Anchorage, LA, would be constructed adjacent to similar industrial facilities. Visual impacts would be low because the area has no special visual resource attributes. The terminal in Peetsville, MS, which would be adjacent to an existing pump station, would change the visual character of the rural and partly forested area. The area, however, would have relatively few viewers and does not have any special scenic views of particular interest to the public, such as national forests or wildlife refuges.

#### *3.3.3.2.3 Coastal Zone Management*

Because the Bruinsburg site, pipelines, RWI and brine disposal systems, and terminals would not be in the designated Mississippi or Louisiana coastal zones, no special coastal zone management requirements are part of any land use at the proposed SPR site.

## 3.3.4 Chacahoula Storage Site

### 3.3.4.1 Affected Environment

The Chacahoula storage site would be located in northwestern LaFourche Parish, LA, about 40 miles (64 kilometers) from the Gulf of Mexico (see figures 2.4.2-1 through 2.4.2-3). The proposed site, which is in wetlands typical of southern Louisiana, would encompass 350 acres (142 hectares) including the security buffer. See Section 3.7 Biological Resources and Appendix B Flood Plains and Wetlands Assessment for discussion of potential development in wetlands. Adjacent lands contain sugar cane fields. No private homes are on or immediately adjacent to the proposed site. Because of its low elevation, the Chacahoula site is vulnerable to storm surges from major tropical storms and heavy precipitation. The land proposed for the SPR site is privately owned with separate owners of the surface and mineral rights.

Hydrocarbons, brine, and sulfur have been extracted from the salt dome, and there is evidence of oil and gas exploration and development on the south and northeast sides of the dome. Sulfur production occurred between 1955 and 1970 along the northeastern part of the dome. The Texas Brine Company operates three brine caverns in the south-central dome area. With the exception of the brining operations, no other activities are present on the dome. Most land available for facility construction is located at the west end of the dome.

A single road to the former sulfur mining area crosses part of the dome. Shell-gravel roads flank the southern and western perimeter of the site, providing potential access to oil and gas wells. The Donner barge canal traverses the western perimeter of the dome and provides access to the dome from rail connections several miles south.

The Chacahoula area was in the path of Hurricane Katrina and, as a result, there was substantial damage to housing and other facilities in the region, most substantively along the coast. The area is still recovering from this damage. The proposed Chacahoula site received only minor direct effects from the hurricane because it is located in undeveloped wetlands.

The proposed Chacahoula site would be enclosed by a perimeter road, fence, and cleared security buffer area. The ROW associated with the RWI system would follow an existing pipeline and a 4.3-mile (6.8-kilometer) access road would be built along the pipeline route toward Highway 90. The brine disposal system to an offshore diffuser in the Gulf of Mexico would follow an existing pipeline ROW. The crude oil pipeline would follow the existing Shell pipeline, while the pipeline to the St. James terminal would follow an existing crude oil pipeline to the terminal.

#### 3.3.4.2 Potential Impacts

##### *3.3.4.2.1 Possible Land Use Conflicts*

Historically, the Chacahoula site area has land uses associated with oil and gas development and other industrial developments such as Texas Brine Company's brine operations. Railroads, canals, and other infrastructure and development have disturbed a portion of other land in the vicinity. Because the proposed site is in an industrial area largely covered by wetlands, the land would not be useful for many land use purposes. Wetlands areas on the proposed site would remain interconnected with those outside the site. If an SPR storage facility were located on the proposed site, land use patterns would not change in any substantial way. No national or state parks or other specially designated land is located on or near the proposed Chacahoula SPR site. Overall, there would be minimal conflict with established land uses for the Chacahoula site.

No residential, commercial, or specially designated areas are located in or near the pipelines, power lines, RWI system, or other infrastructure for the Chacahoula site. Section 3.3.2.1 describes common land use impacts associated with construction and operation and maintenance of new and expansion sites and associated infrastructure not located in such areas.

##### *3.3.4.2.2 Visual Resources*

No special visual resource issues are associated with this SPR site location and its associated infrastructure, which are generally located in rural, undeveloped areas. Section 3.3.2.2 describes common visual impacts associated with construction and operation and maintenance of new sites and associated infrastructure.

##### *3.3.4.2.3 Coastal Zone Management*

The Chacahoula site in Lafourche Parish is not covered in the Louisiana Coastal Management Program; therefore, the proposed storage site would have no special environmental requirements related to coastal management. Portions of the site infrastructure, however, such as parts of the crude oil and brine pipelines would be built in the coastal zone. DOE will coordinate with the Louisiana Department of Natural Resources, Coastal Management Division to identify and address any coastal zone issues associated with the infrastructure for the Chacahoula site.

### 3.3.5 Clovelly Storage Site

#### 3.3.5.1 Affected Environment

The proposed Clovelly SPR site is about 5 miles (8.0 kilometers) east of Galliano in Lafourche Parish, LA (see figures 2-4.3-1 and 2.4.3-2). Recreation opportunities in the area include hunting, fishing, boating, bird watching, and nature photography. The proposed site would be located near Bayou Lafourche and State Highway 1 in wetlands and would be mostly underwater. Uplands in the area are used primarily for sugar cane fields and cattle grazing. Communities along Highway 1 near the proposed site exist include Golden Meadow, Galliano, Cut Off, Larose, Lockport, and Rockland, which have a combined population of more than 35,000 people.

The area has a long history of oil- and gas-related activity. The existing Clovelly Dome Storage Terminal is part of the LOOP project (see section 2.4.3 for further information). The control center in Galliano manages all of the LOOP operations. If DOE selects an alternative that includes this site, the SPR operation would use the existing LOOP oil distribution infrastructure and LOOP would operate the facilities for DOE. In addition, a new onsite RWI would be required.

The Clovelly area was in the path of Hurricane Katrina, and housing and other facilities in the region received substantial damage, mostly along the coast. The area is still recovering from this damage. The proposed Clovelly site, however, received only minor direct effects from the hurricane.

#### 3.3.5.2 Potential Impacts

##### *3.3.5.2.1 Possible Land Use Conflicts*

Although the Clovelly site would be a new SPR location, SPR facilities would not be a new land use in the area. The existing LOOP operations include private (nongovernmental) storage of petroleum at Clovelly salt dome. DOE’s potential use of Clovelly as a part of the SPR would include the co-use of the site with LOOP operations. From a land use perspective, SPR construction and operations and maintenance activities would impose few identifiable impacts other than slightly increasing surface disturbance and industrial activity in the area. Considering the existing wetlands and industrial nature of the site, the land is not compatible with or desirable for most other purposes. Land use patterns would not change in any substantial way if DOE selects this proposed site.

Construction of the associated caverns for the proposed Clovelly SPR site would be on land currently containing soil from previous LOOP construction areas. Because the construction would take place in areas previously used for similar purposes, the land use impacts would be negligible.

The proposed Clovelly SPR site would use the LOOP’s existing brine disposal system and brine diffuser system and the new RWI would be built onsite. No land use impacts from those activities would be expected.

##### *3.3.5.2.2 Visual Resources*

No special visual resource issues are associated with this proposed SPR storage site and infrastructure because the area is already heavily developed and industrial. Section 3.3.2.2 discusses common visual impacts associated with construction and operations and maintenance of proposed new SPR sites and their associated infrastructure.

##### *3.3.5.2.3 Coastal Zone Management*

Clovelly is within the Louisiana designated coastal zone, and coastal zone management requirements would apply to this SPR site. The Lafourche Parish costal management program includes the following goals:

- Slow down the rate of saltwater intrusion into the environmental management unit;
- Maintain the integrity of the relatively undisturbed brackish wetlands area in the north and northeast section of the site by imposing mitigation conditions on any dredge and fill permits issued in this area that retard wetlands deterioration;
- Reduce erosion of the strip of land between Little Lake and the eroded wetlands north of Bayou L'Ours;
- Reduce erosion of the strip of natural levee of Bayou L'Ours running east and west between two rapidly eroding wetlands areas; and
- Maintain LOOP activities and support any applicable mitigation plans developed for the area under the jurisdiction of the Lafourche Parish Coastal Management Program.

If DOE selects the Clovelly site as a new SPR site, DOE and the LOOP owners and operators would cooperate to ensure the implementation of these and any other future Coastal Management Program goals. DOE will continue to interact with the Louisiana Department of Natural Resources, Coastal Management Division, as needed to fulfill its coastal zone management responsibilities for the Clovelly site. This process is summarized in section 3.3.1.4 above.

### 3.3.6 Clovelly and Bruinsburg Storage Sites

#### 3.3.6.1 Affected Environment

The affected environment and potential impacts of the Clovelly-Bruinsburg combined candidate site are largely the same as those for the Clovelly site (80 MMB and 90 MMB alternatives) plus the Bruinsburg site, as described above. The footprint of the Bruinsburg storage site, including the security buffer, however, would be smaller. For example, the storage site would be 254 acres (103 hectares) instead of 364 acres (147 hectares) and 30 instead of 60 injection wells would be built. For purposes of the land use analysis, the differences in the configurations and operating plans at each facility are listed below and described further in section 2.4.4:

- The crude oil pipelines from Bruinsburg to Anchorage, LA, and to Peetsville, MS would not be built. In addition, the terminals in Peetsville would not be built.

- A crude oil pipeline would be constructed to connect to the Vicksburg Entergy system near Vicksburg, MS. SPR would use the existing terminal at Vicksburg, MS.
- A crude oil pipeline would be built to Jackson, MS, connecting to the Capline Jackson Pump station.
- A new 71-acre (28-hectare) terminal with a tank farm would be built at Jackson next to an existing pipeline pump station. The terminal's design would be similar to the proposed terminal at Peetsville, MS, for the Bruinsburg 160 MMB site.

#### 3.3.6.2 Potential Impacts

The construction and operation of these pipelines would not present any land use conflicts, except possibly where the pipeline crosses the Natchez Trace National Scenic Trail and the Natchez Trace Parkway. These potential conflicts would be the same as described in section 3.3.3 for the pipeline to Peetsville for the Bruinsburg 160 MMB site. The proposed terminal at Jackson is in a largely agricultural and forested area near the Town of Raymond, MS. The tank farm would be compatible with existing land uses in the area.

### 3.3.7 Richton Storage Site

#### 3.3.7.1 Affected Environment

The proposed Richton site would be in Perry County, MS, 3 miles (4.8 kilometers) from the Town of Richton (see figures 2.4.5-1 through 2.4.5-3). The proposed site on the Richton salt dome, including security buffer, would encompass about 346 acres (140 hectares). Land in Perry County is used primarily for agriculture and forestry. The County's major crops are corn, sorghum, soybeans, and wheat. More than 80 percent of the County is forested land, some of which is harvested as timber. Slightly less than half of the forestland in Perry County lies in De Soto National Forest, which is managed by the U.S. Forest Service.

There is no hydrocarbon production in the dome area and the potential for future production is low. Sulfur and oil have been found near the dome, but not in commercial quantities. Several small oil and gas fields are located within 10 miles (16 kilometers) of the dome.

A substantial portion of the proposed SPR site is privately owned and primarily used for forestry and agriculture. The proposed SPR site includes a working plantation of slash pine and a small chicken farm located on the southwest corner of the site. Some land is used for recreation such as hunting. A golf course is adjacent to the proposed SPR site, and private homes are east of the proposed site along a road on the southern portion of the property. Two utility corridors cross the dome.

SPR development for the Richton site would include two dual-purpose (crude oil and brine) pipelines to Pascagoula and an oil distribution pipeline to Liberty Station, MS, where it would connect to the Capline pipeline. DOE would build tank farms and other terminal facilities at both locations, as shown in figures 2.4.5-4 and 2.4.5-5. The 63-acre (25-hectare) Pascagoula terminal would be located on the Naval Station Pascagoula Base Realignment and Closure site, which is on the north side of manmade Singing River Island. The site lies just south of the main port of Pascagoula. The dock at Pascagoula would be refurbished. The only in-water construction would be piling installation using barges. The proposed 66-acre (27-hectare) terminal at Liberty Station would be in an agricultural and forested area with some industrial uses, including oil distribution facilities. The Town of Liberty is located within 2 miles (3.2 kilometers) of the proposed site.

The Richton area was in the landfall path of Hurricane Katrina and the area received some water and wind damage. The area largely has returned to pre-hurricane conditions.

#### 3.3.7.2 Potential Impacts

##### *3.3.7.2.1 Possible Land Use Conflicts*

The proposed Richton site has no history of oil- and gas-related activity at or near the site. Constructing, operating, and maintaining the Richton site as an SPR facility would generally be a new land use that would preclude other future land uses. It would change existing land conditions and characteristics. The land ownership and land use changes would be long-term. Section 3.3.2.1 discusses common land use impacts associated with the construction and operations and maintenance of the proposed new SPR sites and associated infrastructure.

Construction of pipelines and utilities in new ROWs for the Richton site would constitute a new long-term land use commitments. DOE found that no parks, forests, or other specially designated lands, residential, or commercial areas would be crossed by the RWI structure or the brine disposal system. The pipeline to Liberty Station, MS, however, would cross the Percy Quin State Park for about 0.5 miles (0.7 kilometers) in a new ROW. If a Richton alternative were selected, DOE would work with the state of Mississippi to re-align the pipeline to cross the park in an existing ROW.

DOE expects no substantive land use impacts associated with the terminal facilities in Pascagoula or Liberty Station because they would be located in areas that have existing industrial uses. The facility development would not constitute a new type of land use in the area.

##### *3.3.7.2.2 Visual Resources*

There are no special visual resource issues associated with the construction and operation and maintenance of the Richton storage site, RWI structure, or brine disposal system. Section 3.3.2.2 describes common visual impacts associated with construction and operations and maintenance of new SPR sites and associated infrastructure.

Visual impacts could be associated with the crude oil pipeline segment through the Percy Quin State Park. This park may be frequented by sightseers who may be sensitive to the changes in visual quality. Construction of the ROW would cause temporary disruption to the landscape in the form of dust, emissions from construction equipment, and trenches. As part of the proposed action, the pipeline would be underground and DOE would attempt to preserve the natural landscape. One section of the pipeline would be located approximately 240 feet (73 meters) from residential areas. Residents in these nearby areas might be affected by pipeline construction activities during the six- to 10-week construction period, and they might be sensitive to corresponding changes in the visual landscape. Long-term effects of the pipeline would be minimal since the pipeline would be buried and only the ROW and the power lines along the ROW to the RWI might contrast with the visual landscape.

##### *3.3.7.2.3 Coastal Zone Management*

Because the Richton storage site would not be in the designated Mississippi coastal zone, there would be no special coastal zone management requirements as part of any land use at a proposed SPR site. The potential use of the Pascagoula Singing River Island as a terminal site must be considered as a potential impact to coastal zone resources since it is in the coastal zone. DOE will coordinate with the Mississippi Department of Marine Resources to identify and address any coastal zone issues associated with the Pascagoula site.

### 3.3.8 Stratton Ridge Storage Site

#### 3.3.8.1 Affected Environment

The Stratton Ridge site is in south-central Brazoria County, TX 3 miles (4.8 kilometers) from both Clute, TX, and Lake Jackson, TX (see figures 2.4.6-1 through 2.4.6-3). The site is characterized by surrounding wetlands, bayous, lakes, and creeks. The Stratton Ridge site is an uplands area despite its relatively low elevation.

Regional land has a mix of industrial and rural uses. The site would encompass 370 acres (150 hectares) including the security buffer and would be directly west of the Brazoria National Wildlife Refuge, which is managed by the USFWS. The petrochemical industry is substantial in the local economy. Dow Chemical operates a major commercial chemical facility that uses salt from the Stratton Ridge salt dome to produce chlorine and to manufacture many products. Other economic activity includes cattle ranching and farming. Rice is the major crop. The area also has a long history of oil- and gas-related land use. The Stratton Ridge site has been used for brine and petroleum storage in a wide range of cavern sizes. These storage caverns are privately owned. These regional land uses have co-existed for many years.

DOE would need to acquire the land including mineral rights on the salt dome for the proposed SPR storage site from private owners. Under current conditions, cattle and feral pigs roam throughout the site and their presence and activities, such as grazing and burrowing, influence the vegetation communities. Pipeline, power line, and rail ROWs cross through the site and nearby areas. The Freeport Liquefied Natural Gas project has proposed building a nearby natural gas storage cavern, which would be constructed along the northern border of the proposed SPR site. Surrounding land generally is used for cattle ranching or low-density residential areas. Across the highway from the proposed site is a field used by the Brazoria County model airplane club.

Approximately 3 miles (5 kilometers) of the co-located RWI pipeline, brine disposal pipelines, and two power lines to the RWI would cross the southwestern edge of the Brazoria National Wildlife Refuge, which is part of the Texas Mid-Coast National Wildlife Refuge Complex. Also, 4.7 miles (7.6 kilometers) of the crude oil pipeline to Texas City would cross the refuge along its northern border adjacent to the existing Bryan Mound pipeline ROW. The Brazoria National Wildlife Refuge provides habitat for migratory waterfowl and other birds. In addition, a section of a brine disposal pipeline would pass near a small section of houses near the Gulf Coast in an existing publicly owned ROW. This pipeline may result in the need for a new road and additional road improvements.

The proposed RWI structure would be located on the coastal side of the ICW across the waterway from the Brazoria National Wildlife Refuge (figure 2.4.6-3). DOE also would construct a 1,000-foot (300-meter) new road from Bay Street to the RWI structure.

Hurricanes Katrina and Rita did not substantially affect the Stratton Ridge area.

#### 3.3.8.2 Potential Impacts

##### *3.3.8.2.1 Possible Land Use Conflicts*

The SPR facilities at the proposed storage site would be a new land use that would be consistent with industrial land use in the area. SPR development would preclude other long-term land uses at this site, such as possibly precluding the use of the Stratton Ridge salt for chlorine production by Dow Chemical. Regional land use patterns, however, would not change substantially. There would be no substantive conflict with other established land uses because of existing industrial development in the area, including petroleum storage. With careful planning, multiple SPR and private cavern storage operations could co-exist at the site. No specially designated lands, residential, or commercial areas are within or adjacent to the Stratton Ridge storage site.

About 3 miles (4.8 kilometers) of the RWI pipeline, brine disposal pipelines, and two power lines in the same new ROW would cross the Brazoria Wildlife Refuge and privately owned land in the refuge's proclamation area. In addition, 4.7 miles (7.6 kilometers) of the crude oil pipeline would cross the refuge on the northern border in an existing ROW. These ROWs would create land use conflicts and an act of Congress may be required to allow this development through the refuge. The new and expanded ROWs would be cleared and trees would not be allowed to regrow within the permanent easement. The remaining area affected by construction would be allowed to regenerate to natural habitat. Visitors to the refuge would likely value undeveloped and undisturbed land.

> Mitigation: If the Stratton Ridge site were selected, DOE would coordinate with the USFWS to obtain the proper ROW easements. DOE would work with USFWS to ensure that land use conflicts are minimized to the maximum extent practicable, including burying the power lines through the refuges. For further discussion of potential mitigation measures, see section 3.7.8.2.2.

A short pipeline that would pass near houses near the Gulf Coast would not create a land use conflict because it would be located underground in a publicly ROW and would not interfere with existing land uses.

The proposed RWI site would be located within and along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. The potential noise impact from the operation of the RWI pumps is discussed in sections 3.7.8.2.3 and 3.10.2.

#### *3.3.8.2.2 Visual Resources*

Visual impacts may be associated with the construction of the pipelines and power lines through the wildlife refuge. Recreational sightseers visiting this special status area might be sensitive to changes in visual quality. Construction of the new and expanded ROW segments would cause temporary impacts to the viewshed. DOE would attempt to preserve the natural landscape setting by placing the pipelines and power lines underground, supporting post-construction wetlands regrowth, and working with USFWS to minimize and mitigate any impacts to the refuge. ROW maintenance activities would occur infrequently and would only temporarily disturb revegetated land, thereby minimizing any long-term visual impacts of the ROWs (see section 3.7.8.2 for the discussion of potential mitigation measures).

Potential visual impacts may be associated with the RWI located on the ICW across from the Brazoria National Wildlife Refuge. The area around the RWI system would consist of shorter marsh types of vegetation, and would contrast greatly with the surrounding landscape. Users of the wildlife refuge may be sensitive to such a change in the landscape.

#### *3.3.8.2.3 Coastal Zone Management*

The Stratton Ridge site and associated infrastructure is within the Texas coastal zone. DOE will continue to interact with the Texas General Land Office, Coastal Resources Program as needed to fulfill its coastal zone management responsibilities for the Stratton Ridge site. This process is summarized in section 3.3.1.4 above.

### 3.3.9 Bayou Choctaw Expansion Site

#### 3.3.9.1 Affected Environment

Bayou Choctaw is a current SPR storage site (see figures 2.5.1-1 and 2.5.1-2). DOE would not be required to purchase any additional land to expand capacity by 20 MMB. To expand capacity by a further 10 MMB, however, DOE would purchase 4 acres including an existing privately owned storage cavern. The site is located about 8 miles (13 kilometers) from Plaquemine, LA, and just east of the ICW.

The extensive water diversions and flood control structures throughout the area have made water levels at the site particularly uncertain; however, the existing SPR site is normally dry and protected from spring flooding by the site's flood control levees and pumps. The area surrounding the site is fresh water wetlands, which includes substantial stands of bottomland hardwoods with interconnecting waterways. The original cypress wetlands at the SPR site was clear-cut long before SPR development began.

The Choctaw oil and gas field was already a mature producer before the advent of SPR oil storage. The region has experienced widespread petroleum extraction activity; however, most wells in the area have been abandoned.

DOE has six operating SPR caverns on the salt dome. Union Texas Petroleum operates seven hydrocarbon storage caverns and two brine caverns on the dome, interspersed with the SPR caverns. Union Texas Petroleum's operations on the dome support the local petrochemical industry. Two new caverns are proposed to be solution mined and one existing cavern would be acquired from an adjacent storage facility. In addition, DOE would construct six new underground injection wells and associated 0.6-mile (0.9-kilometer) extension of the brine disposal pipeline from the existing wells to the new wells.

Hurricane Katrina passed near the Bayou Choctaw area after it made landfall. The nearby Baton Rouge area served as a major source of housing to hurricane evacuees from the primary damage areas on the Louisiana coast. While there was substantial disruption of economic activity in the area, the Bayou Choctaw SPR site was not substantively affected by the hurricane or the relocation effects from evacuees.

#### 3.3.9.2 Potential Impacts

##### *3.3.9.2.1 Possible Land Use Conflicts*

Expansion of the SPR at this existing site, including the underground injection wells, would maintain current land use at the site and in the region. Construction activities would require some additional site disturbance, but this disturbance would not conflict with any existing SPR operations or represent a change in existing land use. Given the existing SPR operations at the site, the land would not be compatible with or desirable for nonindustrial purposes. Land use patterns would not change in any substantial way with SPR expansion. Section 3.3.2.1 describes common land use impacts associated with expansion and operations and maintenance of existing SPR sites and associated infrastructures.

##### *3.3.9.2.2 Visual Resources*

Bayou Choctaw is an existing SPR site. There are no special visual resource issues associated with the proposed expansion at this SPR site. Section 3.3.2.2 describes common visual impacts associated with expansion of existing SPR sites and associated infrastructure.

##### *3.3.9.2.3 Coastal Zone Management*

Because the Bayou Choctaw site would not be in the designated Louisiana coastal zone, there would be no special coastal zone management requirements as part of any land use as an SPR site.

### 3.3.10 Big Hill Expansion Site

#### 3.3.10.1 Affected Environment

The existing Big Hill SPR storage site is located in southwestern Jefferson County, TX (see figures 2.5.2-1 and 2.5.2-2). It is in a small industrial area with large croplands and pastures to the north and west, and extensive wetlands to the south and southeast that stretch to the Gulf Coast. Most of the storage site is uplands habitat consisting of tall grass.

The closest residential areas are 5 miles (8 kilometers) away near the unincorporated communities of Winnie and Stowell. The area is a major waterfowl area with extensive recreational opportunities such as hunting and bird watching. Agricultural production is the primary land use in Jefferson County; TX, more than half of the acreage in the County is dedicated for farming. Oil and gas production constitutes the other major land use activity in the County with commercial marine and crude oil pipeline distribution facilities nearby.

DOE would develop additional SPR caverns in a 210-acre (83 hectares) area, including the security buffer, directly north of the current storage site. Private parties separately own the proposed expansion site and its mineral rights. While two 0.5-MMB liquid petroleum gas storage caverns are located just north of the proposed expansion area, these operations are not expected to pose any construction or operational issues for the expansion.

The Big Hill area was in the path of Hurricane Rita. Damage to the coast south of the site was extensive, and the urban areas nearby sustained some losses from flooding and wind. Power in the Big Hill area, including for the Big Hill SPR facility, was lost for a short time. The area is still recovering. The Big Hill SPR site did not suffer any substantial permanent damage.

#### 3.3.10.2 Potential Impacts

##### *3.3.10.2.1 Possible Land Use Conflicts*

Because Big Hill is a current SPR site, any expansion could take advantage of the existing infrastructure. Construction necessary to expand the facility would be limited primarily to preparing the site, solution mining the new storage caverns, building a new brine pond, installing an additional crude oil pipeline along an existing ROW, and refurbishing the existing brine pipeline. Considering the existing SPR operations at the site, the land would not be compatible with or desirable for most nonindustrial purposes. Expansion of the SPR facilities would not change land use patterns in any substantial way. There would be minimal conflict with other established land uses. No specially designated lands are present at the Big Hill expansion site.

The crude oil and brine pipeline ROWs are in existing and maintained corridors. The crude oil pipeline ROW for the proposed Big Hill site expansion would pass within 0.25 miles (0.4 kilometers) of the J.D. Murphee Wildlife Management Area (see figure 2.5.2-1 in chapter 2). The construction corridor would expand only a short distance out of the existing pipeline ROW. It would not overlap with the management area. Land disturbance along pipeline ROWs would be limited to the construction period.

Thus, infrastructure associated with the Big Hill site would have minimal conflicts with existing land uses.

##### *3.3.10.2.2 Visual Resources*

The expanded crude oil pipeline ROW would pass within 0.25 miles (0.4 kilometers) of the J.D. Murphee Wildlife Management Area. Because the construction corridor would not overlap with the Management Area and the pipelines would be buried underground, visual impacts would be limited to the construction period.

##### *3.3.10.2.3 Coastal Zone Management*

The Big Hill site and associated infrastructure is within the Texas coastal zone. DOE will continue to interact with the Texas General Land Office, Coastal Resources Program as needed to fulfill its coastal zone management responsibilities for the Big Hill site. This process is summarized in section 3.3.1.4 above.

### 3.3.11 West Hackberry Expansion Site

#### 3.3.11.1 Affected Environment

The West Hackberry site is an existing SPR storage facility covering about 570 acres (230 hectares) in Cameron Parish, LA, about 4 miles (6 kilometers) from the town of Hackberry (see figures 2.5.3-1 and 2.5.3-2). The West Hackberry storage site and immediately surrounding area are flat to low wetlands with the exception of the elevated area overlying the salt dome south and southeast of Black Lake. Originally, DOE acquired five previously developed brine caverns and converted them to oil storage capacity. DOE has since developed 17 additional storage caverns at the site. About 53 acres (21 hectares) of privately owned land would be developed for the SPR expansion, though a larger parcel would be purchased.

The major historical land use of the area has been oil and gas exploration and development. While the site was explored for sulfur, DOE has no records indicating that the dome was mined for sulfur. Olin Corporation and its predecessors have been producing brine at the dome since 1934. Five of the caverns derived from their brine operations formed the initial storage sites for the SPR program at West Hackberry. Other caverns historically have been used for hydrocarbon product storage.

The West Hackberry site was in the path of Hurricane Rita. Effects along the coast south of the site were extensive, with substantial loss of housing and other structures because of flooding and wind. The West Hackberry SPR site was affected by precipitation and wind from the hurricane, but the area received no substantial long-term effects.

#### 3.3.11.2 Potential Impacts

##### *3.3.11.2.1 Possible Land Use Conflicts*

Expanding this existing storage site would maintain current land use at the site and in the region. Construction activities would require additional site disturbance, but this disturbance would not conflict with any existing SPR operations or surrounding land uses. Considering the existing SPR operations at the site, the land would not be compatible with or desirable for most nonindustrial purposes. Expanding the facility would not change land use patterns in any substantial way. There would be minimal conflict with other established land uses. Section 3.3.2.1 describes common land use impacts associated with expansion and operations and maintenance of existing SPR sites and associated infrastructures.

While the expansion would use existing infrastructure such as the existing RWI system, concerns for additional SPR use at the West Hackberry site would include site susceptibility to potential complications from tidal influences and heavy precipitation events. Additional site controls such as water barriers, canals, or pumps may be necessary to keep the storage site dry. The additional site controls would have minimal land use impact and, if they are needed, would allow for continued safe and effective SPR operations.

##### *3.3.11.2.2 Visual Resources*

West Hackberry is an existing SPR site. There are no special visual resource issues associated with expanding storage capacity at this site. Section 3.3.2.2 describes common visual impacts associated with expansion and operation and maintenance of existing SPR sites and associated infrastructures.

##### *3.3.11.2.3 Coastal Zone Management*

The West Hackberry area is within the Louisiana designated coastal zone, and coastal zone management requirements would apply to this site. Coastal zone objectives in the two nearby environmental management units (Hackberry and West Black Lake) address the following issues:

- Reduce the subsidence potential from non-environmental sources;
- Reduce the water level in the environmental management units and reduce the chance of future flooding;
- Inhibit saltwater intrusion;
- Restore vegetation and remove environmental management units from tidal action;
- Restore bank to inhibit shoreline erosion;
- Encourage development in areas that are best suited for growth;
- Limit flood hazard potential as much as possible;
- Limit harmful effects of community waste while ensuring efficient treatment of this waste;
- Restrict the use of having detrimental effects to water resources in sensitive areas; and
- Plan for orderly growth in communities with the resources to accommodate it.

If DOE expanded SPR operations at the site, DOE would continue to be responsible for supporting these management goals. DOE will continue to interact with the Louisiana Department of Natural Resources, Coastal Management Division, as needed to fulfill its coastal zone management responsibilities for the Clovelly site. This process is summarized in section 3.3.1.4 above.

### 3.3.12 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. Existing oil and gas activities occur near the Chacahoula storage site the proposed site could be developed by a commercial entity for oil and gas purposes. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity. The onshore Clovelly Dome Storage system would continue to operate unchanged as a component of LOOP with the exception of any expansion that LOOP might undertake. For the sites of terminals that are in developed petroleum storage areas, it is possible that a commercial entity could develop them for petroleum storage.

## 3.4 GEOLOGY AND SOILS

The construction and operation of the proposed new or expansion SPR sites could result in impacts related to or affecting the geology and soils of the area where the SPR facilities would be located. These impacts could include erosion, subsidence, **seismic** activity, **soil liquefaction**, brine and oil seepage into soils, and impacts associated with multiple uses of a salt dome. The following subsections describe the methodology for evaluating the potential impacts, discuss the common impacts for all of the sites, and evaluate the impacts for each specific site by considering the affected environments.

### 3.4.1 Methodology

To form independent conclusions about the likelihood and severity of potential impacts at each potential SPR site, DOE analyzed geology and soils using previous NEPA documents that predicted impacts, existing site reports that evaluated actual impacts, SPR design criteria requirements, and other available references characterizing geological features. The following sections briefly describe the methodology for evaluating each potential impact on geology and soils.

#### 3.4.1.1 Erosion

Site preparation activities would temporarily expose the land surface and could potentially lead to increased soil erosion. The amount of erosion would depend mainly on site-specific characteristics such as soil type, the amount of excavation and filling of soils, the exposed area of soils, and the duration of exposure. To evaluate the potential for erosion, DOE considered its experience at existing SPR sites and the erosion control measures that should be taken.

#### 3.4.1.2 Subsidence

**Subsidence** is the geological sinking or downward settling of an area on the Earth's surface, resulting in the formation of a depression.

Construction and operation of storage caverns would lead to local surface subsidence directly above the caverns. For this Draft EIS, DOE evaluated the potential for subsidence, due to construction and operation of storage caverns, using two methods. The first method is based on the historical local subsidence data measured at the existing SPR sites from filled caverns that have been actively monitored. Subsidence surveys indicate that local subsidence above caverns at existing SPR sites (Bayou Choctaw, Big Hill, West Hackberry) occurs at annual rates of 0.47 to 3.4 inches (12 to 85 millimeters) corresponding to total cavern volumes between 72 MMB (Bayou Choctaw in 1988) and 219 MMB (West Hackberry in 1988). DOE estimated the subsidence rate at each site by comparing the planned cavern volume with that of the exiting caverns, and then used the estimated subsidence rate to calculate the local subsidence over a period of 30 years. The second method is based on the numerical analysis results and experience on salt caverns used for underground storage (Bauer 1997; Bauer 1999; Neal 1991a; Van Eijs 2000). Experience suggests a general rule that 10 percent of the cavern volume is lost over 30 years (caused by the salt creeping and naturally closing openings) and that 80 percent of this loss leads to subsidence (Neal 1991a). DOE used this general rule, together with the planned cavern capacity at each site, to estimate the subsidence at the surface central area over the caverns. DOE assumed that the subsidence bowl is cone-shaped with a distance between the surface edge and the outer walls of the caverns equal to the maximum depth of the caverns. For the proposed new sites, the methods described above are used to evaluate the possible subsidence. For the proposed expansion sites, the possible subsidence is evaluated based on the site-specific historical subsidence data.

#### 3.4.1.3 Seismic Activity

> **Seismic** applies to the activity of naturally or artificially induced earthquakes or earth vibrations, where the seismic waves are the elastic waves produced by these vibrations.

The DOE SPR Level III Design Criteria require sites to be located in areas falling within seismic zone 0 or 1 so that the seismic risk will be minimal (DOE 2001a). For this Draft EIS, DOE first evaluated the potential for the candidate sites to experience earthquakes by comparing the known seismic intensity of each site with this seismic criterion. Second, DOE evaluated the potential for the proposed cavern construction and operation activities to induce seismic activity by analyzing the known location of faults and using its experience at the existing SPR sites.

#### 3.4.1.4 Soil Liquefaction

> **Soil liquefaction** is a process that occurs when saturated sediments are shaken by an earthquake. The soil can lose its strength and cause the collapse of structures with foundations in the sediment.

Soil liquefaction is a condition that occurs when loosely packed deposits change from a solid to a liquid state because of increased pressure and reduced stress. This may result from seismic shaking or other events. DOE evaluated the potential of soil liquefaction by comparing the seismic intensity of each site with the minimum intensity required for causing soil liquefaction.

#### 3.4.1.5 Brine and Oil Seepage from Caverns

Section 3.2 evaluates the potential for brine and oil leaks from pipelines and other proposed surface activities. This section supplements that evaluation by examining the potential for such leaks from the storage caverns themselves. The likelihood of brine and oil seepage from a salt cavern into soils depends on the tightness of salt around the cavern. The DOE SPR Level III Design Criteria (DOE 2001a) specifies the minimum thickness of impervious salt around an SPR cavern to ensure the structural stability and tightness of the cavern (see table 3.4.1-1). For this Draft EIS, DOE used these criteria to evaluate the likelihood of brine and oil seepage by considering the thickness of impervious salt around the cavern at each candidate site.

**Table 3.4.1-1: DOE SPR Level III Design Criteria on Cavern Dimensions**

| Parameter | Allowed Minimum |
|---|---|
| Cavern center-to-center spacing | 750 feet (229 meters) |
| Thickness of salt between two adjacent caverns (P) | 480 feet (146 meters) |
| Distance between cavern wall and dome edge | 300 feet (91 meters) |
| Distance between cavern wall and adjoining property line | 100 feet (30 meters) |
| Cavern roof apex to top of salt (S) | 450 feet (137 meters) |
| Ratio P/D[a] | 1.78 |
| Ratio S/D | 1.0 |

[a] D is the average constructed diameter of the cavern

#### 3.4.1.6 Multiple-Use Impacts

Interactions could occur between various operations in a single salt dome, depending on the distance between two operations. The DOE SPR Level III Design Criteria (DOE 2001a) specifies the minimum distances between two caverns and between a cavern and an adjoining property (see table 3.4.1-1). DOE used these criteria to evaluate the multiple-use impacts of the proposed action by considering the distance between the proposed new caverns and the existing operations of caverns (if any) at each site.

### 3.4.2 Impacts Common to Multiple Sites

This section analyzes the basic kinds of impacts caused by geology and soil conditions at each site. Based on the analysis of information that appears in sections 3.3.3 through 3.3.11, and following the methodology described in section 3.3.1, DOE believes some categories of impacts warrant more detailed and site-specific evaluation. We based our evaluation on subsidence associated with cavern construction and operation and the potential results caused by multiple uses of the candidate domes.

#### 3.4.2.1 Erosion

Surface construction at the SPR sites, along pipelines, at new raw water intake sites, and in other new facilities could lead to erosion of soils caused by excavation, filling, and exposure of soils. The amount of erosion would depend mainly on site-specific characteristics that affect the amount of excavation and filling of soils and the exposed area of soils, the types of soils, the duration of exposure, and the local topography. In general, soil erosion could cause temporary and negligible deposits of soil on lands adjacent to construction sites. Implementation of standard erosion control measures such as seeding, sodding, rip-rapping, installation of sediment retention and detention basins, and **silt** fencing would prevent or reduce erosion of soils caused by construction.

The operation and maintenance of SPR facilities would consist mainly of filling the caverns and transferring the crude oil to oil distribution networks during drawdown. No soil erosion impacts would occur from filling and drawdown activities. Soils would stabilize soon after they are revegetated following construction.

The primary impacts associated with erosion would be to surface waters and biological resources, which are evaluated in sections 3.6 and 3.7, respectively. Because of the limited construction time and the implementation of the standard erosion control measures described above, DOE concludes that erosion impacts on geology and soils would be temporary, cover a small area, and negligible. The following site analyses do not address erosion from site-specific construction or operation and maintenance activities.

#### 3.4.2.2 Subsidence

The construction, operation, and maintenance of raw water intake facilities, crude oil distribution facilities, brine disposal facilities, and support facilities are expected to result in little to no surface subsidence. This conclusion is based on the soils known to exist at each site (characterized in the site-specific affected environment descriptions below), the engineering precautions that would be integrated into the facility designs, and the past experience of minimal to no subsidence caused by these kinds of facilities at existing SPR sites. DOE believes no adverse subsidence impacts would be expected from such activities, and therefore this issue is not addressed in the analysis of each site.

Activities associated with the construction and operation of the storage caverns would lead to local surface subsidence over the cavern, so this potential impact is evaluated for each site in the site-specific sections. For salt domes, the local subsidence over the caverns is produced mainly through slabbing and cavern creep closure. Slabbing creates loose slabs of salt on the cavern walls and roof in sheared or impure salt with properties that vary with direction. The potential for slabbing at the SPR caverns would be extremely low because of the depth and purity of the salt where the SPR caverns would be constructed. Creep closure is an active process in any salt cavity where stress differentials (the pressure difference between the open cavern and the surrounding solid salt formation) exist. Construction and operation of the SPR caverns would result in stress differentials and thus the cavern creep closure. After an SPR site closes, subsidence would continue at a rate that depends on how well the cavern capacity is backfilled and how high the pressure in the former storage cavern is maintained. DOE plans to take steps during site decommissioning to minimize the extent of continued subsidence after closure.

In addition to a local change in topography, one possible impact of the subsidence would be the formation of ponds over the caverns at upland sites where the land surface has subsided to a level below the groundwater table. Proper engineering design, monitoring, and control, such as surface pavement with drainage systems, would prevent pond formation. Local subsidence at wetland sites like the proposed new Chacahoula and Clovelly sites could submerge the platform at the area over the storage caverns. Proper engineering design, monitoring, and controls (e.g., raising the height of the platform) would prevent submergence of the platform.

The local subsidence would be limited to the area overlying the caverns. There would not be one depression for each cavern, but rather a single depression over all of the caverns. Such a localized effect would not contribute to the regional subsidence that occurs throughout the Gulf Coast region. Underground fluid withdrawal (groundwater and petroleum) and natural compaction and drainage of organic soils—not SPR site development and operation—are the main reasons for the regional subsidence (NAS 1991). For example, groundwater withdrawal in Houston, TX, has caused some coastal areas to subside by more than 6.6 feet (2 meters). The Mississippi River delta area of southern Louisiana is subsiding because of natural compaction and loss of sediment transport from the Mississippi River, and the New Orleans, LA, area is one of the principal areas of organic soil subsidence.

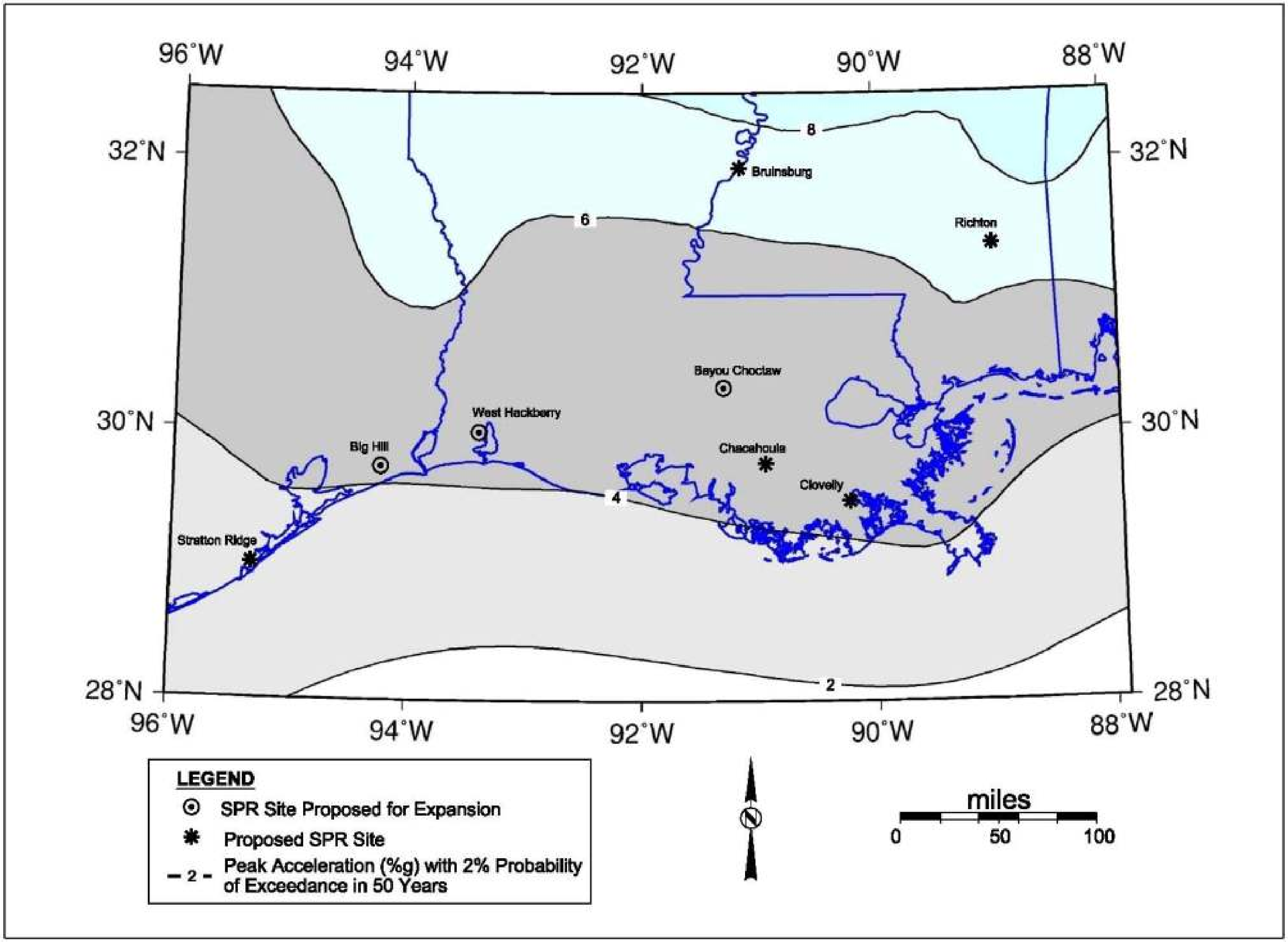
#### 3.4.2.3 Seismic Activity

There is very little potential for regional seismic activity (natural earthquakes) at the candidate sites (USGS 2002). According to the Seismic Risk Map for the Uniform Building Code 1994, the gulf coast region is within seismic zone 0 or 1, the lowest risk zone (ICBO 1997). Although the region has a number of active faults, the faulting is not of natural geological origin, which most likely would not induce earthquakes (FEA 1976).

Figure 3.4.2.3-1 shows the peak acceleration with 2 percent probability of exceedance (i.e., annual frequency of exceedance of 0.0004) in the Gulf Coast area (created from http://equint.cv.usgs.gov/eg-men/html/custom2002-06.html). The peak acceleration at all of the SPR sites would be smaller than 75 percent *g* (i.e., the earthquake magnitude would be smaller than 4.7), where *g* is the acceleration of gravity. An earthquake with peak acceleration smaller than 75 percent *g* (magnitude smaller than 4.7) would not likely result in damages at the existing and proposed SPR sites.

Faults exist locally in the **caprock** and/or around the perimeters of salt domes. The known location of faults around each of the candidate sites is discussed in the site-specific affected environment sections below. The possibility that increased pressure or subsidence from site construction and operation would activate nearby faults and induce seismic activity is very unlikely. As required by the SPR Level III Design Criteria, a detailed subsurface geophysical investigation would be conducted during the detailed design stage to ensure that a salt dome is adequate for cavern development, which would prohibit the construction of new caverns in an area with near-surface faults that might be activated. Therefore, the site-specific sections do not evaluate the potential for proposed construction and operation activities to stimulate earthquakes.

**Figure 3.4.2.3-1: Peak Acceleration with 2 Percent Probability of Exceedance in 50 Years in the Gulf Coast Area**



At the new Bruinsburg site and the Bayou Choctaw and West Hackberry expansion sites, brine would be disposed of through underground injection systems. This would include a new injection well field at Bruinsburg and existing or expanded well fields at Bayou Choctaw and West Hackberry. While this injection would increase the pressures in the pore spaces of the receiving formation in areas near the injection wells, such increased pressures would not be expected to increase the potential for seismic activity. While such a risk could be a concern in seismically active regions, where the frictional resistance within faults may be overcome by increased hydrostatic pressure, DOE's SPR Level III Design Criteria require sites to be located in areas of minimal risk. This issue would be examined during the site-specific underground injection permitting process and any risks would be further mitigated; therefore potential impacts associated with induced seismic activity resulting from underground injection of brine at the proposed Bruinsburg, Bayou Choctaw, and West Hackberry sites were not evaluated in this Draft EIS.

#### 3.4.2.4 Soil Liquefaction

Each of the following site-specific affected environment descriptions generally characterizes the types of soils at the candidate expansion sites. While these soils and the landforms at the different sites have the potential to behave in a manner that could result in liquefaction in a seismic shaking, the potential for this impact is very low. The Bruinsburg site is located in seismic zone 1 with design peak horizontal acceleration at the ground surface equal to 0.075 g, and the other sites are located within seismic zone 0 with design peak horizontal acceleration at the ground surface equal to 0 g, where g is the acceleration of gravity (ICBO 1997). The peak horizontal acceleration at the ground surface required to induce soil liquefaction is more than 0.1 g (Youd and Idriss 2001). Therefore, soil liquefaction is not discussed in the following site-specific sections.

#### 3.4.2.5 Brine and Oil Seepage from Caverns

Four mechanisms may lead to leakage of brine or oil from a salt cavern:

- Flow paths of sufficient permeability in the salt or associated natural seepage pathways such as faults and joints;
- Flow through hydraulic fractures generated in the walls of the cavern;
- Leakage along the salt-cement interface in the cased wellbore of the wells used to inject and withdraw fluids from the caverns; and
- Upward migration through any wells that were drilled previously into the dome and since have been abandoned.

Each of these mechanisms and their potential to result in leakage from the SPR caverns is discussed in the site-specific sections.

Rock salt is essentially impermeable with a permeability of about $10^{-21}$ to $10^{-19}$ square meters, and as shown in table 3.4.1-1. DOE's design criteria would require that at least 300 feet (90 meters) of salt separate the cavern wall from the edge of the dome. In addition, DOE would conduct detailed geophysical surveys for each new site to ensure that the new SPR caverns would not touch any potential seepage pathways. Thus, brine or oil would be very unlikely to leak through the salt itself or associated potential seepage pathways.

Because salt tends to creep but not break, hydraulic fractures are a potential concern only if the crest of the cavern sinks significantly after the storage cavity is formed. The potential for such sinking is minimized by the DOE design criteria that require the top of the salt to be at least 450 feet (140 meters) thick (see table 3.4.1-1). The potential for hydraulic fractures is also minimized by the short time needed to fill the caverns to capacity after construction and by operating the caverns at the highest possible pressure to reduce cavern creep closure and surface subsidence (Neal 1991a; Bauer 1997; Bauer 1999). As a result, any fractures that do form in the top of the dome overlying the caverns would not be expected to propagate through the whole roof salt and reach the caprock. The remaining unfractured roof salt and the caprock would prevent leakage of brine or oil from a salt cavern.

**Caprock** is a layer of rock that is often found covering some or all of a soft dome

With the borehole and casing sealed according to standard practices, the leakage of brine or oil from a salt cavern along the salt-cement interface in the cased wellbore would be unlikely.

For a site with exploration and production wells previously drilled into the dome (such as the site at Richton), brine and oil could leak from the storage caverns through unknown abandoned wells that intersect the caverns. Proper site selection and detailed geophysical surveys would ensure that any such wells are identified, and then best management practices, such as sealing any unused wells that are located above the storage caverns, would virtually eliminate the potential for such leakages.

To protect against cavern leakage, the cavern would be pressure-tested before oil is injected. The total allowable leakage would be less than 100 barrels of oil per year. DOE anticipates that cavern integrity would surpass this requirement.

For these reasons, the likelihood of oil or brine migrating from the storage caverns is low. In addition, the caverns are thousands of feet below sea level, and the rock aquifers at this depth would contain saline water that would be unusable as a potable source. Because the likelihood of oil or brine migration from a cavern is low and the surrounding aquifers are not potable water sources, the impacts would be negligible. The potential impacts associated with oil and brine leaking from the caverns is not addressed in the following site-specific sections.

#### 3.4.2.6 Multiple-Use Impacts

Two categories of potential multiple-use impacts are associated with the proposed action. First, multiple uses of a dome such as sulfur production, brine production, and cavern storage of other materials, could lead to accidental releases, increased levels of subsidence, cavern flooding, and possibly even fire or cavern collapse. For a site with previous and existing mining and storage operations, the multiple-use impacts would be eliminated by locating the new caverns far from the existing dome operations in accordance with the SPR Level III Design Criteria (DOE 2001a), as shown in table 3.4.1-1. With proper engineering design based on the SPR Level III Design Criteria, the proposed new caverns would have no adverse interaction impacts; nevertheless, each site-specific section discusses the extent to which the candidate domes have been utilized for other activities.

The second category of impact would include the loss of access to mineral resources, including salt, caused by the construction and operation of the SPR sites. In chapter 5, this Draft EIS addresses the impact of irreversible and irretrievable commitment of resources.

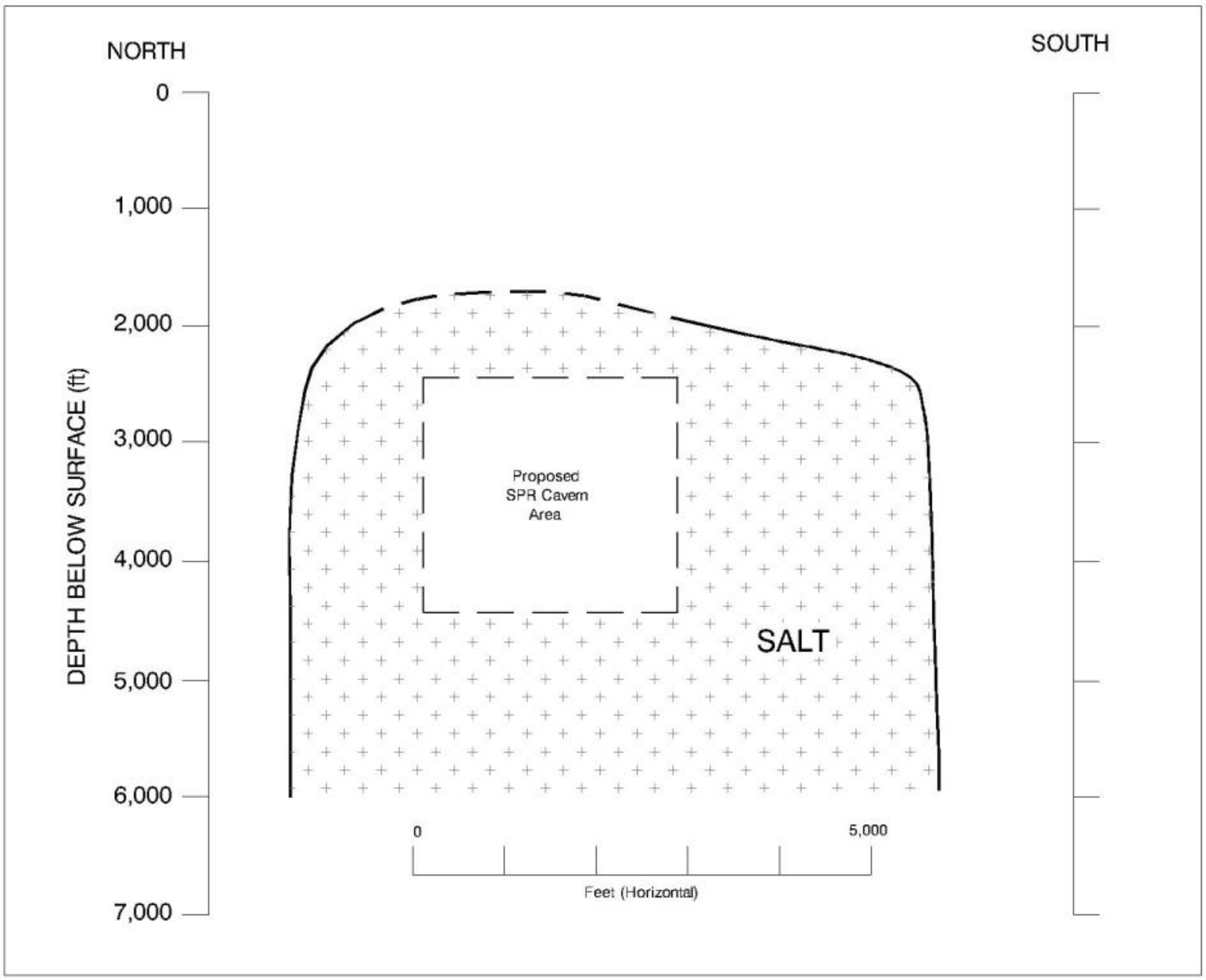
### 3.4.3 Bruinsburg Storage Site

#### 3.4.3.1 Affected Environment

> **Piercement** is a dome or anticlinal fold in which a mobile plastic core (i.e., salt) has ruptured the more brittle overlying rock. Also known as a diapir, dipiric fold, piercement dome, or piercing fold.

The Bruinsburg dome in the Mississippi embayment and a part of the north Louisiana-Mississippi salt dome basin, is characterized by thousands of feet of **fluvial deltaic** and near-shore sediments punctuated by numerous **piercements**. The Bruinsburg salt dome is an irregular shape; its approximate dimensions are 2,600 feet (810 meters) (north-south) by 3,400 feet (1,030 meters) (east-west) at a depth of 2,500 feet (760 meters). The top of the salt dome is at a depth of approximately 2,000 feet (610 meters) with an area of about 240 acres (96 hectares). There is an **overhang** in the western area of the dome (Swann 1989). The north flank of the dome has a minimally overhanging, but near-vertical salt margin (Rautman and Lord 2005, p. 2). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.3-1.

**Figure 3.4.3-1: Cross-Section Diagram of the Bruinsburg Dome**



On the western side of the caprock, a fault trends mostly northward and tangential to the dome margin (Rautman and Lord 2005).  A number of faults also offset sedimentary horizons overlying the caprock (Swann 1989).

No pre-existing leached cavities are in the Bruinsburg salt dome (Rautman and Lord 2005).

The area considered for brine disposal is just south of Highway 552 and north of Alcorn, MS.  The area is dominated by cleared and level land of several hundred acres.  Two geological formations could be used as the brine disposal reservoir:  the Wilcox sand, which is more than 1,300 feet (400 meters) thick and 3,100 feet (950 meters) below surface, and the Sparta sand, which is about 750 feet (230 meters) thick and more than 1,800 feet (550 meters) below surface.

#### 3.4.3.2 Operation and Maintenance Impacts

***Subsidence***

At the potential new Bruinsburg site, DOE would construct 16 new 10-MMB caverns arranged in four rows of four caverns each, for a total capacity of up to 160 MMB (see figure 2.4.1-2).  By comparing the total volume of the new caverns with that of the existing caverns at sites with measured subsidence data, the local subsidence above the caverns can be estimated as 1.05 to 2.44 inches (27 to 62 millimeters) per year, resulting in total subsidence of 2.6 to 6.1 feet (0.80 to 1.9 meters) over 30 years.

With a general rule of 10 percent volume loss over 30 years resulting from salt cavern creep, the total volume loss would be 144 million cubic feet (4.1 million cubic meters); 80 percent would lead to a subsidence volume of 115 million cubic feet (3.3 million cubic meters).  Assuming that the subsidence bowl is cone-shaped with the surface edge of 4,450 feet (1,360 meters) (maximum depth of the caverns) from the outer walls of the caverns, the maximum subsidence at the surface central area over the caverns can be calculated as 3.2 feet (1.0 meters) which is in the range of 2.6 to 6.1 feet (0.80 to 1.9 meters) estimated above.  The local subsidence would be most likely in the range of 2.6 to 6.1 feet (0.80 to 1.9 meters) over 30 years.  Further subsidence after site closure would be reduced by decommissioning methods that would backfill or otherwise help keep the pressure up in the former storage caverns.

Given the groundwater level at the site and the amount of projected subsidence, ponds likely would not form over the caverns; therefore, the main impact would be the formation of a depression over the cavern area, which would tend to capture local drainage at that location.

***Multiple-Use Impacts***

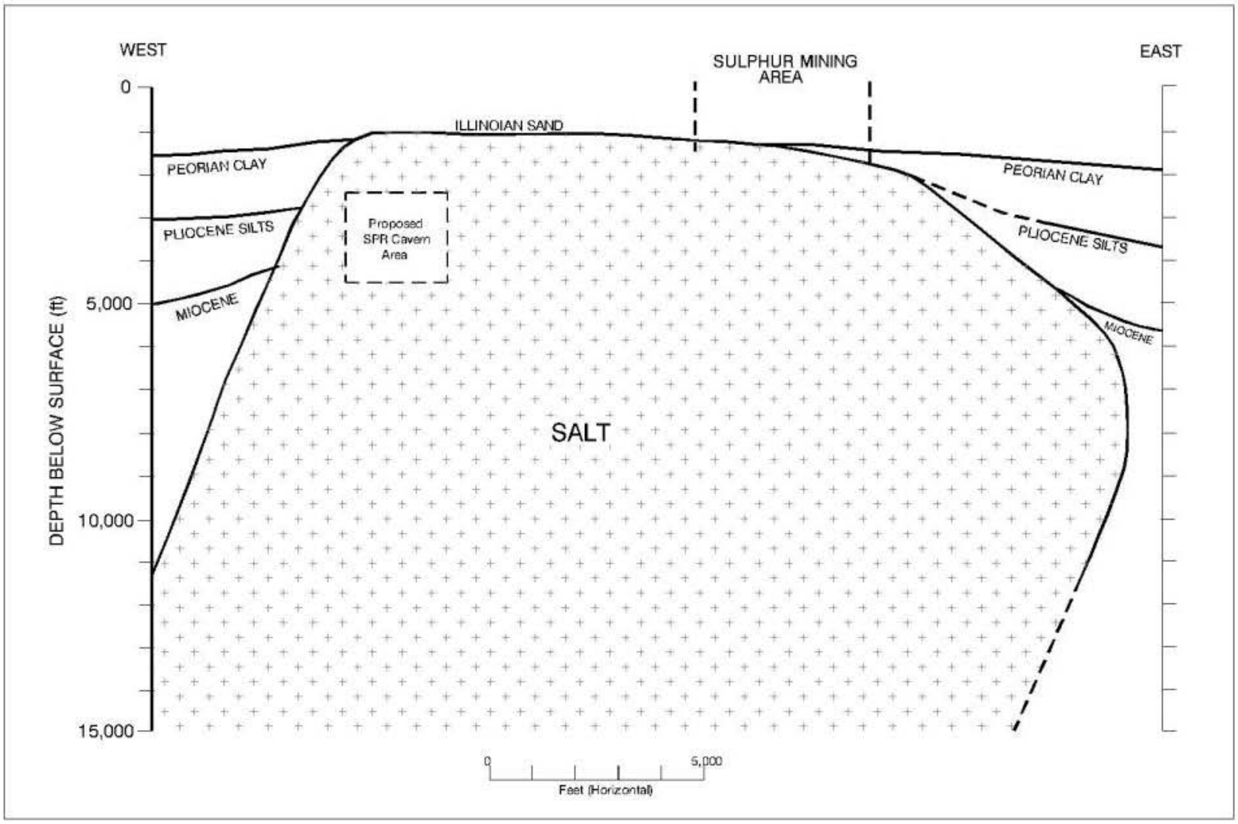
No multiple-use impacts would be expected at the Bruinsburg site because the site has no pre-existing storage caverns.

### 3.4.4 Chacahoula Storage Site

#### 3.4.4.1 Affected Environment

The Chacahoula salt dome is near the center of the Holocene Mississippi Delta, which has created the land in south Louisiana, between the old Lafourche and Teche distributive channels (Magorian and Neal 1990).  The distributive channels once drained off the Mississippi River.  The dome is an elliptical piercement structure that has a broad rounded top and sloping sides, with depths between 2,000 and 12,000 feet (610 and 3,700 meters).  The dome is large enough, about 1,700 acres (690 hectares) at 2,500 feet (760 meters) below ground, to construct a large storage facility with multiple caverns.  An overhang occurs approximately between 6,600 and 10,000 feet (2,010 and 3,040 meters) below ground on the east side. There is no indication that the overhang would affect the storage areas of the dome inside the 2,500-foot (760-meter) below ground salt contour (Magorian and Neal 1990; PBE 2004b). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.4-1.

**Figure 3.4.4-1: Cross-Section Diagram of the Chacahoula Dome**




Caprock overlying the dome is primarily composed of anhydrite, with gypsum and calcite probably present. Sulfur is a minor constituent of the caprock. Caprock is thin or absent over much of the dome, but has enough thickness in the northeast corner to have enabled minor sulfur extraction (DOE 1978b; Magorian and Neal 1990).

Up to 1,500 feet (460 meters) of unconsolidated and partially consolidated muds, sands, and shales overlie the central portion of the dome. Unconsolidated and partially consolidated sands and shales underlie the sediments and extend downward to about 7,500 feet (2,300 meters) below sea level. Sand, shale, and limestone are found below 7,500 feet (2,300 meters) underground, probably reaching depths in excess of 22,000 feet (6,700 meters) below ground. The salt piercement has forced these sediments upward in the immediate vicinity of the dome. Faulting within the lower formations adjacent to the dome is extensive and complex (DOE 1978b).

Extracting operations at the dome have produced hydrocarbons, brine, and sulfur. Sun Oil Company made the first discovery of petroleum in 1938 and has produced 50 MMB of oil and one trillion cubic feet (28 billion cubic meters) of gas on the south and northeast sides of the dome, with many oil and gas production wells drilled. Texas Brine Company operates three brine production caverns in the south central part of the dome. The area in the northeastern part of the dome was mined for sulfur from 1955 to

1962; because of these operations, the site is subject to ponding. Local surface subsidence of 1.0 feet (0.3 meters) or more has occurred (Magorian and Neal 1990; PBE 2004b).

#### 3.4.4.2 Operation and Maintenance Impacts

***Subsidence***

The proposed new caverns would result in additional surface subsidence; however, because the new caverns are far from the abandoned sulfur mining area (see figure 3.4.4-1), the new surface subsidence would not result in further sinking of previously affected areas. Based on a general rule of 10 percent initial volume loss over 30 years, similar group patterns observed in the cavern field at the West Hackberry dome, and quantitative analyses, the local subsidence over 30 years was estimated as 5 feet (1.5 meters) (Neal 1991a).

Because the Chacahoula site is in a submerged wetland, the majority of the proposed cavern area is currently under water. Local subsidence in these conditions could result in the platforms over the storage caverns becoming submerged. Proper engineering design, monitoring, and control, such as raising the height of the platforms, should prevent this problem. Thus, the main impact associated with the predicted subsidence at this site would be an increase in the water depth overlying the cavern area.

***Multiple-Use Impacts***

As previously mentioned, hydrocarbons, brine, and sulfur have been extracted respectively from the south and northeast sides, in the south central part, and in the northeastern part of the salt dome (Magorian and Neal 1990; PBE 2004b). With the proposed new caverns located in the western part of the dome and far from these operations, no adverse multiple-use impacts would be expected.

### 3.4.5 Clovelly Storage Site

#### 3.4.5.1 Affected Environment

The SPR facility at Clovelly would be at the site of Louisiana Offshore Oil Port's (LOOP) Clovelly Dome Storage Facility (see figure 2.4.3-1). The surface above this dome is inundated marshland, cut by barge canals used for past exploratory drilling and production.

The Clovelly salt dome is a nearly vertical salt mass with the top of the salt dome at a depth about 1,100 to 1,200 feet (335 to 366 meters). The caprock overlying the dome includes three zones (from the caprock-salt interface up): nonporous anhydrite with an average thickness of 270 feet (82 meters), fractured gypsum with an average thickness of 380 feet (120 meters), and crushed limestone, calcite, and shale with sandy lenses and fracture fillings averaging 100 feet (30 meters) in thickness. Overlying the caprock is a zone of unconsolidated to partially consolidated sand and gravel, averaging 290 feet (87 meters) in thickness. Over the sand and gravel is a zone of water and unconsolidated sediments composed of mud, muck, shale, and shells averaging 130 feet (39 meters) in thickness. A cross-section diagram of the dome and surrounding area is shown in figure 3.4.5-1.

In 1952, Texas Gulf Sulfur Corporation drilled 18 exploratory holes in the salt dome in search of commercial sulfur deposits. No commercial sulfur was identified (DOT 1976).

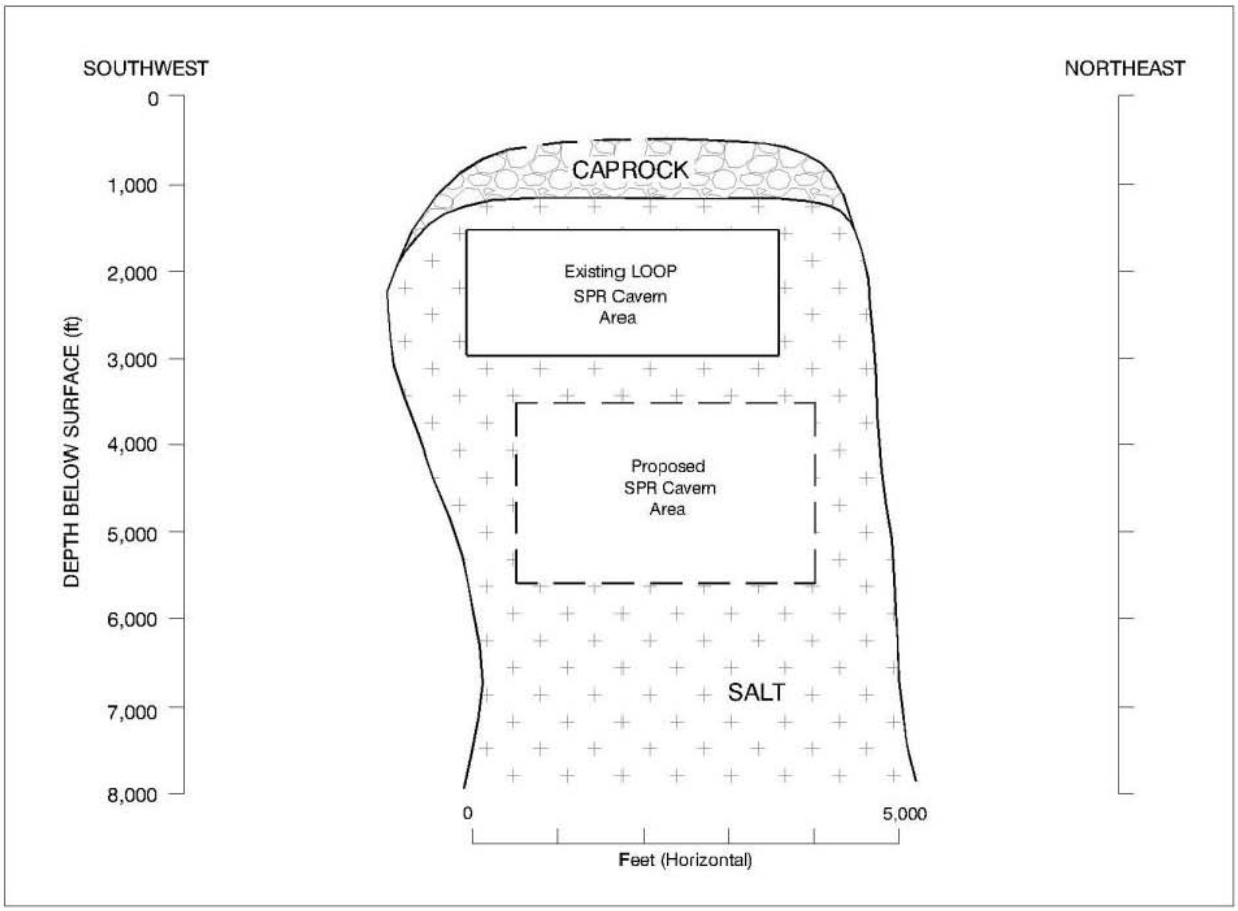
However, since 1950, more than 30 MMB of oil and more than 200 billion cubic feet (5.6 billion cubic meters) of natural gas have been produced from sand reservoirs in highly-faulted areas surrounding the salt dome.

### 3.4.5.2 Operation and Maintenance Impacts

***Subsidence***

Sixteen new caverns with a total capacity of 120 MMB would be constructed at the area of the existing LOOP caverns with an existing LOOP capacity of up to 48 MMB.  All new caverns would be located over 500 feet (152 meters) below existing LOOP caverns (see figure 3.4.5-1).  From quantitative analyses using the measured subsidence data at existing sites and detailed analyses based on a rule-of-thumb of 10 percent initial volume loss over 30 years, DOE estimates that the local subsidence at the surface area over the caverns would be 2.8 to 6.4 feet (0.9 to 2.0 meters) over 30 years.

**Figure 3.4.5-1:  Cross-Section Diagram of the Clovelly Dome**




The majority of the Clovelly site is currently under water and local subsidence could submerge the platforms in the area over the storage caverns.  Proper engineering design, monitoring, and control, such as raising the height of the platforms, would prevent submergence of the platform.  Therefore, as for the Chacahoula site, the main impact associated with the predicted subsidence at Clovelly would be an increase in the water depth overlying the cavern area.

***Multiple-Use Impacts***

The proposed new SPR caverns would be co-located with the existing LOOP caverns (see figure 2.4.3-2). DOE and LOOP activities would be closely integrated and managed to effectively coexist with each other in accordance with agreements between DOE and LOOP. DOE does not expect any multiple-use impacts that might result in significant environmental degradation beyond what is normally encountered at SPR sites located by themselves.

### 3.4.6 Clovelly and Bruinsburg Storage Sites

#### 3.4.6.1 Affected Environment

Under this option, the Bruinsburg 80 MMB and Clovelly 80 or 90 MMB sites would be jointly developed to reach 160 MMB or 170 MMB of new storage capacity. The development at each storage site would be nearly identical to the development described above for each site independently, except that only 80 MMB of capacity would be developed at the Bruinsburg site and either 80 or 90 MMB at the Clovelly site. In addition, the pipelines and terminals for the Clovelly 80 or 90 MMB and Bruinsburg 80 MMB alternatives would be different. For information regarding the affected environment at these two sites, see sections 3.3.3 and 3.3.5.

#### 3.4.6.2 Operation and Maintenance Impacts

***Subsidence***

With the smaller volume of the new SPR caverns compared to the two sites by themselves, the subsidence over the caverns at each site would be smaller compared to the corresponding single site alternative (see sections 3.3.3 and 3.3.5). This would include a depression over the Bruinsburg caverns that has a depth of 1.3 to 3.0 feet (0.4 to 0.9 meters) over 30 years, compared to 2.6 to 6.1 feet (0.80 to 1.9 meters) estimated for Bruinsburg alone. Likewise, under the Clovelly 80 MMB and Bruinsburg 80 MMB alternative, the land at Clovelly would sink less, resulting in the depth of overlying water increasing by 2.1 to 4.9 feet (0.6 to 1.5 meters) over 30 years, compared to 2.7 to 6.4 feet (0.8 to 2.0 meters) estimated for Clovelly alone. Under the Clovelly 90 MMB and Bruinsburg 80 MMB alternative the land would sink slightly more than under the 80 MMB Clovelly and Bruinsburg 80 MMB alternative, but would still sink less than the Clovelly alternative.

***Multiple-Use Impacts***

The Bruinsburg site would not have multiple uses, as discussed in section 3.3.3. At the Clovelly site, the new SPR caverns would still be co-located with the existing LOOP caverns (see figure 2.4.3-2). As discussed in section 3.3.5, DOE and LOOP activities would be closely integrated and managed to avoid multiple use impacts that degrade the environment.

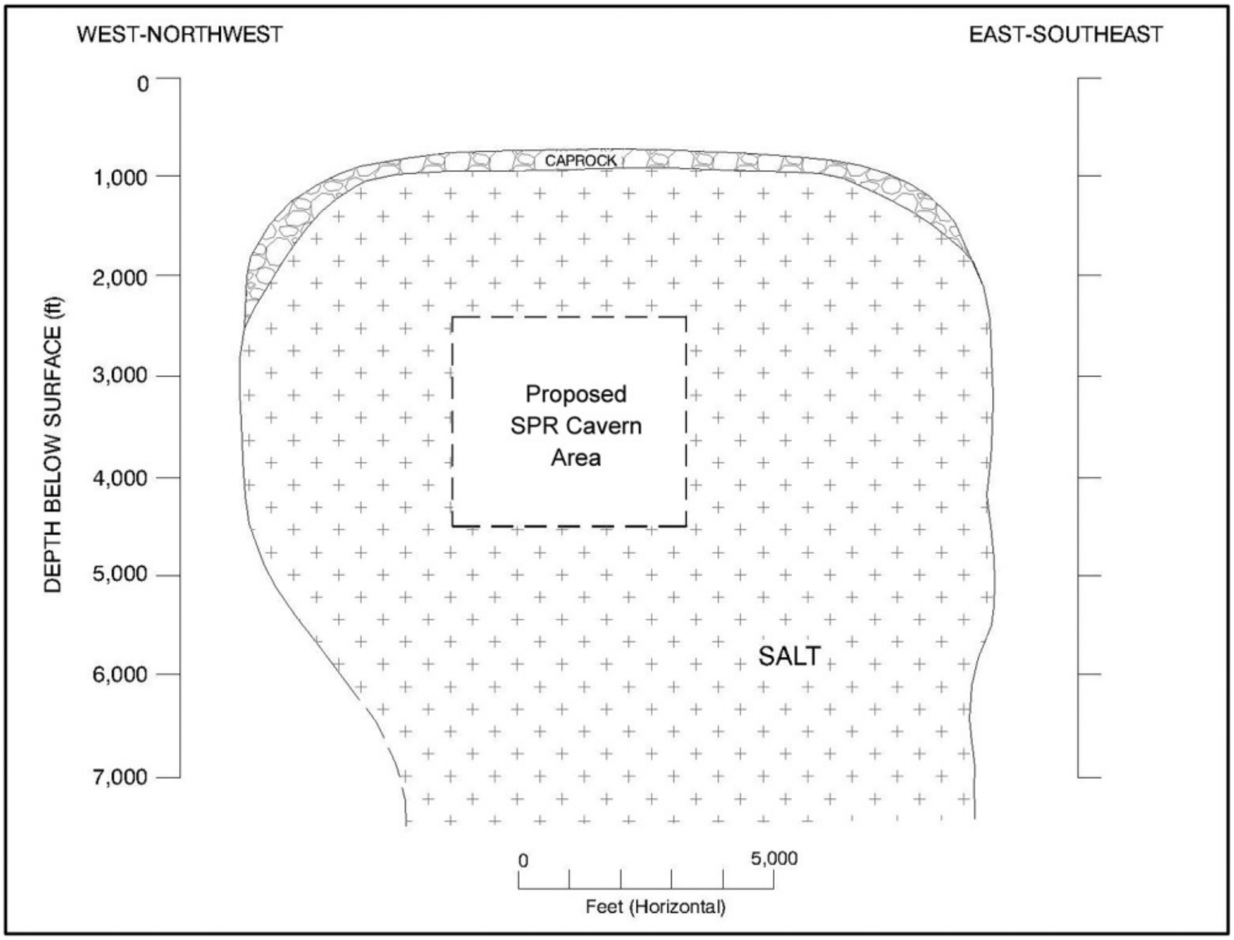
### 3.4.7 Richton Storage Site

#### 3.4.7.1 Affected Environment

The Richton salt dome is a large, oblong piercement dome. At the 2,200-foot (670-meter) depth, the dome measures approximately 5 miles (8 kilometers) (northwest-southeast) by 3 miles (4.8 kilometers) (east-west). The dome is mushroom-shaped with a large overhang on the western edge and a somewhat less well-defined overhang on the eastern edge. Sulfur exploration wells indicate that the shallowest salt is found at 720 feet (220 meters) below land surface. About 5,500 acres (2,200 hectares) within the

2,000-foot (600-meter) deep salt contour are potentially suitable for crude oil storage caverns (DOE 1986; Neal 1991b). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.7-1.

**Figure 3.4.7-1: Cross-Section Diagram of the Richton Dome**




The top of the caprock lies at a depth of approximately 300 feet (91 meters) below sea level. The caprock is approximately 210 feet (65 meters) thick. The caprock has a number of small fractures, which is typical of piercement domes. Most of these fractures are closed at present; however, sulfur exploration drilling and DOE boreholes in the caprock indicate that some of the fractures may be open. Because the roof salt is over 1,000 feet (305 meters) thick, these fractures would have no adverse impact on the storage caverns.

The predominant **stratigraphic** units overlying the dome are sedimentary formations extending to a depth of approximately 660 feet (200 meters) immediately over the caprock of the dome. Alluvium, which consists primarily of fine-grained sand, silt, **clay**, and sandy gravel, is found in the stream valleys around the site. The predominant formation immediately over the salt dome, the Citronelle Formation that dates to the Pliocene age, has a maximum thickness of approximately 220 feet (66 meters), and consists of gravelly, coarse-grained to fine-grained sand with lenses of silt, silty clay, and clay. These same deposits make up the upper stratigraphic units of the edge of the salt dome. Below these deposits are other sedimentary deposits that are of middle Oligocene to Paleocene age and extend to a depth of more than 2,300 feet (700 meters) and a sequence of Cretaceous and Jurassic sedimentary rocks with thickness of 9,800 to 19,000 feet (3,000 to 5,800 meters) (DOE 1986).

Faults are present in the vicinity of the Richton dome. The Phillips fault zone is located north of the dome and parallel to the Wausau salt ridge. It is the only postulated basement fault in the area. Most other faults are present only in the Eocene Wilcox Formation, but a few faults are exposed at the surface. A fault that is present at depths below the Paleocene Midway Group, known as F-7, intersects the northwestern edge of the Richton dome. Development of the fault is thought to be the result of salt dome deformation, and movement along the fault is most likely created by the migration of the salt. Evidence for two other possible faults was observed in the Hattiesburg Formation atop the dome, but this movement is minor and may not extend into the salt. None of these faults appears to have been active during the Quaternary period (DOE 1986; PB-KBB Inc. 1992).

#### 3.4.7.2 Operation and Maintenance Impacts

***Subsidence***

From quantitative analyses using the measured subsidence data at existing sites and detailed analyses based on a general rule of 10 percent initial volume loss over 30 years, DOE estimates that the local subsidence at the surface area over the caverns would be 2.6 to 6.1 feet (0.8 to 1.9 meters) over 30 years.

Because groundwater can be found just below the land surface at Richton, this depression would become filled with water. DOE proposes to use proper engineering design, monitoring, and control, such as drained paved areas, to prevent the formation of subsidence-induced ponds over the caverns. With such measures, the subsidence is expected to change the local topography immediately over the new cavern area, but local drainage patterns would probably not be significantly altered.

***Multiple-Use Impacts***

There is no existing activity, historical mining, or oil production at Richton (PB-KBB Inc., 1992, p.9). Many sulfur exploration wells have been drilled into the salt dome. Best management practices would ensure that no existing wells would intersect the caverns and that the wells above the storage caverns would be fully sealed. Although oil and gas fields exist to the north and south within 10 miles (16 kilometers) from the salt dome, no multiple-use impacts would be expected because they are not within the actual salt column of the Richton salt dome. Thus, DOE expects that no multiple-use impacts would occur at this site.

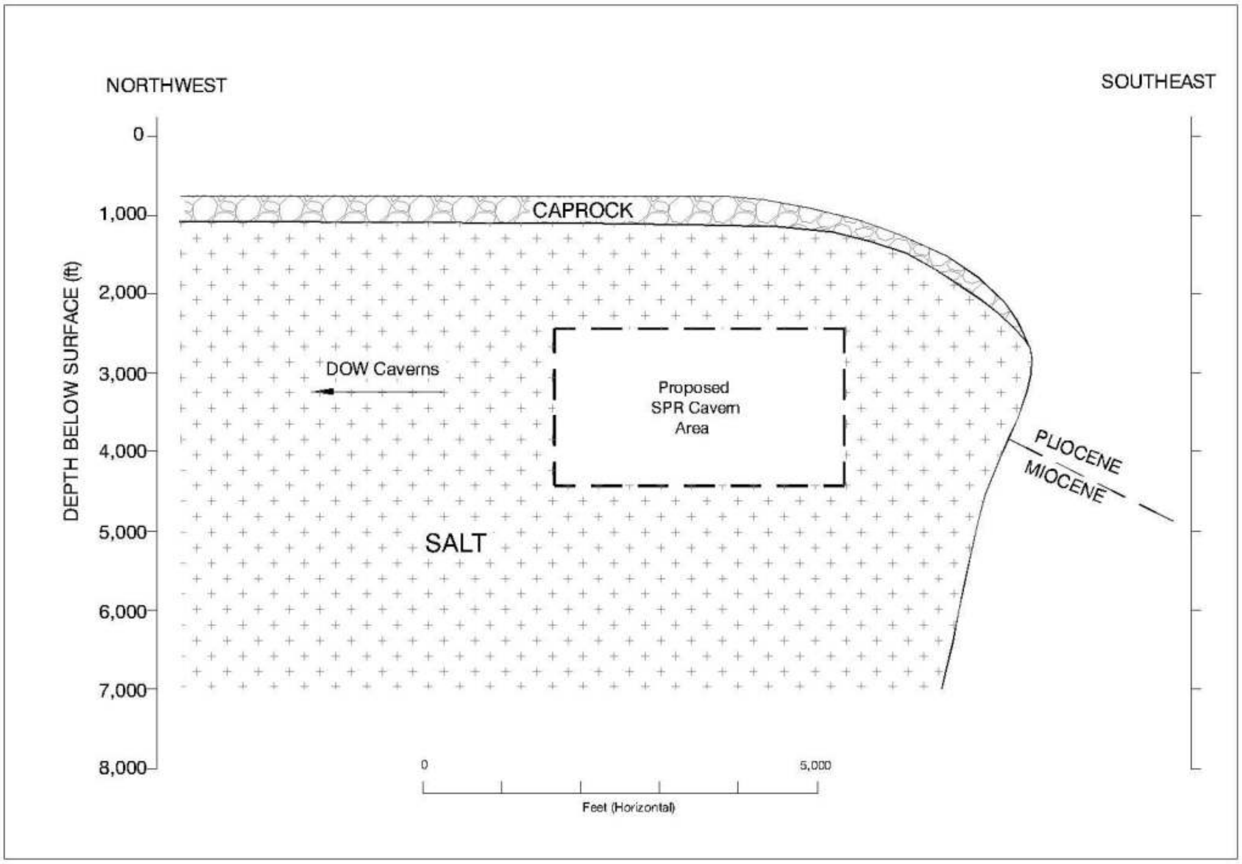
### 3.4.8 Stratton Ridge Storage Site

#### 3.4.8.1 Affected Environment

The Stratton Ridge candidate site ranges from 9.8 to 13 feet (3 to 4 meters) above sea level with local topography characterized by surrounding marshes, bayous, lakes, and creeks (DOE 1991b). The salt dome is irregular in shape with approximate dimensions of 3 miles (4.8 kilometers) (north-south) by 4 miles (6 kilometers) (east-west). The top of the caprock is at a depth of 870 feet (260 meters), and the top of the salt is at a depth of 1,300 feet (390 meters). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.8-1.

There is a salt overhang on the southeastern corner of the dome, but it would not affect the proposed SPR site because of the distance between the overhang and the proposed storage site location (DOE 1991b). A trough-like depression extends generally in a north-south direction on the east-central part of the dome. This depression is apparently the result of an active slump fault at the site. In addition, caprock shifting and associated casing failures have occurred in the area of this suspected fault, releasing ethane into the

**Figure 3.4.8-1: Cross-Section Diagram of the Stratton Ridge Dome**




caprock in at least one instance. Seismic work performed in December 1990 by Cockrell Oil Company demonstrates that this fault completely cuts off the east side of the dome with a 60 degree dip. There is a definite topographic rise on the upthrown side of the surface projection of this fault, supporting this interpretation; however, there is ample room for the proposed new SPR caverns on the high side of the fault, far enough back so that continuing fault movement would not damage well casings (Neal 1991b).

**Radial faulting**, typically found around the perimeters of salt domes, exists on the southern edge of the dome. Other faulting has also been identified in the caprock. These caprock faults are of a much smaller displacement than the radial faults (Neal 1991b). The radial faults and the other faults in the caprock would not affect cavern development and operation because they do not extend deep into the salt mass.

The surface soils immediately overlying the Stratton Ridge dome are the Edna fine sandy loam and the Edna-Aris complex. They feature a subsurface clay layer up to 4.9 feet (1.5 meters) thick, and both are poorly drained, with low **permeability** and slow surface runoff. These soils would not readily permit water to pass into the water table (USDA 1991).

Approximately 57 brine and petroleum product storage caverns with a wide range of sizes are currently in use at the Stratton Ridge dome (DOE 1991b). Subsidence is occurring over the extensive cavern field operated by a number of chemical and petroleum companies such as Dow Chemical, British Petroleum, Conoco, and Occidental, at rates comparable to those experienced at existing SPR sites (USDA 1991; Neal 1991b). The Texas Railroad Commission recently permitted Freeport LNG Development L.P. to drill at least three wells as part of an effort to construct a liquefied natural gas storage facility at the

Stratton Ridge dome (Rautman 2005). In addition, corrosion problems have occurred at the existing commercial caverns in the salt dome at Stratton Ridge because of the presence of dissolved hydrogen sulfide in groundwater (Douglas 1979).

#### 3.4.8.2 Operation and Maintenance Impacts

***Subsidence***

Local subsidence has occurred in the areas of the current cavern operations at Stratton Ridge, and it is causing a saucer-shaped depression to form over the group of caverns owned by Dow Chemical Company, Inc. The data provided by Dow for the period between 1986 and 1990 estimate the rates being experienced at existing SPR sites on other salt domes. The extent of current cavern volume loss resulting from creep closure is such that perennially wet areas could develop at Stratton Ridge even without SPR development (Neal 1991b). During operation and maintenance, local subsidence would continue to increase because of the 16 new SPR caverns with a total capacity of up to 160 MMB. The local subsidence most likely would be in the range of 2.6 to 6.1 feet (0.80 to 1.9 meters) over 30 years.

Because wet areas could develop at the Stratton Ridge site even without SPR development (Neal 1991b, p.4), DOE would use proper engineering design, monitoring, and controls, such as drained paved areas, to prevent the formation of subsidence-induced ponds over the caverns. Impacts associated with subsidence would be limited to the area immediately over the dome, including the proposed SPR site. In addition, the hydrogen sulfide present in the groundwater could travel through fissures in the caprock and lead to increased rates of corrosion and casing failures (Neal 1991b). DOE would use proper engineering design and monitoring to limit the erosion caused by the hydrogen sulfide and to monitor the casings.

***Multiple-Use Impacts***

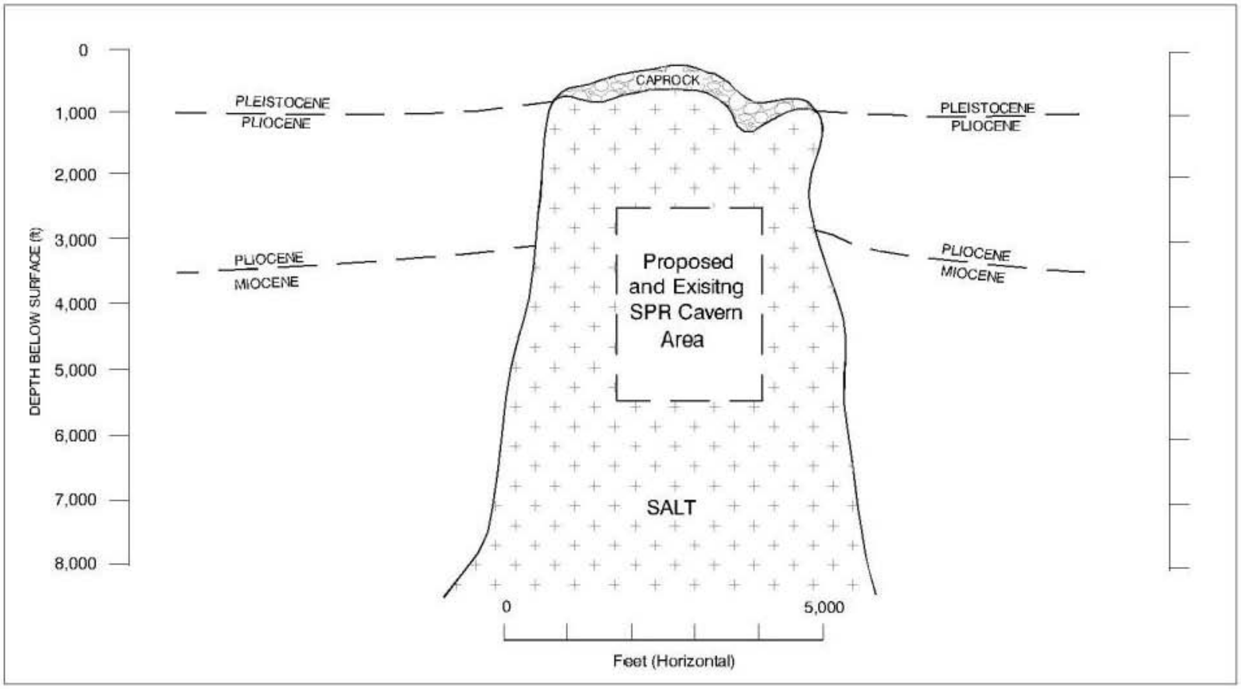
Dow Chemical, British Petroleum, Conoco, and Occidental currently operate an extensive cavern field at the Stratton Ridge salt dome consisting of approximately 57 brine and petrochemical product storage caverns with a wide range of capacities (DOE 1991b). Thus, multiple-use impacts may be possible from an accidental release of light hydrocarbons traveling through caprock fissures to an SPR site from an industrial storage site (Neal 1991b) and becoming a source of fire and contamination at the SPR site. However, because (1) no adverse effects have occurred at existing SPR sites adjacent to caverns storing light hydrocarbons, and (2) the distance between the new SPR caverns and existing light hydrocarbon storage operations would not be smaller than that at the existing SPR sites, following the SPR Level III Design Criteria, DOE expects negligible multiple-use impacts.

### 3.4.9 Bayou Choctaw Expansion Site

#### 3.4.9.1 Affected Environment

The Bayou Choctaw dome is nearly circular in plain view, having a broad irregular top at a depth of 500 to 1,200 feet (152 to 366 meters) below sea level. The sides of the dome show steeply dipping contours, with the east side dipping at about 79 degrees and gradually increasing to a vertical angle. An overhang on the west side significantly decreases the area available for solution-mined storage cavern construction. The caprock overlying the Bayou Choctaw salt dome is composed of insoluble residues of salt and its alteration products. The caprock has a highly irregular surface and its general thickness varies from 200 to 400 feet (61 to 122 meters) (DOC 1976; DOE 1978b). A cross-section diagram of the dome and surrounding area is shown in figure 3.4.9-1.

**Figure 3.4.9-1: Cross-Section Diagram of the Bayou Choctaw Dome**




Unconsolidated and partially consolidated muds and sands overlie the dome caprock with a thickness of 240 feet (72 meters) to 840 feet (260 meters). Outside the dome, unconsolidated and partially consolidated sands and shales underlie the sediments and extend downward to about 9,000 feet (2,700 meters) below sea level. These sediments have been forced upward by the salt piercement in the immediate vicinity of the dome (DOC 1976; DOE 1978b).

Oil production has occurred all around the dome with the greatest density of drilling on the southeast and north flanks (DOE 1978b). Currently six storage caverns, each approximately 12.5 MMB, operate at the Bayou Choctaw site (PBE 2004a).

#### 3.4.9.2 Operation and Maintenance Impacts

***Subsidence***

The 1982 to 1988 survey data show that the site has subsided at a rate of 0.5 to 1.3 inches (12 to 34 millimeters) per year (Neal 1991a). The 1991 survey data show that little subsidence was occurring at the site, probably only 0.1 inches (3.0 millimeters) per year (DOE 1991b). Operation and maintenance of the three new caverns (two would be constructed and one would be acquired) would increase the subsidence rate; but the increment would be small considering the small cavern volume increase (20 MB of two constructed caverns versus 86 MMB of six existing SPR caverns and one acquired cavern). Therefore, the impacts associated with subsidence at the dome area would be negligible.

***Multiple-Use Impacts***

By locating the two new caverns far from the six existing operating caverns following the SPR Level III Design Criteria (see figure 2.5.1-2), no adverse interaction impacts would be expected during operation and maintenance.

### 3.4.10 Big Hill Expansion Site

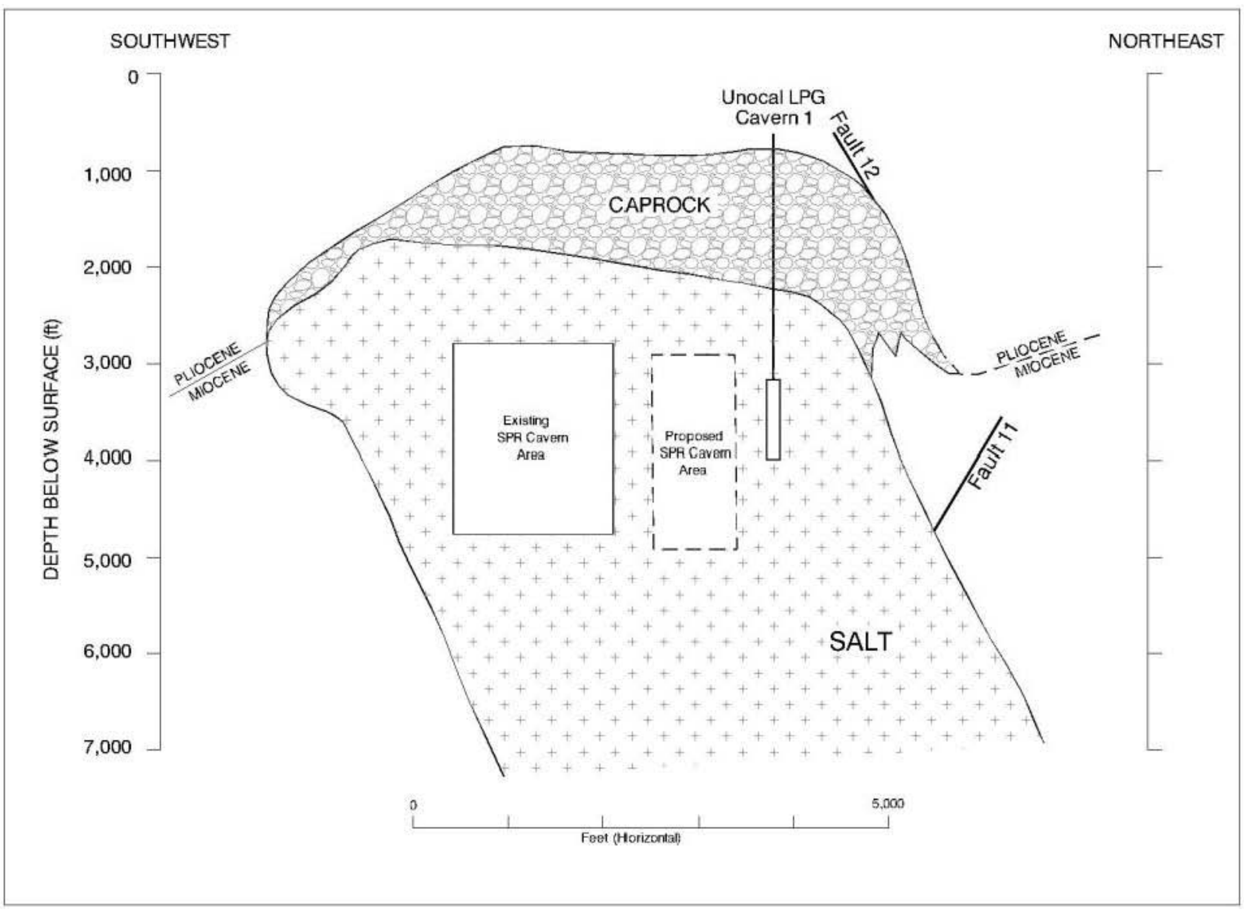
#### 3.4.10.1 Affected Environment

The Big Hill salt dome is a moderately elliptical piercement dome, with a nearly circular horizontal cross section, an irregular top, and steep sides. It is approximately 1.3 miles (2.0 kilometers) (north-south) by 1.0 mile (1.6 kilometers) (east-west).

Beaumont clay and Lafayette gravel in particular have been identified as major sediments overlying the dome. These deposits and other sands and clays have been unevenly deposited by meandering rivers in local floodplains and deltas (DOE 1978d; DOE 1989a). Sediments surround the dome, extending to depths exceeding 9,800 feet (3,000 meters) (DOE 1978d). More shallow sediments from silty loam soils are found at the surface.

A cross-section diagram of the Big Hill dome and surrounding area is shown in figure 3.4.10-1. The salt dome is covered by a roughly circular surface mound that rises to a maximum elevation of about 36 feet (11 meters) above sea level and forms a significant topographic feature in the local area (DOE 1978d; DOE 1989a). The dome has three prominent overhangs, including one minor overhang on the western flank and major overhangs on both the southern and eastern flanks (Neal 1991b; DOE 1991b). The shallowest known salt is found on the west perimeter of the dome at approximately 1,700 feet

**Figure 3.4.10-1: Cross-Section Diagram of the Big Hill Dome**



(530 meters) below sea level. The deepest salt encountered at the site is on the south flank of the dome at 5,700 feet (1,750 meters). An estimated 420 contiguous acres (170 hectares) within the 2,000-foot (600-meter) underground salt contour and extending to 5,900 feet (1,500 meters) deep are potentially suitable for the development of crude oil storage caverns. The existing cavern depth interval of 2,200 to 4,200 feet (670 to 1,300 meters) could be used for additional cavern development. The total potential storage volume is 270 MMB (DOE 1978d).

The top of the caprock lies at a depth of approximately 330 feet (100 meters) below the surface and covers the majority of the salt mass. The thickness of the caprock varies between 850 and 1,400 feet (260 and 410 meters), making it one of the thickest in the Gulf Coast region (DOE 1991b). The caprock is composed of porous sandstone that overlies dolomitic limestone, gypsum, and anhydrite (DOE 1978d). Because of cavities or large pores in the caprock, previous SPR drilling encountered several zones of lost circulation (loss of drilling mud) (DOE 1991b). Because of the upward pressure exerted by the rising salt, the caprock is severely fractured and faulted. One major surface fault has resulted in 98 feet (30 meters) of displaced caprock and likely extends into the dome. Otherwise, the fault patterns identified by extensive drilling in the Big Hill caprock and in the areas flanking the dome are characteristic of the fault patterns of domes. This pattern generally reflects radial faulting with subsidiary concentric, normal faults between the radial faults (DOE 1978d).

Uncertainty remains regarding an apparent north-south trending shearing zone at the site. There is no evidence that this **shear zone** has affected the existing SPR cavern field (Neal et al. 1991c).

#### 3.4.10.2 Operation and Maintenance Impacts

***Subsidence***

Survey data indicate that the site has subsided 0.24 to 0.60 inches (6 to 15 millimeters) per year between April 1989 and May 1994 and 0.24 to 0.36 inches (6 to 9 millimeters) per year between May 1994 and January 1999 (Bauer 1999). The decrease is probably due to the operational procedure of maintaining the caverns at a relatively high operating pressure and the corresponding decrease in creep closure rate of the caverns with time (Bauer 1999). During operation and maintenance, the site likely would subside at a rate higher than the existing rate of 0.24 to 0.36 inches (6.1 to 9.1 millimeters) per year because of the new caverns. Assuming that the subsidence rate is proportional to total cavern volume and that the total existing cavern volume is 170 MMB, the new subsidence rate can be estimated as follows:

- Approximately 0.35 to 0.53 inches (9.0 to 13 millimeters) per year with total new cavern volume equal to 80 MMB;
- Approximately 0.38 to 0.56 inches (9.5 to 14 millimeters) per year with total new cavern volume equal to 96 MMB; and
- Approximately 0.39 to 0.59 inches (10.0 to 15 millimeters) per year with total new cavern volume equal to 108 MMB.

At the highest subsidence rate of 0.59 inches (15 millimeters) per year corresponding to the largest total new cavern volume of 108 MMB, the land surface would subside 1.5 feet (0.45 meters) over 30 years. Because the top of the most shallow aquifer at the Big Hill site is approximately 6.6 feet (2 meters) below land surface, no formation of ponds would be expected during the life of the operation. In addition, engineering controls such as surface pavement with drainage systems would prevent the formation of such ponds.  Thus, DOE expects no subsidence impacts would occur at this expansion site, even for the 108 MMB storage capacity alternative.

***Multiple-Use Impacts***

There are two small liquefied petroleum gas storage caverns of 0.5 MMB each owned by Unocal Corporation in addition to the 14 existing SPR caverns in the salt dome.  There are also oil fields on the northwest and southwest flanks of the dome, although no commercial oil production has ever occurred from the caprock (DOE 1992a, p. 7-3).  With the new caverns located far from the existing operations (see figure 2.5.2-2), DOE expects that no adverse multiple-use impacts would occur.

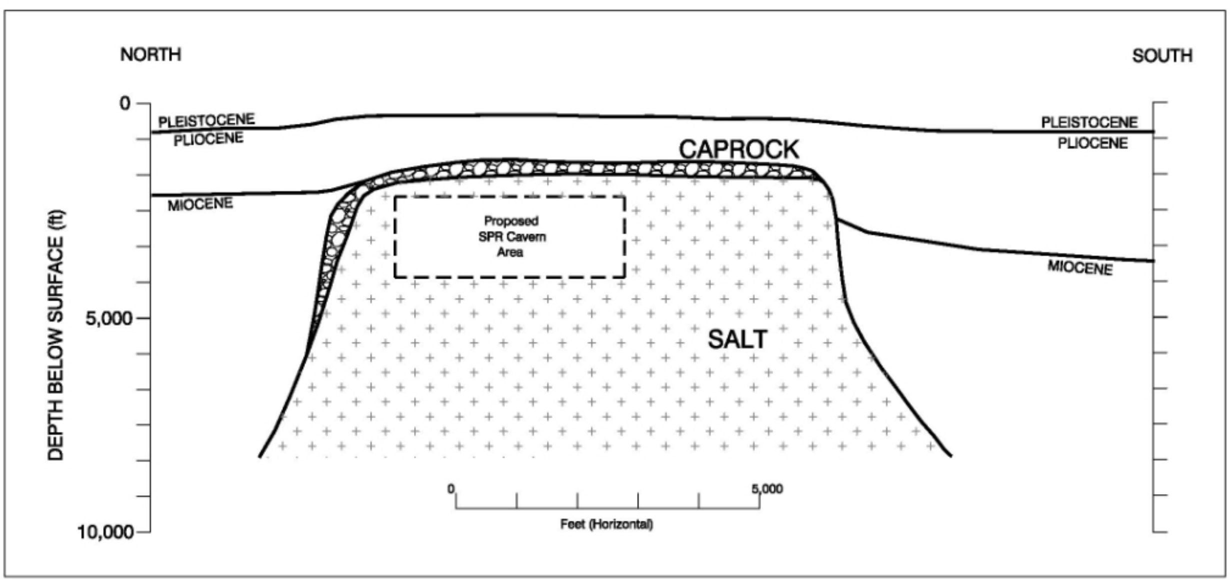
### 3.4.11   West Hackberry Expansion Site

#### 3.4.11.1   Affected Environment

Unconsolidated and partially consolidated muds, sands, and shales overlie the central portion of the West Hackberry dome, with thicknesses ranging from 1,500 to 2,000 feet (460 to 610 meters).  Unconsolidated and partially consolidated sands and shales extend to a depth of 9,500 feet (2,900 meters) on the flanks of the dome.  Above the dome, the sediments have been forced upward by the salt, forming a mound with an elevation of 19 feet (5.8 meters) above mean terrain (DOC 1977).

The West Hackberry dome itself is an elliptical piercement structure, having a broad nearly flat top at an average depth of 2,000 feet (610 meters) below sea level.  The slope of the dome sides range from slightly less than 60 degrees to steeper than 75 degrees on the north side.  The surface area within the 2,000-foot (610-meter) depth contour of the salt stock is about 1,750 acres (710 hectares).  An overhang is on the southeast side of the dome (DOC 1977; DOE 1978d).  A cross-section diagram of the dome and surrounding area is shown in figure 3.4.11-1.

**Figure 3.4.11-1:  Cross-Section Diagram of the West Hackberry Dome**




Caprock covers the entire salt mass above the 3,000-foot (914-meter) depth contour, with a maximum thickness of 525 feet (160 meters).  Caprock depth ranges from less than 1,500 feet (457 meters) in the southwest to more than 4,000 feet (1,220 meters) on the north and south perimeter (DOC 1977).  The caprock is intensively fractured, faulted, and broken into fragments resulting from upward pressures exerted by the rising salt stock (DOE 1978d).

Faulting in formations overlying and adjacent to the dome is extensive and complex. Three major northeasterly trending faults may have influenced the orientation of the dome axis. These faults have created a zone of weakness through which the salt may have risen. A secondary series of radial faults is interpreted to occur on the northwest and southeast perimeter of the dome (DOC 1977).

#### 3.4.11.2 Operation and Maintenance Impacts

***Subsidence***

Data from January 1983 to October 1988 show a subsidence rate of 2 to 3 inches (51 to 76 millimeters) per year at West Hackberry, while data from January 1993 to October 1996 show that the subsidence rate had decreased to 1 to 2 inches (25 to 51 millimeters) per year (Bauer 1997). The decrease is probably resulting from the operational procedure that maintains the caverns at relatively high operating pressure, and the corresponding decrease in creep closure rate of the caverns with time (Bauer 1997). Because no new caverns would be constructed, the future subsidence rate would be expected to be smaller than 3 inches (76 millimeters) per year.

The local subsidence likely would lead to formation of ponds at the area over the caverns. Proper engineering design, monitoring, and controls such as draining paved areas would be used to prevent the formation of subsidence-induced ponds over the caverns. Thus, DOE expects that the impact of subsidence at West Hackberry would be negligible.

***Multiple-Use Impacts***

The three caverns to be acquired by DOE at the West Hackberry site are close to each other and likely would coalesce during operation. The caverns are located in a line with 175 feet (53 meters) and 200 feet (61 meters) between the caverns. The coalescence would increase the rate of subsidence and could lead to cavity collapse. The known instances of salt cavern collapse (Bayou Choctaw, LA 1954; Grand Saline, TX 1976; Belle Isle, LA 1973; Eminence, MS 1973) occurred during brine solution mining, and they are believed to have resulted from uncontrolled or accidental leaching of the salt near the top of the dome rather than from structural failure of the cavern roof. Thickness of the cavern roof in each collapse was less than 300 feet (91 meters) (DOE 1978b, p. E-2). With the roof thickness greater than 1,500 feet (460 meters), the occurrence of collapse is very unlikely.

### 3.4.12 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that would occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. Some of the existing environments for the proposed new SPR storage site alternatives would remain undeveloped and it is possible that others would be developed for salt cavern storage or other oil and gas activities. For those sites that are developed for oil and gas activities, a small amount of localized subsidence is possible. Some of the selection of the No-Action alternative would eliminate potential geological impacts such as small long term subsidence over cavern areas and the multiple use impacts unless the caverns or their surfaces were developed for some other purpose.

The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site, and if the proposed site were developed by a commercial entity for oil and gas purposes some geological subsidence could continue as a result of those activities.  The Richton site would likely remain in use as a pine plantation because of the lack of development pressure.  Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity, some geological subsidence could occur.  The onshore Clovelly Dome Storage system would continue to operate unchanged as a component of LOOP with the exception of any expansion that LOOP might undertake.

## 3.5 AIR QUALITY

This section analyzes the potential air quality impacts of the construction and operations and maintenance activities associated with the proposed action. It starts with a description of the basic methodology used for the analysis (see section 3.5.1) and then provides an overview of the common air quality impacts expected at all of the sites (see section 3.5.2). Sections 3.5.3 through 3.5.11 then describe the affected environment and anticipated impacts at each of the proposed sites in turn, focusing on those impacts of greatest potential concern identified in the common impacts discussion. Finally, the air quality impacts of the no-action alternative are discussed in section 3.5.12. The air quality appendix to this draft EIS (appendix A) provides greater detail on the specific methodology used to develop the emission estimates.

### 3.5.1 Methodology

DOE's analysis of air quality impacts for this draft EIS can be broken down into an analysis of construction impacts and operations and maintenance impacts. DOE also specifically examined greenhouse gas emissions—which are expected to be primarily from construction activities but may also come from operations and maintenance activities—to evaluate potential climate change impacts.

#### 3.5.1.1 Construction Impacts

The analysis of construction impacts focuses on four main sources of direct emissions: site preparation (e.g., cut-and-fill operations); facility and road construction; cavern development; and pipeline construction. With the exception of cavern development activities, which are assumed to be 24-hour-per-day operations, construction activities are assumed to occur during 8-hour workdays, 5 days a week, 250 workdays per year. DOE estimates emissions associated with these four types of construction activities using the following methods:

- Fugitive **particulate matter** emissions from cut-and-fill operations are estimated based on the methodologies outlined in the Western Regional Air Partnership's Fugitive Dust Handbook (WRAP 2004). The methods in this Handbook are identical to EPA's AP–42 emission factor methodology except where WRAP developed more refined methods (EPA 2003a). Because these methodologies were developed for use in generally drier regions of the country, the analysis makes adjustments to account for standard dust suppression practices and added moisture associated with precipitation in the southeast, as described in more detail in appendix A.

- Air emissions from construction equipment powered by internal combustion engines are estimated using the emissions factor method from EPA's NONROAD model (EPA 2002, 2004a, 2004b).

- Air emissions from crew trucks needed in the construction of new or expanded sites are estimated using EPA's MOBILE6.2 model (EPA 2003b).

In addition to the direct emissions listed above, this draft EIS examines indirect emissions associated with the use of motor vehicles by employees to commute to the worksites.

The analysis focuses on five pollutants that are expected to be emitted in greatest quantities from such construction sources: carbon monoxide (CO), nitrogen oxides ($NO_x$), particulate matter with a mean aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$), particulate matter with a mean aerodynamic diameter of 10 micrometers or less ($PM_{10}$), and non-methane hydrocarbons (NMHC). Because of increasingly stringent limits on both gasoline and diesel fuel sulfur content, sulfur dioxide ($SO_2$) was not included in the analysis, since these emissions from internal combustion engines are now negligible. Similarly, fuel no longer contains lead and DOE does not anticipate any lead emissions.

DOE predicts maximum annual emissions of these pollutants during the construction phase and compares those emissions to threshold triggers for new source review requirements under the Clean Air Act (CAA). This comparison serves as a basis for evaluating whether the predicted emissions are likely to exceed the National Ambient Air Quality Standards (NAAQS) defined in EPA regulations (40 CFR Part 50), which are presented in table 3.5.1-1. Texas, Louisiana, and Mississippi are required to meet these standards.

**Table 3.5.1-1: National Ambient Air Quality Standards**

| | Primary Standard (To Protect Public Health) | | | Secondary Standard (To Protect Public Welfare) | | |
|---|---|---|---|---|---|---|
| **Pollutant** | **Level** | **Averaging Time** | **Form of the Standard** | **Level** | **Averaging Time** | **Form** |
| Ozone[a] | 80 ppb | 8-hour | 3-year average of annual fourth highest daily maximum | Same as primary standard | | |
| Particulate matter 10 microns or smaller ($PM_{10}$)[b] | 150 $\mu g/m^3$ | 24-hour | 3-year average of the number of exceedences must be less than one | Same as primary standard | | |
| | 50 $\mu g/m^3$ | Annual | Not to be exceeded | | | |
| Particulate matter 2.5 microns or smaller ($PM_{2.5}$)[b] | 65 $\mu g/m^3$ | 24-hour | 3-year average of 24-hour average 98th percentile | Same as primary standard | | |
| | 15 $\mu g/m^3$ | Annual | 3-year spatial average of annual averages | | | |
| Carbon monoxide | 35,000 ppb | 1-hour | Not to be exceeded more than once per year | No secondary standard | | |
| | 9,000 ppb | 8-hour | Not to be exceeded more than once per year | | | |
| Sulfur dioxide | 140 ppb | 24-hour | Not more than once per year | 550 ppb | 3-hour | Not more than once per year |
| | 30 ppb | Annual | Not to be exceeded | | | |
| Nitrogen dioxide | 53 ppb | Annual | Not to be exceeded | Same as primary standard | | |

Notes:

[a]As of 2005, the 1-hour standard for ozone had been phased out. Attainment of ozone standards now depends only on meeting the 8-hour standard.

[b]The standards for particulate matter, both $PM_{10}$ and $PM_{2.5}$, are currently under review. EPA has a proposed revision to the PM standards; details are available at http://www.epa.gov/PM/actions.html.

ppb = parts per billion; ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter

Source: 40 CFR Part 50

To further analyze potential impacts associated with $PM_{2.5}$ emissions, DOE also uses EPA's air quality screening model SCREEN3 (EPA 1995) to predict maximum ambient air concentrations of $PM_{2.5}$ resulting from the proposed construction activities. These predicted concentrations are then added to known background concentrations of $PM_{2.5}$ and the total resulting concentration is compared to the NAAQS. DOE focuses this analysis on $PM_{2.5}$ rather than $PM_{10}$ because, as described in the affected environment sections for each site, baseline $PM_{2.5}$ concentrations are much closer to the NAAQS and incremental $PM_{2.5}$ emissions from the proposed action are a greater potential concern than $PM_{10}$ emissions.

Finally, the CAA establishes geographic areas of attainment or nonattainment of the NAAQS for CO, PM, nitrogen dioxide ($NO_2$), and ozone based on the severity of each air pollutant. Therefore, the attainment or nonattainment status and severity are discussed separately in the affected environment sections for each of the proposed SPR storage sites and associated facilities. It is important to note that ozone is not directly emitted from sources; rather, it forms as a result of NMHC and $NO_x$ from vehicle and industrial emissions reacting with sunlight in the atmosphere.

#### 3.5.1.2 Operations and Maintenance Impacts

The analysis of operations and maintenance impacts focuses on three categories of emissions:

- CO, $NO_x$, $PM_{2.5}$, $PM_{10}$, and NMHC emissions from backup diesel generators that may be used for power sources in the event of electric power grid failures;
- Hydrogen sulfide emissions during drawdown; and
- NMHC emissions associated with well "workovers," fugitive emissions from brine ponds and storage tanks, as well as other maintenance activities.

Emissions from backup diesel generators are estimated and compared to threshold triggers for new source review and conformity review if located in nonattainment areas. Ambient air concentrations of hydrogen sulfide are estimated and analyzed for odor effects. Historical recorded emissions from well "workovers," brine ponds, and storage tanks and other maintenance activities at existing SPR sites are evaluated and compared to each state's permitted limits.

#### 3.5.1.3 Greenhouse Gas Emissions and Climate Change Impacts

Over the long term, atmospheric greenhouse gases affect global temperatures, wind and rainfall patterns, and other aspects of the global climate system by altering the ability of the Earth to reflect and absorb solar radiation. Some gases have become more concentrated in the atmosphere as a direct result of human activities and are known to affect the global equilibrium by absorbing infrared radiation that would otherwise be emitted into space and converting it into heat. The most important of these greenhouse gases are carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$).

The most significant source of greenhouse gas emissions for the SPR expansion are $CO_2$ emissions associated with combustion sources (construction equipment and motor vehicles) and $CH_4$ during cavern leaching. All combustion engines, including gasoline and diesel-fueled engines, emit large quantities of $CO_2$. Emissions of $N_2O$ and $CH_4$ from gasoline and diesel engines are much smaller, so only $CO_2$ needs to be considered from these sources. Solution mining of salt from cavern development emits trapped $CH_4$ in addition to NMHC. The brine pumped from the caverns also contains some $CO_2$. However, $CO_2$ is soluble in water, and the concentrations of $CO_2$ in the brine are well below equilibrium concentrations found in sea water, so only the $CH_4$ emissions from cavern leaching are considered in this draft EIS.

For both off-road and on-road internal combustion engines, a mass balance method was used to estimate $CO_2$ emissions. This method is based on fuel consumption, assuming that all the carbon in the fuel that is not emitted directly as hydrocarbons is converted to $CO_2$. The method used to estimate $CH_4$ emissions from cavern leaching is fundamentally the same as that used to estimate NMHC emissions based on measurements of hydrocarbons in the brine solution (DOE 1981). Both the method for estimating $CO_2$ from fuel combustion and estimating $CH_4$ from cavern leaching are described in greater detail in the Air Quality Appendix to this draft EIS (see appendix A). Estimated emissions of $CH_4$ are converted to $CO_2$

equivalent global warming potentials by applying a factor of 23, as was used in the Intergovernmental Panel on Climate Change Third Assessment Report (IPCC 2001).

### 3.5.2 Impacts Common to Multiple Sites

Section 3.5.2.1 reviews the major types of emission sources and pollutants that would be associated with construction of all of the proposed sites and related infrastructure. Because the magnitude of these emissions is dependent on the nature and extent of the proposed construction activities, which vary substantially across the different sites, the construction impacts are evaluated in more detail on a site-specific basis in sections 3.5.3 through 3.5.11.

Sections 3.5.2.2 reviews the common types of emissions from the proposed operations and maintenance activities and section 3.5.2.3 reviews the common sources of greenhouse gas emissions and resulting climate change impacts. Because the nature and magnitude of these emissions are similar and can be evaluated together across the different sites, they are evaluated only in these common impact discussions and are not addressed in the site-specific sections that follow.

#### 3.5.2.1 Construction Impacts

SPR site preparation, facility and road construction, cavern development, pipeline construction, and oil storage tank construction and use would generate air emissions. The greatest potential air quality impacts are expected to be associated with large-scale cut-and-fill operations, which emit fugitive particulate matter. In addition, construction equipment is generally powered by internal combustion engines that emit additional air pollutants, including $NO_x$, PM, CO, $CO_2$, and NMHC.

Site preparation can be divided into four sequential phases: clearing and grubbing, rough grading, soil stabilization, and embankment placement and compaction. The emissions associated with these activities depend upon the facility size, existing vegetation, local terrain, and the extent to which affected areas are wetlands.

Facility construction also has four phases: foundation pouring, building construction, electrical installation, and pipe installation. Road construction includes laying road surfaces. These activities generate both fugitive dust and fuel combustion-related emissions. The emissions associated with these activities depend upon the existing infrastructure and size of the facility and road development.

Cavern development involves the use of diesel-powered boring drills working 24 hours per day. DOE expects all initial holes for new cavern development to be drilled during facility construction. Cavern development also involves dissolving the underground salt with fresh water and pumping out saturated brine, as described in Chapter 2. Because the salt is soluble in water but not in oil, oil is pumped into the cavern to protect the cavern ceiling and later to fill the cavern as it is formed. A small portion of the oil at the interface between the organic and aqueous phases mixes with the solution mining water and is pumped out with the brine during the cavern solution mining process. DOE assumes for this air quality analysis that oil that is mixed with the aqueous phase is pumped out and is released to the atmosphere as hydrocarbon vapors (including NMHC) from either the oil/brine separator or the brine ponds (DOE, 1981). For each new or expansion site, except for West Hackberry, NMHC emissions associated with cavern development are estimated based on the maximum expected increase in cavern capacity and the maximum brine production rate. The West Hackberry expansion would not involve any cavern development and would therefore not be expected to emit any NMHC.

New and expansion SPR sites could require extensive pipeline construction for oil, brine, and raw water transport. These pipes would range in diameter from 16 to 48 inches (0.4 to 1.2 meters) and would be buried. The miles of pipeline construction vary among each proposed site, as described in Chapter 2. Emissions-generating activities include both fugitive dust from the soil disturbance and fuel combustion from the off-road construction equipment. Because the majority of pipeline construction would be away from the storage sites themselves, pipeline construction can begin at the start of storage site preparation and can continue for up to three years, depending upon the site.

For several of the new site options (Bruinsburg, Clovelly-Bruinsburg, Richton, and Stratton Ridge), new above-ground oil storage tanks would also be installed and would potentially be active during the cavern solution mining process. Each of these facilities would have up to four 0.4 MMB storage tanks. Emissions of NMHC from these tanks would be associated with standing (rim seal, deck seams and fittings) storage losses and working (during movement of crude through tanks) losses.

All of these construction-related emissions and impacts are evaluated on a site-specific basis in sections 3.5.3 through 3.5.11. This approach allows for a full discussion of the different factors contributing to the emissions and impacts at each site.

#### 3.5.2.2 Operations and Maintenance Impacts

The main operations- and maintenance-related emissions and impacts are summarized below; these include emissions from backup diesel generators, above-ground storage tank losses, brine pond losses, and frac tank emission losses associated with cavern "workovers." These emissions and impacts can be generalized across the proposed sites and do not warrant more detailed site-specific discussions in subsequent sections.

***Backup Diesel Generator Emissions***

Regional electric grids, rather than onsite internal combustion engines, will power most onsite equipment during operations and maintenance. Accordingly, routine operation of the new and expanded SPR sites is anticipated to have low air emissions.

In emergencies when the electric power grid fails, DOE may use backup diesel generators. Air emission permits are generally not required for emergency backup generators if used less than 500 hours per year, which is the expected maximum use from routine maintenance testing and emergency operations. Each of the new expansion or existing sites would be equipped with two standby diesel engine electrical generators: one for the main site rated at 1,200 horsepower (900 kilowatt) and the other for the raw water intake (RWI) rated at 340 horsepower (250 kilowatt). Table 3.5.2-1 gives the combined emissions from a 1,200-horsepower diesel generator and a 340-horsepower diesel generator operating at the same time.

**Table 3.5.2-1: Combined Emissions from a 1,200-Horsepower Diesel Generator and a 340-Horsepower Diesel Generator Operating 500 Hours per Year (tons per year)**

| CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|
| 2.22 | 9.84 | 0.40 | 0.40 | 0.40 |

Notes:

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Source: EPA, 1996; Table 3.5-1 and Table 3.3-1

In addition, the Richton site may need to use three 2,000-horsepower (1,500-kilowatt) diesel-fired engines as pumping units at the midpoint (58 miles [93 kilometers]) of the oil distribution pipeline from Richton to Liberty Terminal during drawdown events. Table 3.5.2-2 gives the total estimated emission rate from three 2,000- horsepower diesel generators.

**Table 3.5.2-2: Emissions from Three 2,000-Horsepower Diesel Generators Operating 500 Hours per Year (tons per year)**

| CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|
| 8.25 | 36.00 | 1.05 | 1.05 | 0.96 |

Notes:

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Source: EPA, 1996; Table 3.5-1

These estimated maximum air emissions from backup diesel generators would be small, sporadic, and inconsequential in terms of air quality impacts. Considered by themselves, the estimated emissions are well below 250 tons per year (230 metric tons per year), the threshold trigger for new source review. They also are below conformity emission threshold levels of 100 tons per year for either $NO_x$ or volatile organic compounds (VOCs) and, as a result, the provisions of the conformity rule would no longer apply. The section below on workover and other maintenance emissions addresses backup diesel generator emissions further by evaluating actual generator emissions from the Big Hill site together with other sources of emissions during operation and maintenance activities.

***Hydrogen Sulfide Emissions***

Crude oil can have significant sulfur content, so emissions of gaseous hydrogen sulfide during drawdown could pose a local odor nuisance or a health risk to sensitive individuals. The extent of these emissions would depend upon the gas-to-oil ratio, vapor phase of hydrogen sulfide fraction, sulfur content of the oil, drawdown rate, and local meteorological conditions.

To address this issue, DOE estimated ambient concentrations of hydrogen sulfide every 328 feet (100 meters) from release sources out to a distance of 5 miles (8 kilometers). The analysis relied on the results of a previous DOE study (Lee et al. 2000) and used the following assumptions:

- The maximum drawdown rate at each facility;
- All crude oil stored at the facility had a high sulfur content, 0.06 standard cubic feet of hydrogen sulfide per barrel;
- Stagnant air conditions (1.0 meters per second) and a mixing height of 0.25 miles (0.40 kilometers);
- Typical 400,000 barrel storage tank; and
- The potential occurrence of all atmospheric stability classes (Stability Class C was found to yield the highest estimated concentrations).

With these conservative assumptions, the estimated maximum ambient levels of hydrogen sulfide would vary by facility from 17 to 43 parts per million (1-hour average), depending upon each facility's maximum drawdown rate. DOE estimates the maximum concentration out to a distance of 0.12 miles (0.19 kilometers) from the source. These levels are high enough that people within that distance would be able to detect hydrogen sulfide odors (rotten egg smell) and would experience coughing and throat irritation when conducting moderate exercise in the area (OEHHA 2000, p. 6). The occurrence of these events, however, would be expected to be very rare as drawdown events are infrequent (only a few times in the past 20 years) and would need to be coupled with both the storage of high sulfur content crude oil (about half to two-thirds of the current crude oil storage) and the stagnant meteorological conditions assumed above.

DOE has a specific plan in place to minimize the impacts of hydrogen sulfide odors in the event of full drawdown. That plan is to inject a hydrogen scavenger (if needed, based on the oil's sulfur content) into the crude oil as it leaves the SPR, with the proper concentration to reduce the hydrogen sulfide to non-objectionable levels for worker exposures at the terminal receiving the oil. DOE has basic ordering agreements in place with several vendors to supply the large quantities of scavenger that might be required for a full drawdown. With these measures in place, DOE does not expect significant impacts associated with hydrogen sulfide emissions.

***Other Operations and Maintenance Emissions***

Historically, emissions from operations and maintenance of the SPR facilities include the following:

(1) VOCs evaporating from small quantities of oil in the brine ponds (as discussed above, the brine picks up small quantities of hydrocarbons when it comes into contact with oil during fill and drawdown activities);

(2) VOCs escaping from small leaks in pipe joints and pumping equipment (such as valves, flanges, and pump seals);

(3) CO, $NO_x$, particulate matter, and VOC emitted from backup diesel generators and pumps used to supply diesel fuel to those generators, as discussed above;

(4) VOCs evaporating from various tanks and other equipment used to store or move oil or other fluids containing volatile compounds, such as "slop oil" tanks (used to store oil discharged as a result of equipment maintenance or contaminated stormwater), crude oil storage tanks, "sump" tanks (which accept crude oil that might be spilled during maintenance activities), diesel fuel storage tanks, gasoline storage tanks, other assorted equipment (such as an "air eliminator" and "solvent recycler"), and "frac" tanks (used to receive crude oil from a cavern that is being worked on to reduce cavern pressure); and

(5) CO, $NO_x$, particulate matter, and VOCs emitted from vehicles used by workers commuting to and from the sites.

For the purpose of this draft EIS, historical emissions from the 161 MMB Big Hill facility can be used to estimate emissions from the proposed new or expanded SPR facilities. The current permit limits for emissions from operations and maintenance at Big Hill are shown in table 3.5.2-3. These include permit limits for backup diesel generators, which are well below the maximum estimated emissions presented above. Actual emissions have been below the total permitted levels shown in the bottom row of this table, so these values are conservative for the purpose of estimating emissions at other sites.

Although not the subject of a permit limit in Texas, there are also occasional frac tank emissions of VOCs, depending on the need for cavern maintenance activities. Recorded frac tank emissions of VOCs have been highly variable from year to year, since the same extent of cavern maintenance is not needed every year. In particular, VOC emissions from frac tanks at Big Hill were: 62.5 tons in 1998; 7 tons in 1999; 0.5 tons in 2000; 53.9 tons in 2001; 10.7 tons in 2002; 16.6 tons in 2003; and 17.4 tons in 2004.

**Table 3.5.2-3: Permit Limits for Emissions from Operations and Maintenance of Current Big Hill Facility (tons per year)**

| Emission Source | CO | $NO_x$ | $PM_{10}/PM_{2.5}$[a] | VOC |
|---|---|---|---|---|
| Brine pond | — | — | — | 3.15 |
| Fugitive emissions from piping | — | — | — | 9.34 |
| 6-kilowatt generator | 0.01 | 0.03 | 0.01 | 0.01 |
| 900-kilowatt generator | 0.43 | 2 | 0.03 | 0.06 |
| 80-kilowatt generator | 0.03 | 0.14 | 0.01 | 0.01 |
| Diesel pump | 0.1 | 0.45 | 0.03 | 0.04 |
| Slop oil tank | — | — | — | 0.18 |
| Crude oil tank | — | — | — | 1.37 |
| Sump tank | — | — | — | 0.06 |
| Diesel fuel tanks (4) | — | — | — | 0.04 |
| Gasoline tank | — | — | — | 0.24 |
| Air eliminator | — | — | — | 1.5 |
| Solvent recycler | — | — | — | 0.06 |
| Total permit limit for all sources | 0.57 | 2.62 | 0.08 | 16.1 |

[a] Permit limits are the same for $PM_{10}$ and $PM_{2.5}$ emissions

Adding the recent maximum frac tank emissions of VOCs (62.5 tons per year) to the total permitted VOC emissions from other onsite sources reported in table 3.5.2-3 (16.1 tons per year) yields a maximum estimate of 78.6 tons per year of VOCs emitted from Big Hill operation and maintenance activities.

DOE expects that operation and maintenance emissions at the proposed expansion sites would be similar to those at Big Hill, but the emissions are likely to vary in proportion to the storage capacity of the different facilities.  Therefore, for this draft EIS, DOE took the maximum Big Hill emissions discussed above and scaled them up or down to reflect the storage capacity of the site relative to the Big Hill storage capacity.  To these scaled results, DOE then added estimated emissions associated with worker vehicles commuting to the sites.  The estimated results are summarized in table 3.5.2-4.

**Table 3.5.2-4: Estimated Maximum Emissions During the Operations and Maintenance at Proposed Expansion and New Sites (tons per year)**

| Proposed Sites | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | VOC |
|---|---|---|---|---|---|
| **Expansion Sites** | | | | | |
| Big Hill | 12.1 | 2.5 | 0.081 | 0.081 | 53.6 |
| Bayou Choctaw | 7.1 | 0.92 | 0.031 | 0.031 | 6.8 |
| West Hackberry | 16.3 | 1.3 | 0.046 | 0.046 | 3.1 |
| **New Sites** | | | | | |
| Richton | 15.7 | 3.5 | 0.12 | 0.12 | 79.0 |
| Clovelly | 24.3 | 3.4 | 0.12 | 0.12 | 59.1 |
| Chacahoula | 12.8 | 3.4 | 0.11 | 0.11 | 79.3 |
| Stratton Ridge | 36.4 | 4.8 | 0.16 | 0.16 | 78.1 |
| Bruinsburg | 33.1 | 4.6 | 0.16 | 0.16 | 79.2 |
| Clovelly-Bruinsburg | 33.1 | 4.6 | 0.16 | 0.16 | 79.9 |

Source:  Estimated as described in preceding text

The maximum estimated emissions in table 3.5.2-4 are well below 250 tons per year (230 metric tons per year), the threshold trigger for new source review.  They also are below conformity emission threshold levels of 100 tons per year for either $NO_x$ or VOC and, as a result, the provisions of the conformity rule would no longer apply. Based on this analysis, DOE expects the proposed operations and maintenance activities to have an insignificant impact on air quality.

#### 3.5.2.3 Greenhouse Gas Emissions and Climate Change Impacts

The emissions of greenhouse gases associated with construction and expansion of the SPR sites during maximum activity are shown for each site in table 3.5.2-5. Maximum total greenhouse gas emissions associated with the proposed action (0.22 million tons of $CO_2$ equivalents per year for the expansion alternative involving Bruinsburg and the three expansion sites) would be less than 0.004 percent of the annual total greenhouse gas emissions for the United States in 2000 (7,140 million tons of $CO_2$ equivalents per year). Once cavern development is complete, emissions would be limited to only indirect impacts associated with emissions from commuter vehicles (as high as 0.019 million tons of $CO_2$ equivalent per year, depending upon which combination of sites are developed), which would be about a third of the construction impacts. Therefore, the incremental emissions and climate change impacts of the proposed SPR site development are considered very small.

**Table 3.5.2-5: Annual Average Emissions of Greenhouse Gases Associated with Site Construction and Expansion (million tons of $CO_2$ equivalents)**

| Site | Construction Impacts | Leaching Impacts | Indirect Impacts[a] | Total |
|---|---|---|---|---|
| Bruinsburg | 0.071 | 0.065 | 0.011 | 0.147 |
| Chacahoula | 0.024 | 0.065 | 0.004 | 0.060 |
| Clovelly | 0.023 | 0.053 | 0.005 | 0.093 |
| Richton | 0.025 | 0.065 | 0.005 | 0.095 |
| Stratton Ridge | 0.024 | 0.065 | 0.011 | 0.100 |
| Bayou Choctaw | 0.005 | 0.008 | 0.002 | 0.015 |
| Big Hill | 0.012 | 0.044 | 0.004 | 0.059 |
| West Hackberry | Negligible | N/A | 0.002 | 0.002 |

[a] Indirect impacts would be associated with emissions from worker vehicles

N/A = not available

### 3.5.3 Bruinsburg Storage Site

#### 3.5.3.1 Affected Environment

A **design value** is a pollutant concentration, based on ambient measurement, which describes the air quality status of a given area. Areas in which the design value exceeds the NAAQS may result in a nonattainment designation for the area.

Currently, all of Mississippi is in attainment for all criteria pollutants. The ozone monitors closest to the proposed Bruinsburg SPR storage site have 8-hour **design values** between 69 and 74 parts per billion and the nearest $PM_{2.5}$ monitors have 3-year annual average concentrations between 11.9 and 13.3 micrograms per cubic meter and a 24-hour average concentration between 27 and 30 micrograms per cubic meter (see table 3.5.3-1). These upper-end values correspond to 93 percent of the NAAQS for 8-hour ozone (80 parts per billion) and 89 percent of the NAAQS for annual $PM_{2.5}$ (15 micrograms per cubic meter). Other NAAQS, such as for 1-hour and 8-hour CO, 24-hour and annual $PM_{10}$, and 24-hour average for $PM_{2.5}$ (65 micrograms per cubic meter) are met by much greater margins. Thus, the pollutants of primary concern are 8-hour ozone and annual $PM_{2.5}$.

**Table 3.5.3-1: Design Values for 8-Hour Ozone, Annual, and 24-Hour $PM_{2.5}$ at Monitoring Sites Near Bruinsburg Storage Site**

| Monitoring Site | County | Pollutant | 2001–2003 Design Value | 2002–2004 Design Value |
|---|---|---|---|---|
| Jackson | Hinds | 8-hr ozone | 73 ppb | 69 ppb |
| Highway 22 | Madison | 8-hr ozone | 74 ppb | 73 ppb |
| Vicksburg | Warren | 8-hr ozone | 74 ppb | N/A |
| Northeast Jackson | Hinds | Annual $PM_{2.5}$ | 13.0 $\mu g/m^3$ | 12.9 $\mu g/m^3$ |
| Downtown Jackson | Hinds | Annual $PM_{2.5}$ | 13.3 $\mu g/m^3$ | 13.1 $\mu g/m^3$ |
| Vicksburg | Warren | Annual $PM_{2.5}$ | 12.2 $\mu g/m^3$ | 11.9 $\mu g/m^3$ |
| Northeast Jackson | Hinds | 24-hr $PM_{2.5}$ | 30 $\mu g/m^3$ | 30 $\mu g/m^3$ |
| Downtown Jackson | Hinds | 24-hr $PM_{2.5}$ | 29 $\mu g/m^3$ | 28 $\mu g/m^3$ |
| Vicksburg | Warren | 24-hr $PM_{2.5}$ | 30 $\mu g/m^3$ | 27 $\mu g/m^3$ |

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; N/A = not applicable; PM = particulate matter; hr = hour

Sources: MDEQ, 2003; MDEQ, 2004

#### 3.5.3.2 Construction Impacts

As a proposed new SPR facility, about 270 acres (110 hectares) of the Bruinsburg site would need to be cleared and prepared. DOE estimates that this would require approximately 31 working days for clearing and grubbing, 10 working days for rough grading, 124 working days for soil stabilization with lime, and 57 working days for embankment compaction and stabilization. In addition, a marine terminal would be developed in Anchorage, LA, to support the Bruinsburg SPR site operation.

Constructing buildings and roads at the Bruinsburg site would require approximately 60 days for foundation pouring, 60 days for building construction, 250 days for electrical installation, 60 days for local pipe installation, and 60 days for road building.

Cavern solution mining would occur after other facility construction is complete and would result only in evaporative hydrocarbon emissions from oil extracted from the brine solution. Up to half of the 16 10-MMB-capacity caverns would be developed simultaneously, after which the other 8 would be developed.

In addition to the above onsite sources, emissions would be associated with pipeline ROW development and pipeline installation, as follows:

- A 14-mile (22-kilometer) brine disposal pipeline to injection wells located along the proposed Baton Rouge crude oil pipeline ROW along with a 15-mile (24-kilometer) maintenance road;
- A 39-mile (63-kilometer) crude oil pipeline connecting the facility to the Peetsville Pump Station in Lincoln County, MS;
- A 109-mile (176-kilometer) crude oil pipeline to connect the storage facility to the Anchorage, LA, Terminal area; and
- A 4.1-mile (6.6-kilometer) pipeline for RWI from the Mississippi River.

Pipeline construction would begin at the start of site preparation and continue for about 27 months using 2 pipeline construction crews.

Of the proposed new sites, Bruinsburg is unique in proposing underground injection as the method of brine disposal. DOE would space 60 brine disposal wells at approximately 1,000-foot (300-meter) distances along the brine disposal and crude oil pipelines ROW. Brine disposal wells would be drilled to a depth of 2,000 to 3,000 feet (600 to 900 meters) through rock into underlying porous media. DOE estimates that nine 500-horsepower drills similar to those used for storage cavern development could drill these wells in about 3 years.

DOE would clear an area of about 230 feet by 230 feet (70 meters by 70 meters) around each well. Overall, DOE would conduct clearing, grubbing, and rough grading activities similar to those for the SPR storage site for about 73 acres (30 hectares). The emissions would be about 59 percent of the emissions for the storage facility, based on the ratio of 73 acres to 120 acres (30 to 49 hectares). Despite the smaller area for the injection wells, the well construction schedule would be similar to the storage site schedule because of the increased effort needed for the dispersed location of the wells.

As noted above, an 11-mile (18-kilometer) aggregate surface access road would be built along the brine disposal pipeline. Emissions associated with construction of the access road are estimated by including an additional backhoe and two tractor trailers to the pipeline crew and doubling grader activity.

During the period when clearing, grubbing, and rough grading activities take place, DOE assumed that an average of 20 vehicles per day would travel the full length of the 11-mile (18 kilometer) gravel road and back. At other times, DOE assumed that an average of eight vehicles per day would travel the full length of the gravel road and back.

A summary of estimated direct air emissions and durations for different construction activities is given in table 3.5.3-2. Emissions are totals for all activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for those activities in any one year. The maximum annual emissions rate in the final row includes all the emissions during the 12-month period of greatest emissions. This is the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

**Table 3.5.3-2: Maximum Direct Emissions during Construction of Proposed Bruinsburg Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)**

| Activity | Days | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| Clearing and grubbing | 54 | 18.52 | 0.38 | 31.25 | 3.59 | 3.26 |
| Rough grading | 10 | 0.07 | 0.26 | 2.47 | 0.26 | 0.02 |
| Soil stabilization | 124 | 4.62 | 2.63 | 9.38 | 1.23 | 0.83 |
| Embankment compacting | 57 | 5.60 | 0.63 | 15.71 | 1.75 | 0.96 |
| Foundation pouring | 60 | 0.75 | 1.56 | 0.14 | 0.14 | 0.10 |
| Building construction | 60 | 0.38 | 0.45 | 0.07 | 0.07 | 0.05 |
| Electrical installation | 250 | 0.39 | 0.83 | 0.09 | 0.09 | 0.09 |
| Pipe installation | 60 | 0.11 | 0.38 | 0.03 | 0.03 | 0.02 |
| Road construction | 60 | 0.30 | 0.57 | 3.58 | 0.42 | 0.05 |
| Pipeline construction[a] | 560 | 2.01 | 2.68 | 35.72 | 3.85 | 0.35 |
| Cavern drilling | 730 | 11.12 | 47.51 | 2.27 | 2.27 | 1.57 |
| Solution mining[b] | 425 | 0.00 | 0.00 | 0.00 | 0.00 | 23.9 |
| Solution mining/fill[b] | 359 | 0.00 | 0.00 | 0.00 | 0.00 | 93.8 |

**Table 3.5.3-2: Maximum Direct Emissions during Construction of Proposed Bruinsburg Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)**

| Activity | Days | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| Final fill | 160 | 0.00 | 0.00 | 0.00 | 0.00 | 21.0 |
| Brine disposal site prep[c] | 43 | 6.87 | 0.28 | 21.84 | 4.73 | 1.13 |
| Brine disposal well drilling[c] | 1095 | 25.0 | 107 | 5.11 | 5.11 | 3.54 |
| Gravel road travel[d] | N/A | 0.48 | 0.10 | 24.86 | 5.27 | 0.00 |
| Maximum annual emissions | — | 72.10 | 162.04 | 123.82 | 13.69 | 98.82 |

Notes:

[a] The emissions associated with the pipeline construction are distributed over some 166 miles (267 kilometers)
[b] Based on simultaneous development of eight caverns; these activities would proceed sequentially
[c] The emissions associated with brine disposal wells and aggregate road travel are distributed over 11 miles (18 kilometer) of the proposed brine disposal pipeline
[d] After initial period of clearing, grubbing, and rough grading

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons; N/A = not available

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.3-3 summarizes these emissions. CO emissions would be the largest, but since these emissions would be dispersed over miles of roadway, the effect is likely to be small.

**Table 3.5.3-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Construction Activities at the Proposed Bruinsburg Site**

| Year | Workers | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| One | 211 | 54.90 | 3.52 | 0.13 | 0.13 | 4.15 |
| Two | 323 | 84.05 | 5.24 | 0.20 | 0.20 | 6.35 |
| Three | 388 | 100.96 | 6.29 | 0.24 | 0.24 | 7.63 |
| Four | 137 | 35.65 | 2.22 | 0.08 | 0.08 | 2.70 |

Notes:

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Construction of the proposed Bruinsburg storage facility would be accompanied by an upgrade of the existing Placid Refinery dock to receive oil tankers. Because it is not necessary to either dredge a channel or construct a new dock at Anchorage, emissions associated with this construction are expected to be minor. Also, at the Anchorage location and at the Peetsville pumping station, four 0.4 MMB above-ground floating storage tanks would be constructed and operated during the solution mining activities. Application of EPA's TANKS 4.0 model finds that standing losses–those associated with a tank simply storing oil-from four well–maintained floating roof tanks of this size (400 MB) are much less than 1.1 tons (1 metric ton) of NMHC per year. Working losses-those associated with oil moving through a tank during active solution mining-are estimated at 11 tons (10 metric tons) of NMHC per year across all four tanks. These small emissions are not expected to exceed the NAAQS at this offsite location.

Tables 3.5.3-2 and 3.5.3-3 and the above-described storage tank emissions conservatively estimate the total impact from the construction of the Bruinsburg storage facility and associated infrastructure. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for new source review under the CAA. The purpose of this review is to ensure that air quality is not significantly degraded from the addition of new sources of air pollution, and in areas meeting the NAAQS, new source review assures that new emissions do not significantly worsen air quality. Accordingly, sources that are below the new source review permit requirement triggers are unlikely to significantly worsen ozone air quality. This analysis indicates that emissions from construction of the new Bruinsburg storage facility are below the threshold triggers and are therefore unlikely to cause an exceedance of the ozone NAAQS.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Bruinsburg facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors (in this case the Vicksburg monitor) and the sums can be compared to the 24-hour and annual average NAAQS, which are 65 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.3-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

**Table 3.5.3-4: Modeled SCREEN3 $PM_{2.5}$ Concentrations and Local Monitored Concentrations at the Proposed Bruinsburg Site**

| Averaging Period | Modeled Concentration (μg/m$^3$) | Monitored Concentration (μg/m$^3$) | Total Concentration (μg/m$^3$) |
|---|---|---|---|
| 24-hour | 5 | 30 | 35 |
| Annual | 1.3 | 12.2 | 13.5 |

μg/m$^3$ = micrograms per cubic meter

### 3.5.4 Chacahoula Storage Site

#### 3.5.4.1 Affected Environment

The proposed Chacahoula storage site is located in the Houma-Bayou Cane-Thibodaux Metropolitan Statistical Area, which is currently in attainment for all NAAQS, including 8-hour ozone, annual average $PM_{2.5}$ and $PM_{10}$, 24-hour average $PM_{2.5}$ and $PM_{10}$, and 1-hour and 8-hour CO.

Ozone design values for the 8-hour ozone standard at the Thibodaux monitoring station in Lafourche Parish were determined by averaging the fourth highest values for each 3-year period from the EPA AirData Web site (EPA 2004c), as shown in table 3.5.4-1. Similarly, annual and 24-hour $PM_{2.5}$ design values were also calculated using values from the EPA AirData Web site for neighboring Terrebonne Parish and also appear in table 3.5.4-1. The 8-hour ozone design value is below, but near the NAAQS of 80 parts per billion. The only other pollutant close to the NAAQS is the annual $PM_{2.5}$ concentration, which is at 70 percent of the standard. Other pollutants such as nitrogen dioxide, $PM_{10}$, and CO are met by much greater margins. Thus, the pollutants of primary concern in this draft EIS are ozone and $PM_{2.5}$.

**Table 3.5.4-1: Design Values for 8-hour Ozone in Lafourche Parish and Annual and 24-Hour $PM_{2.5}$ in Terrebonne Parish**

| Site | Parish | Pollutant | 2001–2003 Design Value | 2002–2004 Design Value |
|---|---|---|---|---|
| Thibodeaux | Lafourche | 8-hr ozone | 79 ppb | 77 ppb |
| Highway 24 | Terrebonne | Annual $PM_{2.5}$ | 10.4 $\mu g/m^3$ | 10.0 $\mu g/m^3$ |
| Highway 24 | Terrebonne | 24-hr $PM_{2.5}$ | 23 $\mu g/m^3$ | 23 $\mu g/m^3$ |

Notes:
ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; hr = hour
Source: EPA, 2004c

### 3.5.4.2 Construction Impacts

DOE modeled construction activities at Chacahoula based on the cost estimate for the Chacahoula site (DOE, 2004c), the cost estimate for the Stratton Ridge site (DOE 2004e), and Chapter 2 of the 1992 draft EIS for the expansion of the SPR (DOE 1992b).

As a proposed new facility, DOE expects that about 240 acres (96 hectares) of the Chacahoula site would be prepared for construction. However, since the site is largely underwater, grading, soil stabilization, and compacting would not be needed. Nonetheless, grubbing of large trees may be needed to improve the line of site for security purposes and filling would be required for pads and facility construction. The work would require approximately 60 days for foundation pouring, 60 days for building construction, 250 days for electrical installation, 60 days for local pipe installation, and 60 days for road building.

The storage caverns at Chacahoula would be developed following the same process as at Bruinsburg, up to eight at a time, as described in section 3.5.3.2, except that the maximum solution mining rate would be 1.2 MMBD. This maximum rate effects the time period for the solution mining and fill operations.

In addition to onsite emissions, emissions would be associated with the development of four pipelines:

- A 58-mile (93-kilometer) brine pipeline into the Gulf of Mexico (40 miles [65 kilometers] onshore, 18 miles [19 kilometers] offshore);
- A 54-mile (87-kilometer) crude oil pipeline to the LOOP terminal at Clovelly;
- A 21-mile (34-kilometer) crude oil pipeline to the St. James Terminal, LA; and
- A 13-mile (21-kilometer) RWI pipeline to the ICW.

Pipeline construction is expected to begin at the start of site preparation and continue for approximately 22 months using two pipeline construction crews working an average of 250 days per year.

Table 3.5.4-2 summarizes the estimated direct emissions and durations for each construction activity for the Chacahoula storage facility. The table gives total emissions for activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for activities in any one year. The maximum annual emission rates

**Table 3.5.4-2: Maximum Direct Emissions during Construction of Proposed Chacahoula Site (total tons except emissions lasting > 1 year, which are in tons per year)**

| Activity | Days | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| Clearing | 35 | 10.87 | 0.25 | 0.33 | 0.33 | 2.11 |
| Rough grading | N/A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Soil stabilization | N/A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Embankment compacting | N/A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Foundation pouring | 60 | 0.75 | 1.56 | 0.14 | 0.14 | 0.10 |
| Building construction | 60 | 0.38 | 0.45 | 0.07 | 0.07 | 0.05 |
| Electrical installation | 250 | 0.39 | 0.83 | 0.09 | 0.09 | 0.09 |
| Pipe installation | 60 | 0.11 | 0.38 | 0.03 | 0.03 | 0.02 |
| Road construction | 60 | 0.30 | 0.57 | 3.5 | 0.42 | 0.05 |
| Pipeline construction[a] | 460 | 1.67 | 1.85 | 35.17 | 3.79 | 0.28 |
| Cavern drilling | 730 | 11.12 | 47.51 | 2.27 | 2.27 | 1.57 |
| Solution mining | 510 | 0.00 | 0.00 | 0.00 | 0.00 | 23.9 |
| Solution mining/fill | 431 | 0.00 | 0.00 | 0.00 | 0.00 | 93.8 |
| Final fill | 160 | 0.00 | 0.00 | 0.00 | 0.00 | 21.0 |
| Maximum annual emissions | — | 25.23 | 52.51 | 41.60 | 7.14 | 94.08 |

Notes:

[a] The emissions associated with onshore pipeline construction are distributed over 125 miles (201 kilometers). Emissions from offshore construction are assumed to be negligible relative to the onshore pipeline.

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons; N/A = not available

in the final row include all the emissions occurring during the 12-month period of greatest emissions. This is the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.4-3 summarizes these emissions. These emissions would be small and distributed over miles of roadway.

**Table 3.5.4-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Construction Activities at Proposed Chacahoula Site**

| Year | Number of Workers | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| One | 186 | 18.18 | 1.13 | 0.04 | 0.04 | 1.37 |
| Two | 298 | 29.13 | 1.82 | 0.07 | 0.07 | 2.20 |
| Three | 363 | 35.49 | 2.21 | 0.08 | 0.08 | 2.68 |
| Four | 112 | 10.95 | 0.68 | 0.03 | 0.03 | 0.83 |

Notes:

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Tables 3.5.4-2 and 3.5.4-3 conservatively estimate the total emissions from the construction of the Chacahoula storage facility and associated infrastructure. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for new source review under the CAA. Thus, the potential impact from the construction of the new Chacahoula storage facility on ozone air quality is unlikely to cause an exceedance of any of the NAAQS.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Chacahoula facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors and the sums can be compared to the 24-hour and annual average NAAQS, which are 65 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.4-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

**Table 3.5.4-4: Modeled $PM_{2.5}$ SCREEN3 Concentrations and Local Monitored Concentrations for the Proposed Chacahoula Site**

| Averaging Period | Modeled Concentration ($\mu g/m^3$) | Monitored Concentration ($\mu g/m^3$) | Total Concentration ($\mu g/m^3$) |
|---|---|---|---|
| 24-hour | 2 | 23 | 25 |
| Annual | 0.5 | 10.4 | 10.9 |

μg/m3 = micrograms per cubic meter

### 3.5.5 Clovelly Storage Site

#### 3.5.5.1 Affected Environment

The proposed Clovelly site is located in the Houma-Bayou Cane-Thibodaux Metropolitan Statistical Area, just like the proposed Chacahoula site. This region is in compliance with all NAAQS as discussed in section 3.5.4.1

#### 3.5.5.2 Construction Impacts

DOE has projected the construction activities at Clovelly based on the equipment and time schedule from the cost estimate for the Clovelly site (DOE 2004d), the more detailed cost estimate for the Stratton Ridge site (DOE 2004e), and Chapter 2 of the 1992 draft EIS for the Expansion of the SPR (DOE 1992b, pages 2-17 through 2-19 and pages 2-23 through 2-26).

Since the Clovelly site is mostly underwater, grading, soil stabilization, and compacting would not be needed and only emissions associated with constructing new buildings and roads were considered in this analysis. All of the offsite pipelines needed for the Clovelly site already exist; for example, the facility would use the existing brine disposal pipeline of nearly 28 miles (45 kilometers). Only onsite connecting pipelines would be installed. Storage caverns would be solution mined and filled as described for Bruinsburg in section 3.5.3.2, but with a maximum solution mining rate of 500 MBD.

Table 3.5.5-1 provides the estimated direct air emissions and durations for construction activities for Clovelly. The table provides total emissions for activities that last for less than one year. For activities lasting more than one year, such as cavern development, emissions are given as maximum rates for those activities in any one year. The maximum annual emission rates in the final row include all the emissions occurring during the 12-month period of greatest emissions. This is the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.5-2 summarizes these emissions. These emissions would be small and distributed over miles of roadway.

Tables 3.5.5-1 and 3.5.5-2 conservatively estimate the total impact from the construction of the Clovelly storage facility and associated infrastructure. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for new source review. Thus, the potential impact from the construction of the new Clovelly storage facility on air quality is unlikely to cause an exceedance of the ozone NAAQS.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Clovelly facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared

**Table 3.5.5-1: Maximum Direct Emissions during Construction of Proposed Clovelly Site (Emissions are in total tons except those lasting > 1 year, which are in tons per year)**

| Activity | Days | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| Clearing | 35 | 10.87 | 0.25 | 0.33 | 0.33 | 2.11 |
| Rough grading | N/A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Soil stabilization | N/A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Embankment compacting | N/A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Foundation pouring | 60 | 0.75 | 1.56 | 0.14 | 0.14 | 0.10 |
| Building construction | 60 | 0.38 | 0.45 | 0.07 | 0.07 | 0.05 |
| Electrical installation | 250 | 0.39 | 0.83 | 0.09 | 0.09 | 0.09 |
| Pipe installation | 60 | 0.11 | 0.38 | 0.03 | 0.03 | 0.02 |
| Road construction | 60 | 0.30 | 0.57 | 3.5 | 0.42 | 0.05 |
| Pipeline construction | N/A | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Cavern drilling | 730 | 11.12 | 47.51 | 2.27 | 2.27 | 1.57 |
| Solution mining | 829 | 0.00 | 0.00 | 0.00 | 0.00 | 9.95 |
| Solution mining/fill | 701 | 0.00 | 0.00 | 0.00 | 0.00 | 39.1 |
| Final fill | 130 | 0.00 | 0.00 | 0.00 | 0.00 | 13.9 |
| Maximum annual emissions | — | 23.56 | 50.66 | 6.43 | 3.35 | 39.1 |

Notes:

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons; N/A = not available

**Table 3.5.5-2: Indirect Emissions (tons per year) from Worker Commutes Associated with Construction Activities at Proposed Clovelly Site**

| Year | Number of Workers | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| One | 123 | 23.46 | 1.46 | 0.06 | 0.06 | 1.77 |
| Two | 196 | 37.38 | 2.33 | 0.09 | 0.09 | 2.83 |
| Three | 238 | 45.39 | 2.83 | 0.11 | 0.11 | 3.43 |
| Four | 83 | 15.83 | 0.99 | 0.04 | 0.04 | 1.20 |

Notes:

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors and the sums can be compared to the 24-hour and annual average NAAQS, which are 65 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.5-3 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

**Table 3.5.5-3: Modeled SCREEN3 $PM_{2.5}$ Concentrations and Local Monitored Concentrations for Proposed Clovelly Site**

| Averaging Period | Modeled Concentration ($\mu g/m^3$) | Monitored Concentration ($\mu g/m^3$) | Total Concentration ($\mu g/m^3$) |
|---|---|---|---|
| 24-hour | 2 | 23 | 25 |
| Annual | 0.5 | 10.4 | 10.9 |

μg/m3 = micrograms per cubic meter

### 3.5.6 Clovelly-Bruinsburg Storage Sites

#### 3.5.6.1 Affected Environment

As discussed in sections 3.5.3.1 and 3.5.5.1, the proposed Bruinsburg and Clovelly SPR sites are located in counties that are in compliance with all federal NAAQS.

#### 3.5.6.2 Construction Impacts

To reach 160 MMB or 170 MMB of new storage capacity, SPR sites at Clovelly and Bruinsburg would be jointly developed under the Clovelly 80 MMB and Bruinsburg 80 MMB alternative or the Clovelly 90 MMB and Bruinsburg 80 MMB alternative, in a manner identical to the development described for the Clovelly-only and Bruinsburg-only options with the following exceptions:

- Only 80 MMB of storage capacity would be developed at the Bruinsburg site and either 80 MMB or 90 MMB at the Clovelly site;

- The 109-mile (176-kilometer) crude oil pipeline from Bruinsburg, MS to Anchorage, LA would not be constructed;
- The 39-mile (63-kilometer) crude oil pipeline from Bruinsburg to the Peetsville Pump Station in Lincoln County, MS would not be constructed;
- A new 54-mile (87-kilometer) crude oil pipeline from Bruinsburg to Jackson Terminal would be constructed with a lateral 19-mile (30-kilometer) spur to the Vicksburg Entergy Grand Gulf Station;
- The maintenance road would be 40 percent smaller;
- The brine disposal pipeline would be 41 percent smaller;
- The marine terminal in Anchorage, LA would not be constructed; and
- Above-ground storage tanks at Peetsville would not be constructed, but instead such tanks would be located at Jackson, MS.

DOE estimates these changes would have the net effect of making the already conservative air emissions estimate for Bruinsburg (see section 3.5.3) and Clovelly (see section 3.5.5) even more conservative. Thus, potential air quality impacts from joint development of the Clovelly and Bruinsburg sites are considered unlikely to cause an exceedance of the ozone NAAQS.

For further information regarding the specific air quality impacts related to construction of these two sites, please see sections 3.5.3 and 3.5.5.

### 3.5.7 Richton Storage Site

#### 3.5.7.1 Affected Environment

Design values for 8-hour ozone and annual and 24-hour average $PM_{2.5}$ at monitoring sites near the proposed Richton facility are given in table 3.5.7-1. Currently, all of Mississippi is in attainment for all criteria pollutants. In the vicinity of the proposed Richton site, the nearest ozone monitors have 8-hour design values between 73 and 77 parts per billion. The nearest $PM_{2.5}$ monitors have 3-year annual

**Table 3.5.7-1: Design Values for 8-Hour Ozone, Annual, and 24-Hour $PM_{2.5}$ at Monitoring Sites Near Richton, MS**

| Monitoring Site | County | Pollutant | 2001–2003 Design Value | 2002–2004 Design Value |
|---|---|---|---|---|
| Stennis Air | Hancock | 8-hr ozone | 76 ppb | 77 ppb |
| Saucier | Harrison | 8-hr ozone | 75 ppb | 73 ppb |
| Vancleave | Jackson | 8-hr ozone | 73 ppb | 75 ppb |
| Hattiesburg | Forrest | Annual $PM_{2.5}$ | 13.1 $\mu g/m^3$ | 13.3 $\mu g/m^3$ |
| Laurel | Jones | Annual $PM_{2.5}$ | 14.3 $\mu g/m^3$ | 14.4 $\mu g/m^3$ |
| Hattiesburg | Forrest | 24-hr $PM_{2.5}$ | 29 $\mu g/m^3$ | 30 $\mu g/m^3$ |
| Laurel | Jones | 24-hr $PM_{2.5}$ | 32 $\mu g/m^3$ | 31 $\mu g/m^3$ |

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; hr = hour

Sources: MDEQ 2003; MDEQ 2004

average concentrations between 13 and 14 micrograms per cubic meter. These upper-end values correspond to 96 percent of the NAAQS for 8-hour ozone (80 parts per billion) and 93 percent of the NAAQS for annual $PM_{2.5}$ (15 micrograms per cubic meter). Other NAAQS for 1-hour and 8-hour CO, $NO_2$, 24-hour and annual average $PM_{10}$, and 24-hour average $PM_{2.5}$ (65 micrograms for cubic meter) are met by much greater margins. Thus, the pollutants of primary concern in this draft EIS are ozone and annual $PM_{2.5}$.

#### 3.5.7.2 Construction Impacts

For this draft EIS, DOE has estimated equipment needs and construction schedules based on the equipment and time schedule presented in the 1992 conceptual design of the Richton site (DOE 1992a), the cost estimate for the Stratton Ridge site (DOE 2004e), and Chapter 2 of the 1992 draft EIS for the expansion of the SPR (DOE 1992b).

As a proposed new SPR site, DOE estimates that about 240 acres (96 hectares) of the Richton site would need to be cleared and prepared. DOE estimates that this would require approximately 33 working days for clearing and grubbing, 10 working days for rough grading, 130 working days for soil stabilization with lime, and 60 working days for embankment compaction and stabilization. In addition, an oil terminal would be built in Pascagoula, MS and in Liberty, MS to support the Richton SPR site operation.

Building the new buildings and roads would require approximately 60 days for foundation pouring, 60 days for building construction, 250 days for electrical installation, 60 days for local pipe installation, and 60 days for road building.

Cavern solution mining would occur after other facility construction is complete and would result only in NMHC emissions from oil extracted from the brine solution. The caverns would be solution mined and filled in the same manner as described in section 3.5.3.2 for Bruinsburg, that is, eight at a time. The maximum solution mining rate is 1.2 MMBD.

In addition to the above onsite sources, emissions would be associated with the following pipeline ROW development and pipeline installation:

- A 100-mile (161-kilometer) pipeline for brine disposal to the Gulf of Mexico and crude oil distribution to the Pascagoula terminal and a parallel dual-purpose pipeline of 88 miles (142 kilometers) (a greater width is used in estimating emissions from these parallel pipelines);
- A 116-mile (186-kilometer) crude oil pipeline also connecting the storage facility to the Capline Interstate Pipeline Injection Station at Liberty, MS;
- A mid-point pump station along the pipeline to Capline, which would use three 2,000-horsepower diesel fired engines pumping units; however, these pumps would only operate during drawdown conditions; and
- A 10-mile (16-kilometer) RWI pipeline from Leaf River.

Pipeline construction would begin at the start of site preparation and continue for nearly three years using three pipeline construction crews working an average of 250 days per year.

A summary of estimated direct air emissions and durations for different construction activities is given in table 3.5.7-2. This table estimates total emissions for activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for those activities in any one year. The maximum annual emissions rate in the final row of the table includes all the emissions during the 12-month period of greatest emissions. This is the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.7-3 summarizes these emissions. These emissions would be small and distributed over miles of roadway.

Tables 3.5.7-2 and 3.5.7-3 and the above-described storage tank emissions conservatively estimate the total impact from construction of the Richton storage facility and associated infrastructure. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for new source review. Thus, the potential impact from the construction of the new Richton storage facility on air quality is unlikely to cause an exceedance of the NAAQS for ozone.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Richton facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth-movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using

**Table 3.5.7-2: Maximum Direct Emissions during Construction of Proposed Richton Site (Emissions are in total tons except those lasting > 1 year, which are in tons per year)**

| Activity | Days | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| Clearing and grubbing | 52 | 18.02 | 0.36 | 26.25 | 3.07 | 3.14 |
| Rough grading | 10 | 0.07 | 0.26 | 2.77 | 0.30 | 0.02 |
| Soil stabilization | 130 | 4.84 | 2.75 | 9.92 | 1.30 | 0.87 |
| Embankment compacting | 60 | 5.90 | 0.66 | 16.69 | 1.86 | 1.01 |
| Foundation pouring | 60 | 0.75 | 1.56 | 0.14 | 0.14 | 0.10 |
| Building construction | 60 | 0.38 | 0.45 | 0.07 | 0.07 | 0.05 |
| Electrical installation | 250 | 0.39 | 0.83 | 0.09 | 0.09 | 0.09 |
| Pipe installation | 60 | 0.11 | 0.38 | 0.03 | 0.03 | 0.02 |
| Road construction | 60 | 0.30 | 0.57 | 3.58 | 0.42 | 0.05 |
| Pipeline construction[a] | 700 | 2.50 | 2.78 | 53.58 | 5.77 | 0.42 |
| Cavern drilling | 730 | 11.12 | 47.51 | 2.27 | 2.27 | 1.57 |
| Solution mining | 425 | 0.00 | 0.00 | 0.00 | 0.00 | 23.9 |
| Solution mining/fill | 359 | 0.00 | 0.00 | 0.00 | 0.00 | 93.8 |
| Final fill | 160 | 0.00 | 0.00 | 0.00 | 0.00 | 21.0 |
| Maximum annual emissions | — | 42.65 | 54.77 | 111.52 | 14.61 | 94.22 |

Notes:

[a] Emissions associated with building the pipelines are distributed over their 302-mile (486-kilometer) length, but with 88 miles (9.6 kilometers) of crude oil pipeline collocated with the single purpose brine line

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

**Table 3.5.7-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Construction Activities at Proposed Richton Site**

| Year | Workers | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| One | 186 | 22.52 | 1.40 | 0.05 | 0.05 | 1.70 |
| Two | 298 | 36.09 | 2.25 | 0.09 | 0.09 | 2.73 |
| Three | 363 | 43.96 | 2.74 | 0.10 | 0.10 | 3.32 |
| Four | 112 | 13.56 | 0.85 | 0.03 | 0.03 | 1.03 |

Notes:

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

EPA screening factors (EPA 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors (in this case the nearest monitor is in Hattiesburg) and the sums can be compared to the 24-hour and annual average NAAQS, which are 65 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.7-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

**Table 3.5.7-4: Modeled SCREEN3 $PM_{2.5}$ Concentrations and Locally Monitored Concentrations for Proposed Richton Site**

| Averaging Period | Modeled Concentration ($\mu g/m^3$) | Monitored Concentration ($\mu g/m^3$) | Total Concentration ($\mu g/m^3$) |
|---|---|---|---|
| 24-hour | 5.0 | 30 | 35.0 |
| Annual | 1.2 | 13.3 | 14.5 |

µg/m3 = micrograms per cubic meter

### 3.5.8 Stratton Ridge Storage

#### 3.5.8.1 Affected Environment

The proposed Stratton Ridge site is located in Brazoria County in the Houston Metropolitan Statistical Area. According to the U.S. EPA Green Book (EPA 2005), this is currently a nonattainment area for 8-hour ozone (moderate), but in attainment for all other NAAQS, including annual average $PM_{2.5}$, 24-hour average $PM_{2.5}$, $PM_{10}$, and CO.

During the period of 2001-2004, two monitors in Brazoria County monitored ozone and one monitored $PM_{2.5}$. Eight-hour ozone design values for these two monitors were determined by averaging the fourth highest values for each 3-year period from the EPA AirData Web site and are shown in table 3.5.8-1. Annual and 24-hour average $PM_{2.5}$ design values for the Clute monitor were also calculated using data from the AirData Web site and also appear in table 3.5.8-1. Both monitoring sites show that the 8-hour NAAQS for ozone (80 ppb) is exceeded.

**Table 3.5.8-1: Design Values for 8-hour Ozone and Annual and 24-Hour $PM_{2.5}$ in Brazoria County**

| Site | Pollutant | 2001–2003 Design Value | 2002–2004 Design Value |
|---|---|---|---|
| Clute | 8-hr $O_3$ | 87 ppb | N/A |
| Manvel | 8-hr $O_3$ | 92 ppb | 97 ppb |
| Clute | Annual $PM_{2.5}$ | 9.5 $\mu g/m^3$ | N/A |
| Clute | 24-hr $PM_{2.5}$ | 21 $\mu g/m^3$ | N/A |

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; hr = hour; N/A = not applicable; $PM_{2.5}$ = particulate matter 2.5 microns or smaller

Source: EPA 2004c

#### 3.5.8.2 Construction Impacts

DOE has projected the construction activities for the Stratton Ridge storage facility based on the equipment and time schedule documented in the cost estimate for the Stratton Ridge site (DOE, 2004e) and Chapter 2 of the 1992 draft EIS for the expansion of the SPR (DOE 1992b, pages 2-17 through 2-19 and pages 2-23 through 2-26).

As a proposed new SPR site, DOE expects that about 270 acres (110 hectares) of the Stratton Ridge site would need to be cleared and prepared. This would require approximately 22 working days for clearing and grubbing, 7 working days for rough grading, 87 working days for soil stabilization with lime, and 40 working days for embankment compaction and stabilization.

Constructing the new buildings and roads would require approximately 60 days for foundation pouring, 60 days for building construction, 250 days for electrical installation, 60 days for local pipe installation, and 60 days for road building.

Cavern solution mining and filling would follow the plan for Bruinsburg, as described in section 3.5.2.2, that is, eight at a time. The maximum solution mining rate is 1.2 MMBD.

In addition to the above onsite emissions, offsite emissions would be associated with pipeline development. A 37-mile (60-kilometer) pipeline would be required for oil distribution to Texas City, TX, and additional 3 miles (4.8 kilometers) to connect the tank farm to the BP refinery. In addition, 6.2 miles (10 kilometers) of RWI pipeline and 10 miles (16 kilometers) of brine disposal pipeline would be needed. The RWI pipeline would be constructed in the same ROW as the land portion of the brine pipeline. Pipeline construction would begin at the start of site preparation and continue for about 18 months using one pipeline construction crew.

A summary of all estimated direct emissions and durations for different construction activities is given in table 3.5.8-2. The table provides total emissions for activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for those activities in any one year. The maximum annual emissions rate in the final row of the table includes all the emissions (both onsite and offsite) during the 12-month period of greatest emissions. This would be for the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

**Table 3.5.8-2: Maximum Direct Emissions during Construction of Stratton Ridge Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)**

| Activity | Days | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| Clearing and grubbing | 47 | 15.84 | 0.33 | 30.73 | 3.48 | 2.84 |
| Rough grading | 7 | 0.05 | 0.18 | 1.86 | 0.20 | 0.01 |
| Soil stabilization | 87 | 3.24 | 1.84 | 6.74 | 0.88 | 0.58 |
| Embankment compacting | 40 | 3.93 | 0.44 | 10.66 | 1.19 | 0.68 |
| Foundation pouring | 60 | 0.75 | 1.56 | 0.14 | 0.14 | 0.10 |
| Building construction | 60 | 0.38 | 0.45 | 0.07 | 0.07 | 0.05 |
| Electrical installation | 250 | 0.39 | 0.83 | 0.09 | 0.09 | 0.09 |
| Pipe installation | 60 | 0.11 | 0.38 | 0.03 | 0.03 | 0.02 |
| Road construction | 60 | 0.30 | 0.57 | 3.63 | 0.42 | 0.05 |
| Pipeline construction[a] | 380 | 0.83 | 0.93 | 18.14 | 1.95 | 0.14 |
| Cavern drilling | 730 | 11.12 | 47.51 | 2.27 | 2.27 | 1.57 |
| Cavern solution mining | 425 | 0.00 | 0.00 | 0.00 | 0.00 | 23.9 |
| Solution mining/fill | 359 | 0.00 | 0.00 | 0.00 | 0.00 | 93.8 |
| Final fill | 160 | 0.00 | 0.00 | 0.00 | 0.00 | 21.0 |
| Maximum annual emissions | — | 35.18 | 51.60 | 70.42 | 10.00 | 93.94 |

Notes:

[a] The emissions associated with pipeline construction are distributed over some 56 miles (90 kilometers) of pipelines

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.8-3 summarizes these emissions. These emissions would be small and distributed over miles of roadway.

**Table 3.5.8-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Construction Activities at Proposed Stratton Ridge Site**

| Year | Workers | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| One | 186 | 53.34 | 3.32 | 0.13 | 0.13 | 4.03 |
| Two | 298 | 85.45 | 5.33 | 0.20 | 0.20 | 6.46 |
| Three | 363 | 104.09 | 6.49 | 0.25 | 0.25 | 7.87 |
| Four | 112 | 32.12 | 2.00 | 0.08 | 0.08 | 2.43 |

Notes:

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

If Stratton Ridge is selected, DOE would also build four 0.4 MMB above-ground floating roof storage tanks at Texas City, TX. These tanks could potentially be operated during the solution mining activities to supply crude oil for cavern development. Application of EPA's TANKS 4.0 model finds that standing losses—those associated with a tank simply storing oil—from four well-maintained floating roof tanks of this size (400 MB) are much less than 1.1 tons (1.0 metric ton) of NMHC per year. Working losses of NMHC—those associated with oil moving through a tank during active solution mining activities—are estimated at 11 tons (9.5 metric tons) per year across all four above-ground storage tanks. In any given year, there may be both standing and working losses, and to be conservative, the total emissions from the tanks can be estimated to be the sum of these two emissions, or less than 12.1 tons (11 metric tons).

Tables 3.5.8-2 and 3.5.8-3 and the above-described storage tank emissions conservatively estimate the total impact from the construction of the Stratton Ridge storage facility and associated infrastructure. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for new source review. Thus, the potential impact from the construction of the new Stratton Ridge storage facility on air quality is unlikely to cause an exceedance of the NAAQS for ozone.

Section 176(c) of the CAAA requires that Federal actions conform to the State Implementation Plan for locations that lie within a nonattainment area. The conformity rule establishes the conformity criteria that a nonattainment area must comply with to demonstrate that the proposed action will conform to the State Implementation Plan for achieving attainment of the NAAQS. EPA has delegated implementation of the CAA to the State of Louisiana, which in turn relies on the Louisiana Department of Environmental Quality to administer and enforce the CAA requirements. The state regulation for implementation of the General Conformity Rule is found in the Louisiana Administrative Code (LAC), Part III, Chapter 14, Subchapter A, 1401-1415. As described in section 3.5.8.1, Stratton Ridge is located in an area with a designation of moderate ozone nonattainment. Thus, this site must comply with the provisions of the conformity rule for ozone precursor emissions of NOx, and VOC. However, if the proposed action's total of direct and indirect emissions are below specified emission levels (40 CFR 93.153(b)), which for a moderate ozone nonattainment area are less than 100 tons (91 metric tons) per year for either $NO_x$ or VOC, the provisions of the conformity rule no longer apply.

For $NO_x$, DOE estimates that Stratton Ridge construction activities would result in maximum direct emissions of 51.60 tons per year (see table 3.5.8-2) and maximum indirect emissions of 6.49 tons per year (see table 3.5.8-3). That sums to a maximum NOx emission of 58.09 tons per year, which is less than the 100-ton per year threshold for the conformity rule to continue to apply.

To compare VOC emissions to the conformity rule threshold, the above estimates of direct NMHC emissions need to be adjusted to account for the ethane component (this is not an issue for indirect emissions because ethane is not a significant component of gasoline or diesel combustion emissions). VOC emissions exclude both methane and ethane, since they have very little ozone forming potential. Direct NMHC emissions, however, include emissions of ethane. SPR solution mining measurements have shown that ethane ranges from 6 percent to 39 percent of the total NMHC emissions (DOE 1981). Applying the mean fraction of 20 percent to the direct NMHC emissions estimated above, the total maximum VOC emissions can be estimated as follows:

- A maximum of 93.94 tons per year of direct NMHC emissions from construction (see table 3.5.8-2) minus 20 percent equals 75.15 tons per year of VOC emissions; plus
- A maximum of 7.87 tons per year of indirect NMHC emissions from worker commutes (see table 3.5.8-3), which equates to 7.87 tons per year of VOC emissions; plus
- A maximum of 12.1 tons per year of direct NMHC emissions from tank losses (see above text) minus 20 percent equals 9.7 tons per year of VOC emissions; equals
- A total maximum of 92.72 tons per year of VOC emissions from all construction activities.

This estimated maximum VOC emissions put the proposed action below the conformity rule threshold of 100 tons per year. As a result, the provisions of the conformity rule would no longer apply.

The conformity rule also has a provision that requires a conformity analysis be performed if the emissions of concern are above 10 percent of the area's total emissions (40 CFR 93.153(i)). This type of action would be considered a "regionally significant action" subject to full conformity analysis if the emissions exceed the 10 percent threshold. The State Implementation Plan totals for Brazoria County are approximately 16,000 tons per year for VOC and 54,000 tons (49,000 metric tons) per year for $NO_x$ (EPA 2004c). The estimated maximum VOC emissions of less than 100 tons (91 metric tons) per year is considerably less than 10 percent of the respective regional emissions. Therefore, the provisions of the conformity rule would no longer apply to the proposed action at Stratton Ridge, and the potential air quality impact from the SPR expansion at Stratton Ridge would be unlikely to cause an exceedance of the NAAQS for ozone.

DOE recognizes that the preliminary conformity review conducted for this draft EIS estimates maximum VOC emissions that, at 92.72 tons per year, are close to the 100 tons-per-year threshold that triggers a full conformity determination in the affected nonattainment area. In the event that the Stratton Ridge site is selected, a comprehensive additional conformity review would be conducted taking into account any other sources, factors, or activities that may have not been considered in this draft EIS to determine if the current estimate is sufficiently conservative and could be exceeded. If necessary, a full conformity determination to demonstrate compliance with the State Implementation Plan would also be undertaken at that time. In the event that the result of this conformity determination is such that conformity could not be demonstrated, the proposed action at Stratton Ridge would be terminated and an alternative site selected.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Stratton Ridge facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth-movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors and the sums can be compared to the 24-hour and annual average NAAQS, which are 65 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.8-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

**Table 3.5.8-4: Modeled SCREEN3 $PM_{2.5}$ Concentrations and Local Monitored Concentrations for Proposed Stratton Ridge Site**

| Averaging Period | Modeled Concentration ($\mu g/m^3$) | Monitored Concentration ($\mu g/m^3$) | Total Concentration ($\mu g/m^3$) |
|---|---|---|---|
| 24-hour | 5.0 | 21 | 26.0 |
| Annual | 1.1 | 9.5 | 10.6 |

μg/m3 = micrograms per cubic meter

### 3.5.9 Bayou Choctaw Expansion Site

#### 3.5.9.1 Affected Environment

The Bayou Choctaw site is located in Iberville Parish in the Baton Rouge Metropolitan Statistical Area. According to the U.S. EPA Green Book (EPA, 2005), the Baton Rouge Metropolitan Statistical Area is currently a nonattainment area for 8-hour ozone. The Area is in attainment for all other NAAQS, including $PM_{2.5}$, $PM_{10}$, and CO.

There are no ozone monitors in Iberville Parish, but neighboring Ascension and West Baton Rouge Parishes have one monitor each. Eight-hour ozone design values for these two monitors were determined by averaging the fourth highest values for each 3-year period from the EPA AirData Web site and are shown in table 3.5.9-1. There are two $PM_{2.5}$ monitors in Iberville Parish and annual and 24-hour average $PM_{2.5}$ design values were calculated and appear in table 3.5.9-1.

**Table 3.5.9-1: Design Values for 8-hour Ozone and Annual and 24-Hour $PM_{2.5}$ Near Bayou Choctaw**

| Site | Parish | Pollutant | 2001–2003 Design Value | 2002–2004 Design Value |
|---|---|---|---|---|
| King Road | Ascension | 8-hr ozone | 77 ppb | 80 ppb |
| Port Allen | W. Baton Rouge | 8-hr ozone | 84 ppb | 84 ppb |
| Iberville | Iberville | Annual $PM_{2.5}$ | 10.8 $\mu g/m^3$ | 10.2 $\mu g/m^3$ |
| St. Gabriel | Iberville | Annual $PM_{2.5}$ | 12.4 $\mu g/m^3$ | 12.3 $\mu g/m^3$ |
| Iberville | Iberville | 24-hour $PM_{2.5}$ | 25 $\mu g/m^3$ | 25 $\mu g/m^3$ |
| St. Gabriel | Iberville | 24-hour $PM_{2.5}$ | 28 $\mu g/m^3$ | 28 $\mu g/m^3$ |

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; $PM_{2.5}$ = particulate matter 2.5 microns or smaller.

Source: EPA 2004c

#### 3.5.9.2 Construction Impacts

To expand the Bayou Choctaw site, DOE would develop up to two new 10-MMB caverns and purchase one 10-MMB cavern from Petrologistics Olefins. Because the facility is located in wetlands, clearing and grubbing activities would not be needed, except for a small effort to integrate the site into the existing facility and for security. No new buildings are planned, and only some new firewater pipelines are planned for the expansion. Thus, cavern drilling would be the primary onsite construction activity that would generate air emissions. Offsite, DOE would construct a new 3,000-foot (914-meter) brine disposal pipeline and six new brine injection wells.

Emissions associated with preparing the new caverns were conservatively estimated at 20 percent of the emissions for developing a new 160 MMB capacity site such as Richton. These emissions would be associated with constructing well pads, electrical systems, new accesses roads, and upgrades to existing access roads. Emissions estimates for developing the two new caverns are based on a maximum solution mining rate of 110 MMBD. This rate is much lower than the rate at the other SPR proposed new sites or expansions, resulting in longer time to develop the Bayou Choctaw caverns.

A summary of estimated direct emissions and durations for different construction activities is given in table 3.5.9-2. The table provides total emissions for activities that last for less than one year. For activities lasting more than one year, such as pipeline construction and cavern development, emissions are given as maximum rates for those activities in any one year. The maximum annual emissions rate in the final row of the table includes all the emissions during the 12-month period of greatest emissions. This would be for the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

**Table 3.5.9-2: Maximum Direct Emissions from Expansion of Existing Bayou Choctaw Site (Emissions are in total tons except those lasting > 1 year, which are in tons per year)**

| Activity | Days | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| Electrical installation | 50 | 0.08 | 0.17 | 0.02 | 0.02 | 0.02 |
| Pipe installation | 12 | 0.02 | 0.08 | 0.01 | 0.01 | 0.00 |
| Road construction | 12 | 0.06 | 0.11 | 1.02 | 0.01 | 0.01 |
| Pipeline construction[a] | 2.0 | 0.01 | 0.01 | 0.13 | 0.014 | 0.001 |
| Brine disposal site preparation | 4 | 0.69 | 0.03 | 2.18 | 0.47 | 0.11 |
| Brine disposal well drilling | 110 | 2.50 | 10.7 | 0.51 | 0.51 | 0.35 |
| Cavern drilling | 365 | 5.56 | 23.75 | 1.14 | 1.14 | 0.79 |
| Cavern solution mining | 1160 | 0.00 | 0.00 | 0.00 | 0.00 | 2.19 |
| Solution mining/fill | 980 | 0.00 | 0.00 | 0.00 | 0.00 | 8.60 |
| Final fill | 40 | 0.00 | 0.00 | 0.00 | 0.00 | 1.31 |
| Maximum annual emissions | — | 8.92 | 34.85 | 5.00 | 2.37 | 9.06 |

Notes:

[a] The emissions associated with pipeline construction are distributed over 3,000 feet (914 meters) of offsite brine disposal pipeline

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.9-3 summarizes these emissions. The emissions would be small and distributed over miles of roadway.

**Table 3.5.9-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Expansion of Bayou Choctaw Site**

| Year | Workers | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| One | 198 | 13.81 | 0.86 | 0.03 | 0.03 | 1.04 |
| Two | 198 | 13.81 | 0.86 | 0.03 | 0.03 | 1.04 |
| Three | 198 | 13.81 | 0.86 | 0.03 | 0.03 | 1.04 |
| Four | 198 | 13.81 | 0.86 | 0.03 | 0.03 | 1.04 |

Notes:

CO = carbon monoxide; $NO_x$ = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Tables 3.5.9-2 and 3.5.9-3 conservatively estimate the total impact from the construction of the Bayou Choctaw storage facility and associated infrastructure. In no case are the combined emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for new source review. Thus, the potential impact from the construction of the expanded Bayou Choctaw storage facility on air quality is unlikely to exceed the NAAQS for ozone.

Section 176(c) of the CAAA requires that federal actions conform to the State Implementation Plan for locations that lie within a nonattainment area. The conformity rule establishes the conformity criteria that a nonattainment area must comply with in order to demonstrate that the proposed action will conform to the State Implementation Plan for achieving attainment of the NAAQS. EPA has delegated implementation of the CAA to the State of Louisiana, which in turn relies on the Louisiana Department of Environmental Quality to administer and enforce the CAA requirements. The state regulation for implementation of the General Conformity Rule is found in the Louisiana Administrative Code (LAC), Part III, Chapter 14, Subchapter A, 1401-1415. As described in section 3.5.9.1, Bayou Choctaw is located in a marginal ozone nonattainment area. Thus, this site must comply with the provisions of the conformity rule for ozone precursor emissions, such as NOx and VOC. However, if the proposed action's total of direct and indirect emissions are below specified emission levels (40 CFR 93.153(b)), which for a marginal ozone nonattainment area are less than 100 tons (91 metric tons) per year for either $NO_x$ or VOC, the provisions of the conformity rule no longer apply.

For $NO_x$, DOE estimates that Bayou Choctaw construction activities would result in maximum direct emissions of 34.85 tons per year (see table 3.5.9-2) and maximum indirect emissions of 0.86 tons per year (see table 3.5.9-3). That totals a maximum NOx emission of 35.71 tons per year, which is less than the 100-ton per year threshold for the conformity rule to continue to apply.

To compare VOC emissions to the conformity rule threshold, the above estimates of direct NMHC emissions need to be adjusted to account for the ethane component, as described above in section 3.5.8.2 for Stratton Ridge. Going through the same process outlined in that section, the total maximum VOC emissions from Bayou Choctaw construction can be estimated as follows:

- A maximum of 9.06 tons per year of direct NMHC emissions from construction (see table 3.5.9-2) minus 20 percent equals 7.25 tons per year of VOC emissions; plus

- A maximum of 1.04 tons per year of indirect NMHC emissions from worker commutes (see table 3.5.9-3), which equates to 1.04 tons per year of VOC emissions; equals

- A total maximum of 8.29 tons per year of VOC emissions from all construction activities.

This estimated maximum VOC emission puts the proposed action below the conformity rule threshold of 100 tons per year. As a result, the provisions of the conformity rule would no longer apply.

The conformity rule also has a provision that requires that a conformity analysis be performed if the emissions of concern are above 10 percent of the area's total emissions (40CFR 93.153(i)). This type of action would be considered a "regionally significant action" subject to full conformity analysis if the emissions exceed the 10 percent threshold. The State Implementation Plan totals for Iberville Parish are approximately 6,700 tons (6,100 metric tons) per year for VOC and 39,000 tons (35,000 metric tons) per year for $NO_x$ (USEPA 2004c). The maximum of less than 8.29 tons (7.54 metric tons) per year for VOCs and 35.71 tons (32.51 metric tons) per year for $NO_x$ is considerably less than 10 percent of the respective regional emissions. Thus the proposed action does not need to carry out a conformity determination and the potential impact from the expansion of the existing Bayou Choctaw storage facility on air quality is therefore unlikely to exceed the NAAQS.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA, 1995), to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Bayou Choctaw facility. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1 hour concentration using EPA screening factors (EPA, 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors and the sums can be compared to the 24-hour and annual average NAAQS, which are 65 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.9-4 for the near fence-line concentration. This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

**Table 3.5.9-4: Modeled SCREEN3 $PM_{2.5}$ Concentrations and Local Monitored Concentrations for Proposed Bayou Choctaw Expansion**

| Averaging Period | Modeled Concentration ($\mu g/m^3$) | Monitored Concentration ($\mu g/m^3$) | Total Concentration ($\mu g/m^3$) |
|---|---|---|---|
| 24-hour | 0.8 | 28 | 28.8 |
| Annual | 0.19 | 12.4 | 12.6 |

μg/m3 = micrograms per cubic meter

### 3.5.10 Big Hill Expansion Site

#### 3.5.10.1 Affected Environment

The Big Hill site is located in Jefferson County in the Beaumont-Port Arthur Metropolitan Statistical Area. According to the U.S. EPA Green Book (EPA 2005), the Beaumont-Port Arthur Metropolitan Statistical Area is currently a nonattainment area for 8-hour ozone. The area is in attainment for all other NAAQS, including $PM_{2.5}$, $PM_{10}$, and CO.

For the period of 2001-2004, five monitors in Jefferson County had complete ozone data. Eight-hour ozone design values for these monitors are determined by calculating the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone. These values are available on EPA's AirData Web site and are shown in table 3.5.10-1 along with annual and 24-hour average $PM_{2.5}$ design values for two $PM_{2.5}$ monitors.

**Table 3.5.10-1: Design Values for 8-hour Ozone, Annual, and 24-Hour $PM_{2.5}$ in Jefferson County**

| Site | Pollutant | 2001–2003 Design Value | 2002–2004 Design Value |
|---|---|---|---|
| Beaumont | 8-hr ozone | 78 ppb | 79 ppb |
| Port Arthur (53rd St) | 8-hr ozone | 79 ppb | 78 ppb |
| Port Arthur (90th St) | 8-hr ozone | 86 ppb | 84 ppb |
| Hamshire Street | 8-hr ozone | 76 ppb | 77 ppb |
| Sabine Pass | 8-hr ozone | 91 ppb | 93 ppb |

**Table 3.5.10-1: Design Values for 8-hour Ozone, Annual, and 24-Hour $PM_{2.5}$ in Jefferson County**

| Site | Pollutant | 2001–2003 Design Value | 2002–2004 Design Value |
|---|---|---|---|
| Port Arthur | Annual $PM_{2.5}$ | 11.1 μg/m³ | 11.1 μg/m³ |
| Hamshire Street | Annual $PM_{2.5}$ | 10.5 μg/m³ | 10.6 μg/m³ |
| Port Arthur | 24-hr $PM_{2.5}$ | 28 μg/m³ | 27 μg/m³ |
| Hamshire Street | 24-hr $PM_{2.5}$ | 29 μg/m³ | 26 μg/m³ |

Notes:

ppb = parts per billion; μg/m³ = micrograms per cubic meter; hr = hour; $PM_{2.5}$ = particulate matter 2.5 microns or smaller

Source: EPA 2004c

### 3.5.10.2 Construction Impacts

DOE has used conservative assumptions to estimate the emissions related to expanding the existing Big Hill storage facility. The amount of new land needed at Big Hill would be 147 acres (60 hectares), which would have about 65 acres (26 hectares) of land clearing and grubbing. The facility capacity may be increased up to 108 MMB. In addition, 23 miles (37 kilometers) of oil distribution pipeline would have to be added to implement the increased drawdown rate. Approximately 1.3 miles (2.1 kilometers) of existing brine disposal pipeline would also need to be upgraded. DOE emissions are expected to be negligible from this pipeline upgrade activity. Cavern development and solution mining are assumed to occur in two equal phases of 54 MMB.

A summary of estimated direct emissions and durations for different construction activities at Big Hill is given in table 3.5.10-2. Total emissions are provided for activities that last for less than 1 year. For activities lasting more than 1 year, such as cavern development, emissions are given as maximum rates for those activities in any 1 year. The maximum annual emissions rate in the final row of the table includes all the emissions during the 12-month period of greatest emissions. This is the first year for all pollutants except NMHC, which peaks during the solution mining/fill period.

**Table 3.5.10-2: Maximum Direct Emissions from Expansion of Big Hill Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)**

| Activity | Days | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| Clearing and grubbing | 54 | 17.73 | 0.38 | 38.60 | 4.32 | 3.25 |
| Rough grading | 5 | 0.03 | 0.13 | 1.29 | 0.14 | 0.01 |
| Soil stabilization | 65 | 2.42 | 1.38 | 5.05 | 0.66 | 0.43 |
| Embankment compacting | 30 | 2.95 | 0.33 | 7.77 | 0.87 | 0.51 |
| Foundation pouring | 30 | 0.38 | 0.78 | 0.07 | 0.07 | 0.05 |
| Building construction | 30 | 0.19 | 0.23 | 0.04 | 0.04 | 0.03 |
| Electrical installation | 125 | 0.20 | 0.42 | 0.04 | 0.04 | 0.05 |
| Pipe installation | 30 | 0.05 | 0.19 | 0.02 | 0.02 | 0.01 |
| Road construction | 30 | 0.15 | 0.29 | 1.82 | 0.21 | 0.02 |
| Pipeline construction[a] | 210 | 0.70 | 0.78 | 9.98 | 1.07 | 0.12 |
| Cavern drilling | 365 | 11.12 | 47.51 | 2.27 | 2.27 | 1.57 |
| Cavern solution mining | 287 | 0.00 | 0.00 | 0.00 | 0.00 | 18.8 |
| Solution mining/fill | 243 | 0.00 | 0.00 | 0.00 | 0.00 | 62.3 |

**Table 3.5.10-2: Maximum Direct Emissions from Expansion of Big Hill Site (emissions are in total tons except those lasting > 1 year, which are in tons per year)**

| Activity | Days | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| Final fill | 108 | 0.00 | 0.00 | 0.00 | 0.00 | 9.56 |
| Maximum annual emissions | — | 35.63 | 51.76 | 65.09 | 9.46 | 62.42 |

Notes:

[a] The emissions associated with building the pipeline are distributed over its 23-mile (37-kilometer) length

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Source: EPA 2004c

In addition, motor vehicles used by workers to commute to the worksite would also indirectly emit pollutants to the atmosphere. Table 3.5.10-3 summarizes these emissions. The emissions would be small and distributed over miles of roadway.

**Table 3.5.10-3: Indirect Emissions (tons per year) from Worker Commutes Associated with Expansion of Big Hill Site**

| Year | Workers | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | NMHC |
|---|---|---|---|---|---|---|
| One | 198 | 23.14 | 1.44 | 0.05 | 0.05 | 1.75 |
| Two | 198 | 23.14 | 1.44 | 0.05 | 0.05 | 1.75 |
| Three | 198 | 23.14 | 1.44 | 0.05 | 0.05 | 1.75 |
| Four | 198 | 23.14 | 1.44 | 0.05 | 0.05 | 1.75 |

Notes:

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{10}$ = particulate matter 10 microns or smaller; $PM_{2.5}$ = particulate matter 2.5 microns or smaller; NMHC = non-methane hydrocarbons

Source: EPA 2004c

Tables 3.5.10-3 and 3.5.10-4 conservatively estimate the total impact from the construction of the Big Hill storage facility expansion and associated infrastructure. In no case are emissions of any single pollutant anticipated to exceed 250 tons per year (230 metric tons per year), the threshold trigger for new source review. Thus, the potential impact from the construction of the expanded Big Hill storage facility on air quality is unlikely to cause an exceedance of the NAAQS for ozone.

**Table 3.5.10-4: Modeled SCREEN3 Concentrations and Locally Monitored Concentrations for Proposed Big Hill Expansion**

| Averaging Period | Modeled Concentration ($\mu g/m^3$) | Monitored Concentration ($\mu g/m^3$) | Total Concentration ($\mu g/m^3$) |
|---|---|---|---|
| 24-hour | 5 | 29 | 34 |
| Annual | 1.2 | 11.1 | 12.3 |

μg/m3 = micrograms per cubic meter

Section 176(c) of the CAAA requires that Federal actions conform to the State Implementation Plan for locations that lie within a nonattainment area. The conformity rule establishes the conformity criteria that a nonattainment area must comply with in order to demonstrate that the proposed action will conform to the State Implementation Plan for achieving attainment of the NAAQS. EPA has delegated implementation of the CAA to the State of Texas, which in turn relies on the Texas Commission on

Environmental Quality to administer and enforce the CAA requirements. The state regulation for implementation of the General Conformity Rule is found in the Texas Administrative Code, Title 30, Part 1, Chapter 101, Subchapter A, Section 101.30. As described in section 3.5.9.1, Big Hill is located in a marginal ozone nonattainment area. Thus, this site must comply with the provisions of the conformity rule for ozone precursor emissions, such as NOx and VOC. However, if the proposed action's total of direct and indirect emissions are below specified emission levels (40 CFR 93.153(b)), which for a marginal ozone nonattainment area are less than 100 tons (91 metric tons) per year for either $NO_x$ or VOC, the provisions of the conformity rule no longer apply.

For $NO_x$, DOE estimates that Big Hill construction activities would result in maximum direct emissions of 51.76 tons per year (see table 3.5.10-2) and maximum indirect emissions of 1.44 tons per year (see table 3.5.10-3). That totals a maximum NOx emission of 53.2 tons per year, which is less than the 100-ton per year threshold for the conformity rule to continue to apply.

To compare VOC emissions to the conformity rule threshold, the above estimates of direct NMHC emissions need to be adjusted to account for the ethane component, as described above in section 3.5.8.2 for Stratton Ridge. Going through the same process outlined in that section, the total maximum VOC emissions from Big Hill construction can be estimated as follows:

- A maximum of 62.42 tons per year of direct NMHC emissions from construction (see table 3.5.10-2) minus 20 percent equals 49.94 tons per year of VOC emissions; plus
- A maximum of 1.75 tons per year of indirect NMHC emissions from worker commutes (see table 3.5.10-3), which equates to 1.75 tons per year of VOC emissions; equals
- A total maximum of 51.69 tons per year of VOC emissions from all construction activities.

This estimated maximum VOC emission puts the proposed action below the conformity rule threshold of 100 tons per year. As a result, the provisions of the conformity rule would no longer apply.

The conformity rule also has a provision that requires that a conformity analysis be performed if the emissions of concern are above 10 percent of the area's total emissions (40CFR 93.153(i)). This type of action would be considered a "regionally significant action" subject to full conformity analysis if the emissions exceed the 10 percent threshold. The State Implementation Plan totals for Jefferson County are approximately 25,000 tons per year for VOC and 69,000 tons per year for $NO_x$ (USEPA, 2004c). The maximum of 51.69 tons per year of VOC emissions and 53.2 tons per year of $NO_x$ emissions are considerably less than 10 percent of the respective regional emissions. Thus, the provisions of the conformity rule would no longer apply to the proposed action, and the potential impact from the expansion of the existing Big Hill storage facility on air quality is unlikely to cause an exceedance of the ozone NAAQS.

To further assess the potential impact of $PM_{2.5}$ emissions, DOE used EPA's air quality screening model, SCREEN3 (EPA, 1995) to conservatively estimate the maximum $PM_{2.5}$ concentration during construction of the proposed Big Hill expansion. Maximum annual average $PM_{2.5}$ emissions were used in the modeling (this includes both material resuspended from earth movement activities as well as exhaust emissions from motor vehicles and construction equipment), with emissions evenly distributed over the land cleared and prepared for development. SCREEN3 conservatively estimates 1-hour concentrations using these input data. Annual and 24-hour concentrations are then estimated from the 1-hour concentration using EPA screening factors (EPA, 1992) of 0.4 and 0.1, respectively. These estimated concentrations are added to the maximum 24-hour and annual averages from nearby monitors and the sums can be compared to the 24-hour and annual average NAAQS, which are 65 and 15 micrograms per cubic meter, respectively. The results are shown in table 3.5.10-4 for the near fence-line concentration.

This screening model shows that during the construction period, the peak 24-hour and annual concentrations will not exceed the NAAQS for $PM_{2.5}$. These results are conservative because maximum estimated emissions and maximum monitored concentrations were used together with a simplified screening model that tends to overestimate actual concentrations.

### 3.5.11 West Hackberry Expansion Storage Site and Associated Infrastructure

#### 3.5.11.1 Affected Environment

The West Hackberry facility is located in Cameron Parish in the Lake Charles Metropolitan Statistical Area. U.S. EPA's Green Book currently lists the Lake Charles Metropolitan Statistical Area as being in attainment for all NAAQS, but the 8-hour ozone measurements are near the 80 ppb NAAQS. All other NAAQS, including $PM_{2.5}$, $PM_{10}$, and 1-hour and 8-hour CO standards are met.

For the period of 2001–2004, three nearest monitors are in Calcasieu Parish and have complete ozone data. Eight-hour ozone design values for these three monitors were obtained from EPA's AirData Web site (2006), which selects the fourth highest values for each 3-year period. Results are shown in table 3.5.11-1 along with annual and 24-hour average $PM_{2.5}$ design values for two $PM_{2.5}$ monitors.

**Table 3.5.11-1: Design Values for 8-Hour Ozone, Annual, and 24-Hour $PM_{2.5}$ in Calcasieu Parish**

| Site | Pollutant | 2001–2003 Design Value | 2002–2004 Design Value |
|---|---|---|---|
| Carlyss | 8-hr ozone | 79 ppb | 80 ppb |
| Westlake | 8-hr ozone | 73 ppb | 70 ppb |
| Vinton | 8-hr ozone | 79 ppb | 76 ppb |
| Vinton | Annual $PM_{2.5}$ | 10.0 $\mu g/m^3$ | 9.7 $\mu g/m^3$ |
| Lake Charles | Annual $PM_{2.5}$ | 11.3 $\mu g/m^3$ | 10.8 $\mu g/m^3$ |
| Vinton | 24-hr $PM_{2.5}$ | 24 $\mu g/m^3$ | 22 $\mu g/m^3$ |
| Lake Charles | 24-hr $PM_{2.5}$ | 31 $\mu g/m^3$ | 29 $\mu g/m^3$ |

Notes:

ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; hr = hour; $PM_{2.5}$ = particulate matter 2.5 microns or smaller

Source: EPA 2004c

#### 3.5.11.2 Construction Impacts

To expand the West Hackberry site, DOE would purchase three existing 5-MMB caverns adjacent to the existing SPR facility. No site preparation, building construction, solution mining, drilling, or offsite pipeline construction would be required for the expansion. At most, only minor onsite construction activities would occur. Because full construction (not including cavern development) at other sites is unlikely to cause air quality impacts, the impacts from construction at West Hackberry can be considered negligible.

### 3.5.12 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained, and hence any additional environmental impacts from air pollutant emissions would not occur. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the proposed Chacahoula storage site could be developed by a commercial entity for oil and gas purposes. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity. The onshore Clovelly Dome Storage system would continue to operate unchanged as a component of LOOP with the exception of any expansion that LOOP might undertake.

No additional air pollutant emissions would occur in the study areas as a result of the selection of the No-Action alternative.

## 3.6 WATER RESOURCES

This section assesses potential impacts on water resources associated with the proposed new and expansion SPR sites and their associated infrastructure. These resources include both surface and groundwater. For this section, floodplains are considered surface water resources, but wetlands or aquatic organisms are not. Those are addressed in Section 3.7 Biological Resources.

Section 3.6.1 Methodology describes the approach used to evaluate existing conditions and potential impacts associated with the proposed new and expansion SPR sites. Section 3.6.2 discusses the general impacts associated with construction and operations and maintenance at many or all of the SPR storage sites and associated infrastructure. Potential impacts DOE has judged to be minor across all alternatives in this section are not evaluated further. However, alternatives that DOE has found to have greater potential impacts are evaluated in separate sections for specific site. Sites that have unique features and the potential for unique impacts are discussed site-by-site. Section 3.6.2 references the best management practices presented in Chapter 2 and indicates how those practices would reduce potential impacts.

Sections 3.6.3 through 3.6.10 address each proposed new and expansion site separately, describing existing water resources that could be affected by the proposed action and potential impacts that warrant site-specific discussion.

### 3.6.1 Methodology

#### 3.6.1.1 Surface Water

DOE identified and characterized the existing conditions of surface water bodies in all potentially affected areas. Sources of information consulted by DOE include the following: 305(b) reports, 303(d) lists of impaired waters, Louisiana's Title 33 Environmental Regulatory Code, various documents and information from the USGS's Water Resources of the United States Web site (USGS 2006d), EPA's Surf Your Watershed (EPA 2006i) and EnviroMapper (EPA 2006b) databases, and various state agency representatives. DOE identified surface water bodies that have the following particular characteristics:

- Serve as raw water source;
- Are crossed by pipelines, roads, and other utilities;
- Receive brine discharge; or
- Lay in or are directly downgradient of construction and storage sites.

These water bodies generally were characterized by size; relative flow rates; locations; salinity; known uses; and special designations such as scenic rivers, public water supplies, and impaired waters. DOE identified only the major surface water bodies associated with the proposed alternatives. After a preferred alternative is selected, DOE would conduct a delineation of waters of the United States and navigable waterways and secure a jurisdictional determination from USACE and U.S. Coast Guard.

After identifying potentially affected water resources, DOE assessed the proposed activities associated with the construction and operations and maintenance of each proposed site and the potential effect and degree of risk each activity might have on water resources. DOE considered the characteristics of the affected water resources, in particular the capacity of these water resources to assimilate impacts.

To assess the potential impacts resulting from brine disposal in the Gulf of Mexico, DOE conducted a detailed modeling analysis based on empirical (field) data collected from the brine diffuser at Big Hill, Bryan Mound, and the former brine diffuser at West Hackberry. The analysis was then applied to each proposed new and expansion site to evaluate potential impacts. This analysis was able to project the likely increase in salinity levels in the water column, vertical and horizontal extent of the brine plume, and salinity concentration contours as a function of distance from the brine disposal site. The predictions for impacts are for a reasonably conservative set of circumstances that are likely to overestimate the extent of the brine plume in most cases.

The report summarizing these modeling results is included in appendix C of this draft EIS.

DOE also evaluated the extent of proposed new construction in floodplains and whether the proposed alternatives would comply with Executive Order 11988, Floodplain Management. Sections 3.6.2 through 3.6.11 address this information for each site. DOE prepared a detailed Floodplain Assessment and Finding (appendix B) in accordance with Executive Order 11988.

The floodplain calculations summarized in this draft EIS and the floodplain assessment include all floodplain areas (100-year and 500-year) located within each expansion site, ancillary facilities (tank farms), and all associated ROWs (brine/water lines, oil lines, power lines, and access roads).

The Gulf Coast area of all the proposed sites—except Richton and Bruinsburg—is subject to the effects of hurricanes and associated tidal surges. Hurricanes Katrina and Rita (fall, 2005) demonstrated these effects. The evaluation of water resources in this draft EIS is based on surface water data gathered before Hurricanes Katrina and Rita struck and field visit observations made after the hurricanes' impacts were rendered. Although the sites (except Richton and Bruinsburg) likely were affected by the tidal surge and an influx of increased salinity, field observations indicate that surface water channel geometries from before the hurricanes remained intact and flood waters receded. The impacts of the hurricanes on salinity and other water quality parameters are not fully understood, and such an analysis is beyond the scope of this report.

Table 3.6.1-1 lists impacts evaluated for different components of the proposed actions that are discussed in this section.

**Table 3.6.1-1: Types of Surface Water Impacts Analyzed**

| Source of Construction or Operations and Maintenance Impact | Potential Surface Water Impacts Analyzed |
|---|---|
| Construction of pipeline, road, utility, and RWI intake structure across and in surface water bodies | Increase in suspended sediments;<br>Change of streambed morphology (causes headcutting);<br>Change in flow and salinity regimes caused by berming and channeling |
| Raw water withdrawal from surface water bodies | Reduction of surface water flow rates, volume, and levels |
| Brine disposal in the Gulf of Mexico | Increased salinity |
| Introduction of potential for oil spills | Contamination of water with oil and oil-degradation products |
| Introduction of potential for brine spills | Increased salinity of receiving water |
| Introduction of potential spills and routine use of other materials such as fuels, maintenance fluids, and pesticides onsite, with possible runoff to surface waters or infiltration to groundwaters[a] | Contamination of receiving water[a] |
| Construction in floodplains | Loss of hydraulic flood storage and effect on base flood elevation |
| Location of RWI and brine diffuser structure | Impeded navigation |
| Construction in upland areas | Runoff resulting in siltation and sedimentation in surface water bodies |
| Introduction of wastewater treatment plant discharges and spills | Contamination of receiving water |

**Table 3.6.1-1: Types of Surface Water Impacts Analyzed**

| Source of Construction or Operations and Maintenance Impact | Potential Surface Water Impacts Analyzed |
|---|---|
| Non-point source surface water runoff | Contamination of receiving water |
| Provision of potable, sanitary, and cleaning water to site | Strain on source water resources |

[a] Analysis presented in section 3.2

#### 3.6.1.2 Groundwater

DOE characterized potentially affected groundwater resources by defining the depths, characteristics, uses, and designations of aquifers below and adjacent to the proposed sites. DOE specifically characterized groundwater use by identifying public and private wells listed in available public records, along with available information on delineated groundwater management districts and sole-source aquifers. Information sources consulted by DOE included the following: GIS layers obtained from the state environmental agencies showing source water protection areas; USGS and EPA Web sites containing information on target aquifers; EPA's Sole Source Aquifer Database; and state agency representatives and Web sites. The information gathered is provided in sections 3.6.2 through 3.6.11 for each site.

DOE then evaluated potential sources and scenarios that could affect the identified groundwater resources. The probability of impacts was evaluated for the types of impact sources, the nature of potentially affected aquifers, and the uses of aquifers. From there, DOE evaluated the significance of the impact based on the regional and local context and intensity. Table 3.6.1-2 lists the different groundwater impacts evaluated, most of which are common to most or all of the sites, and most have the potential for only minor impacts on groundwater or they pose a low risk for groundwater impacts. These impacts are discussed in the following sections.

**Table 3.6.1-2: Types of Groundwater Impacts Analyzed**

| Source of Construction or Operations and Maintenance Impact | Potential Groundwater Impacts Analyzed |
|---|---|
| Brine discharges from pipelines (surface) or leakage through the brine wells set in the cavern (subsurface) | Increased salinity of groundwater |
| Disposal of brine via injection into deep aquifers | Increased salinity of groundwater quality in injection zones and overlying aquifers |
| Leakage from oil storage caverns (subsurface) | Contamination of groundwater with oil |
| Leakage from oil pipelines (surface) | Contamination of groundwater with oil |
| Accidental discharge of fuel, maintenance fluids, pesticides, and herbicides (surface) [a] | Contamination of groundwater[a] |

[a] Analysis presented in section 3.2

### 3.6.2 Impacts Common to Multiple Sites

The following sections describe and evaluate the types of potential impacts to water resources that are generally common to all of the proposed sites. In sections 3.6.2 through 3.6.11, DOE evaluates further the significance of impacts for particular sites. In addition, because underground injection of brine is proposed only at Bruinsburg, Bayou Choctaw, and West Hackberry, those impacts are not included in this general discussion, but rather are addressed in the site-specific sections.

#### 3.6.2.1 Surface Water Common Impacts

##### *3.6.2.1.1 Impacts of Raw Water Withdrawal from Surface Water*

The proposed facilities would withdraw water from nearby surface water bodies for use in cavern solution mining during the construction period. Cavern solution mining would continue for up to 5 years at each site where new caverns would be developed. As part of continuing operations, raw water would be withdrawn for displacement of oil in the caverns during oil drawdown. The impacts of raw water withdrawal on surface water bodies are specific to the characteristics of each water body, particularly the channel geometry, water levels, and flow rates at and near the RWI point.

Two of the proposed new sites and two expansion sites (Chacahoula, Stratton Ridge, Big Hill, and West Hackberry, respectively) would withdraw raw water from the ICW. The ICW channel geometry is similar for the proposed RWI points at the four sites. USACE maintains the ICW at 12-feet (3.7 meters) deep at mean low tide, and 130-feet (38-meters) wide at channel bottom (USACE 2005a). Previous modeling of the potential impacts of SPR RWI from the ICW (e.g., for the Big Hill site, DOE 1981 and see appendix B) indicates that changes to water depth caused by the RWI would be several hundredths of a foot (less than 1.5 centimeters). Water depth change would be greatest at the intake point, decreasing with distance from the intake point. This change in water depth is small compared to daily tidal depth fluctuations of 1.0 foot (30 centimeters) or more in many parts of the ICW. Changes to flow velocities associated with RWI would be several hundredths of a foot per second (several hundredths of a kilometer per hour)—again insignificant in comparison to baseline flow rates. Impacts on water salinity would be highly specific to the affected water body. In the case of the proposed Big Hill site, water salinities at all modeled locations would be expected to change by less than 1 part per thousand because of RWI, compared to natural salinity fluctuations of 1 to 10 parts per thousand (DOE 1981 and see appendix B). The cited Big Hill modeling effort assumed a water withdrawal rate of 1.4 MMBD, which is significantly higher than the rate proposed at any of the SPR expansion facilities other than Big Hill. Thus, impacts predicted for water withdrawal at Big Hill are greater than could be expected at any of the proposed expansion sites that would withdraw water from the ICW.

DOE would secure from USACE the necessary permits for the RWI structures and withdrawal (Section 404 permit) and a water quality certificate or Section 401 permit from the state. DOE would comply with any withdrawal limitations or minimum in-stream flow conditions imposed by these agencies.

The four remaining proposed sites (Bruinsburg, Clovelly, Richton, and Bayou Choctaw) would withdraw raw water from local surface water bodies other than the ICW. The potential impacts associated with raw water withdrawal at these sites are discussed in the site-specific sections to provide more details.

> Mitigation: No mitigation measures are identified for the sites that would withdraw water from the ICW. For those sites that would withdraw water from other surface water bodies, possible mitigation measures are identified in the Richton site-specific section only.

##### *3.6.2.1.2 Impacts of Brine Disposal in the Gulf of Mexico*

Brine from the leaching of the salt caverns or from filling caverns with oil would be discharged into the Gulf of Mexico from all sites except Bruinsburg, Bayou Choctaw, and West Hackberry, where brine would be injected into deep subsurface aquifers via injection wells. Brine would be generated during the cavern development process, which would be expected to last for 4 to 5 years. After that, brine would be generated during cavern filling events or drawdown. The primary surface water impact associated with brine disposal in the Gulf of Mexico would be elevated salinity levels in the water column near the diffuser site.

DOE estimated salinity impacts to water from the brine diffuser discharge using a model based on empirical data from operating and formerly operating SPR diffusers. Model results are included in appendix C and are discussed below and in the site-specific sections.

All the proposed brine diffuser locations would be in waters of similar depths (about 30 to 50 feet [9 to 15 meters]) along the coastline. The depth of the diffuser and its placement just above the bottom sediments would ensure that the diffuser does not affect navigation. The bottom of the Gulf of Mexico slopes gently seaward at all the proposed locations except for Chacahoula. The diffuser for Chacahoula is situated near the base of Ship Shoal, where the bottom rises steeply about 10 feet (3.1 meters) onto the shoal. This situation will be discussed in the Chacahoula site-specific section. Salinities in coastal Gulf of Mexico fluctuate, primarily because of varying inputs of fresh water from the Mississippi River. Salinity data relevant to the brine discharge sites are discussed below.

Brine is denser than seawater, and after it is discharged through the diffusers, the brine would sink into a layer at the bottom of the water column; therefore, the bottom current velocity is an important determinant of the dissemination and resultant extent of the brine plume. Based on a review of available oceanographic data, a bottom current velocity of 9 centimeters per second (212 inches per minute) was selected as representative of typical conditions (see appendix C). Table 3.6.2-1 summarizes brine diffusion modeling results for typical conditions. In general, modeling results indicate that the maximum increase in salinity under typical conditions would be 4.3 parts per thousand, which could extend a maximum of 0.8 nautical miles (0.92 mile [1.5 kilometers]) from the diffuser location. Salinity increases of up to 1 part per thousand could extend as far as 1.9 nautical miles (2.2 miles [3.5 kilometers]) from the diffuser under such conditions.

**Table 3.6.2-1: Estimated Extent of Brine Plumes Caused by Brine Disposal in the Gulf of Mexico**

| Site[a] | Projected Distance of Salinity Increases in the Gulf of Mexico |
|---|---|
| **New Sites** | |
| Chacahoula, LA | See site-specific discussion, section 3.6.4 |
| Clovelly, LA | Increase of 1 ppt[b] salinity out to 1.4 nautical miles from the diffuser<br>Increase of 4 ppt salinity out to 0.60 nautical miles from the diffuser |
| Richton, MS | Increase of 1 ppt salinity out to 1.7 nautical miles from the diffuser<br>Increase of 4 ppt salinity out to 0.70 nautical miles from the diffuser |
| Stratton Ridge, TX | Increase of 1 ppt salinity out to 1.8 nautical miles from the diffuser<br>Increase of 4 ppt salinity out to 0.80 nautical miles from the diffuser |
| **Expansion Sites** | |
| Big Hill, TX | Increase of 1 ppt salinity out to 1.9 nautical miles from the diffuser<br>Increase of 4 ppt salinity out to 0.80 nautical miles from the diffuser |

Notes:

[a] Bruinsburg, Bayou Choctaw, and West Hackberry would dispose of brine by underground injection, not Gulf discharge

[b] ppt = parts per thousand

Nautical mile = 1.15 miles and 1.85 kilometers

Because the brine diffusers for each of the SPR sites are located at similar water depths along the Gulf of Mexico coastline, data collected from active and formerly active SPR brine discharge locations are considered to be representative of baseline conditions at the other proposed brine discharge sites. Based on seasonal bottom current data from the Big Hill diffuser site, the lowest current velocities (which result in higher salinity plumes) occur in late spring and summer (appendix C, table 4). Salinities measured at the Clovelly LOOP brine diffuser stations did not indicate a seasonal trend in salinity concentrations of receiving waters (35 to 36 parts per thousand in June; 28 to 30 parts per thousand in August; and 31 to 32 parts per thousand in November) (Barry A. Vittor & Associates 2002, p. v). The maximum increase in salinity of 4.3 parts per thousand indicated by the model would be within normal seasonal variability. It is unclear if low current velocities and high ambient bottom salinities would occur at the same time of the year, which could result in 4.3 parts per thousand salinity above the normal maximum salinity. The potential impacts of increased salinity on biota are evaluated in section 3.7 where biological resources are discussed.

DOE evaluated uncertainties associated with the modeling results and determined that they are unlikely to substantially affect the model outcome or impact analysis. Bottom current velocity and the rate of brine discharge are important determinants on how much salinity concentrations would increase in surrounding water, and both of these factors are realistically accounted for in the model. DOE would not discharge below the rate used in the model (30 feet [9.2 meters] per second). Thus, model results reflect the minimum allowable discharge rate. Discharge rates exceeding 30 feet per second would more readily disperse the brine into the water column and reduce the size of the brine plume. The model was run for the two most prevalent bottom current directions, which are primarily parallel to the shoreline (long-shore currents). Although field data indicate that currents in all directions do occur in this area, net transport would be roughly longshore. The modeling results shown in appendix C present the results when the currents remain constant. This presentation does not show the impacts during transient conditions, such as reversing currents that could increase salinities but would reduce the extent of the plume estimated by the model. The effect of a hurricane, which brings large volumes of water to the shoreline, would be to further dilute the brine plume, and would not result in higher salinities than those forecasted by the model.

National Pollutant Discharge Elimination (NPDES) permits would be required for any discharges to surface waters, including the Gulf of Mexico. The permitting process would require that the CORMIX model be used to analyze the impacts of the discharge on surrounding waters before a permit is issued. Since this would be done before operation of the brine diffuser, the impacts to Gulf of Mexico waters would be analyzed further than that presented in this draft EIS as a further precaution against adverse impacts to surface waters and biota. In addition, a Section 404/401 permit and possibly a Section 10 permit would be obtained from USACE and the state for the construction of the diffuser and brine diffuser pipeline. As with permits for existing SPR sites, the permits for the new and expansion sites would require that effluent meet certain requirements protective of water quality and biota, and they would also mandate an ongoing monitoring and reporting program to document that the discharge would meet those requirements. Monitoring program results from the Bryan Mound and Big Hill operating SPR brine discharge locations in the Gulf of Mexico are reported in Annual Environmental Reports issued by DOE and in the Discharge Monitoring Reports provided to the state under the NPDES permit. Review of the most current report available (2003) indicates that discharge water quality is consistently within permit requirements (DOE 2004f).

> Mitigation: Because of its unique location in proximity to a shoal area (Ship Shoal), the Chacahoula brine diffuser site and associated brine discharge are discussed in the site-specific section. Mitigation measures specific to that site are identified in that section.

##### *3.6.2.1.3 Impacts Associated with Constructing Pipelines Across Surface Water Bodies*

Development of the SPR expansion sites would entail construction of new offsite pipelines associated with all sites except the Clovelly and West Hackberry sites, which would use existing pipelines. The new pipelines would cross a variety of water bodies, including intermittent, small, moderate-sized, and larger streams and rivers, and manmade canals including the ICW. These water bodies range from fresh to brackish to saline, with increasing salinity and tidal influence closer to the coastline.

The potential impacts to surface water bodies associated with the construction of pipeline crossings would depend on the construction methods used. Two methods are proposed for crossing streams and rivers: open cut and directional drilling. These methods are described in section 2.3.9; the potential impacts associated with these methods are summarized below.

**Directional Drilling:** This method would have the least impact on surface water bodies because it involves boring and placing the pipeline underneath the channel. This approach would not entail significant disturbance of water body banks, the water column, or streambeds or bottoms of water bodies. There would be a potential for some bank erosion and delivery of sediment to water bodies in cases where drilling equipment is setup close to water bodies. This would be controlled and effectively reduced through best management practices required by the Erosion and Sediment Control Plan, the Section 404/401 permit, the Section 10 permit, and the NPDES stormwater permit for construction activities. The best management practices would include erosion and runoff control measures, and construction of barriers to sediment movement. Any impacts to surface waters would be small in scale, of short duration, and localized near the drill equipment location.

**Open Cut:** This method could potentially result in the following conditions:

- A temporary increase in turbidity in the water column resulting from disturbance of bottom sediments and the introduction of sediment in runoff;
- A temporary increase in suspended nutrients and organic matter resulting from disturbance of bottom sediments and the introduction of sediment in runoff; also could lead indirectly to reduced dissolved oxygen levels in the water column;
- Deposition of sediment in water bodies, which could disrupt habitat, lead to reduced channel depth, and cause other changes in stream processes;
- Headcutting, a process of streambed degradation triggered by a disturbance of loose streambed substrate; could lead to the collapse of stream banks, loss of streamside vegetation, and widening of streams; and
- Saltwater intrusion or disruption of salinity regimes where pipeline installation between surface water bodies could open new channels for flow.

Open cut installation of pipelines across surface water bodies could lead to impacts related to resuspension of bottom sediments and organic matter in the water column, which would be of short duration and occur during actual construction activity and extending for a short time after construction activity ended. In water bodies that have no or low current, these impacts would be localized near the construction sites, and would be relatively intense for brief periods. In water bodies with stronger currents, impacts would extend for some distance down current. In such systems, impacts in the water column would be less intense because of flushing and dilution action. DOE would implement construction best management practices to minimize the impacts of open cut pipeline construction through surface water bodies. Some of these best management practices would be required by several regulatory and permit requirements. Specifically, all work would be done in accordance with DOE-prepared Soil Erosion and Sediment Control Plans; Erosion Control, Revegetation and Maintenance Plan; Erosion and Sediment Control permits; NPDES stormwater permit for construction activities; Section 10 permit; and USACE Section 404 permit and 40l Water Quality Certification from the state.

Best management practices could include site-specific runoff controls, installation of geotextiles, use of silt curtains and temporary coffer dams and other methods that minimize suspension of bottom sediments, all of which would be required as part of the state and Federal permits. Such plans would minimize sediment suspension and siltation and channel-filling impacts. As a result of these measures, little or no sediment would be introduced to water bodies from adjacent land areas. In addition, associated secondary impacts such as reduction in stream depth and changes in other stream processes would not be expected to occur.

Headcutting would be a potential impact following pipeline installation in streams with significant current that have streambeds composed of sandy or unconsolidated substrate. Streams in the coastal regions of Mississippi and Louisiana are particularly vulnerable to headcutting following disturbance of streambeds. As headcuts move progressively upstream, they can result in alteration of streambed grade, collapse of stream banks, loss of streamside vegetation, and widening and lateral movement of stream beds. Progressing headcuts cause re-entrainment of sediment and turbidity in the downstream water column. DOE would minimize the potential for headcutting by restoring streambeds to natural contours, stabilizing and revegetating the slope after installation of pipeline crossings, and minimizing or avoiding to the extent possible any permanent alteration in streambed grade at pipeline crossings. Strict compliance with the Erosion and Sediment Control Plan, NPDES stormwater permit for construction activity, and the Section 404/401 permit would reduce the potential for headcutting.

Transport of water from higher salinity to lower salinity regimes could occur where trenches are excavated to install pipelines between surface water bodies. To minimize saltwater intrusion along a pipeline, DOE would install clay plugs at periodic intervals in pipeline trenches during construction. After pipeline installation, DOE would backfill pipeline trenches with sufficient native topsoil to restore surface topography and vegetation and prevent water channeling.

> <u>Mitigation</u>: In addition to the above best management practices, DOE would consider several site-specific mitigation measures to prevent or minimize headcutting and the associated impacts to stream morphology and water quality. Although current plans call for the application of directional drilling only for larger streams (i.e., those wider than 100 feet [31 meters]) and for streams parallel and adjacent to other structures requiring directional drilling—such as highways, railroads, and other pipelines, DOE also would consider the use of directional drilling for installation of pipeline under other streams that are particularly vulnerable to headcutting. This would include unstable streams in the Mississippi and Louisiana coastal zones that have experienced headcutting, streams with moderate to strong currents, and streambeds composed of sand or unconsolidated substrate. DOE would also consider instituting a monitoring program for streams where the open cut method would be used to ascertain if headcutting has started. If headcutting were to occur in these streams, DOE would consider application of remedial measures such as streambed grade stabilization structures.

##### *3.6.2.1.4 Impacts from Erosion and Runoff from Construction Activities*

Some construction would take place in upland areas at the storage sites (e.g., Richton and Bruinsburg), at the crude oil storage tank facilities and crude oil terminals, and for some segments of the pipelines, access roads and transmission line ROWs. If there is a downslope water body, construction activities could produce runoff to the surface water that could degrade water quality. As described in Chapter 2, best management practices, such as the use of geotextiles, hay bales, and riprap to impede runoff, would help minimize erosion and prevent sediment runoff in these areas. These measures would effectively control sediment transport offsite, largely preventing sedimentation in any adjoining water bodies. Particular attention would be given to spoils storage areas, where sediment could run off and affect nearby surface waters. Because of the best management practices and sediment and erosion controls that would be implemented, sediment releases to surface waters would be expected to be minimal to none.

Any release of sediment to local water bodies would be expected to occur during heavy precipitation when flushing and assimilative capacity in these water bodies would be at a maximum. The potential impacts of sedimentation to surface water bodies include increased turbidity in the water column; increased suspended nutrients and organic matter in the water column leading indirectly to a reduction in dissolved oxygen levels; and deposition of sediment on water body beds, which could disrupt habitat, cause reduced channel depth, and cause other changes in stream processes. As described above, because the amount of sediment reaching water bodies is projected to be very low or none, any appreciable impacts within surface water bodies would be minor, localized and short-term.

##### *3.6.2.1.5 Impacts of Oil Spills to Surface Water*

Oil spills associated with the proposed SPR facilities could occur at storage facilities, along oil pipeline routes, and at oil transfer terminals. Oil released through oil spills could enter any of the water bodies identified in the site-specific sections, which would be near SPR expansion sites or oil transfer terminals, or crossed by oil pipelines. These water bodies include intermittent, small, moderate-sized, and larger streams and rivers, manmade canals (including the ICW), tidal rivers, estuaries, and the Gulf of Mexico.

If oil spills were to occur, measures outlined in facility Emergency Response Procedures would help minimize the impacts to surface waters. Each existing SPR site complies with Federal Spill, Prevention, Control, and Countermeasures (SPCC) regulations, and with Louisiana's SPCC regulations. This includes development of and compliance with plans to prevent and contain petroleum and hazardous substance spills. SPR sites maintain spill plans in accordance with Title 40 CFR 112 and corresponding state regulations (DOE 2004f). The proposed new and expansion sites would comply with these same regulations, and would maintain appropriate spill prevention and response plans.

Section 2.3 identifies the control measures that would be used to minimize the likelihood of oil spills, and the likelihood that these spills would reach surface waters. These measures include the construction of containment systems to prevent release of oil to surface waters. For example, a dike would be built surrounding the wellhead area at each cavern to contain and control spills that might result from a manifold failure or blowout, and surrounding crude oil storage tanks as well to contain any oil leaked from these tanks. Pipelines would be protected by corrosion-control coating and monitored with pressure gauges and volume meters to rapidly detect any leaks, and systems would be in place to rapidly stop the flow of oil to any leak points.

Spill prevention and response measures that would be implemented include quickly-deployed spill control systems such as booms and absorbent materials. DOE also would contract with an emergency response company that could respond to a spill with additional equipment and response personnel beyond those available to DOE.

These various measures described above would greatly reduce the probability of oil spills, as well as the magnitude of potential consequences.

Section 3.2 presents the historical rate of oil spills from all components of oil handling facilities associated with SPR sites (the storage sites themselves, oil transport vessels, pipelines, and terminal facilities). Section 3.2 also quantifies the risk associated with oil spills at each proposed SPR site and associated infrastructure. Based on the historic performance of SPR facilities, DOE projects that a small number of oil spills would occur at each of the proposed new and expansion sites. Section 3.2.2.1 (table

3.2.2.1-1) provides a projection of the likely number of reportable oil spills that could occur at each site during initial fill operations. During any drawdown and refill operations in later years, the overall potential for spills would be proportional to the amount of oil drawn down and replaced. A total drawdown and total refilling of the site would be an extreme case for a single year's activity, and therefore, the values in table 3.2.2.1-1 represent a reasonable upper bound of the number of oil spills anticipated during any year of SPR storage-site operation.

Most of these spills would be expected at the storage sites, with a smaller number of spills at the associated terminals. Because of the spill prevention and response measures described earlier, and based on historic performance statistics, most of the oil spills would be of low volume. The probability of higher-volume spills is very low.

If spilled oil were to reach surface water bodies, impacts on surface water resources would vary, depending on the amount of oil introduced to the water body and the characteristics of the water body. These potential impacts are described in section 3.2.2.1 and include the coating of vegetation and existing features that contact the water surface in the area of the oil slick; the release of volatile and sometimes toxic oil components to the atmosphere; the breakdown and dissolution of oil components, some of which may be toxic, into the water column (particularly in the case where oil dispersant chemicals are used); and the deposition of oil emulsions, partially oxidized oil tar globules, and other dense oil constituents on the water body bottom. Oil components deposited on the water body bottom and left adhering to vegetation could remain in the environment for extended periods (months or years), and continue to break down gradually and release low levels of oil constituents to the water column and sediments.

Elevated concentrations of oil constituents occurring in the water column and on the water surface immediately after a spill would decrease over time because of dispersion, dilution, and degradation. The rate of concentration decline would depend on the size and flushing rate of the water body affected, as discussed below.

**Low-Energy Water Bodies**

Impacts of oil spills would be pronounced in smaller, low-energy water bodies, such as ponds or slow-moving creeks through marshlands, where little dispersion or dilution could take place, and the effects of any uncontained oil would be concentrated in a small area. In a marshy area with high levels of turbidity and organics in the water column, the oil would adhere to some of these particulates, which would increase the residence time of the contamination. However, these types of water bodies also have high levels of microbes that may aid in degradation of the spilled petroleum compounds.

**Higher Energy Water Bodies**

Oil released to streams and rivers with strong flow or tidal flushing, or into larger open bodies of water such as the Gulf of Mexico, would disperse more rapidly, resulting in milder impacts over a wider area. River currents would spread contamination downstream, resulting in decreasing concentrations. Over open water, wind would also facilitate mixing and dispersion.

Although the consequences of a very high-volume spill could be substantial, the probability of such a spill is very low, as demonstrated by the quantitative analysis discussed above and in section 3.2. The consequences to water resources of the more likely low-volume spills would be expected to be minimal. The overall risk to water resources associated with oil spills from the proposed SPR sites and infrastructure would be low.

> Mitigation: In addition to control measures, best management practices, and emergency response preparations described earlier, DOE would give preference to oil-spill response measures that remove oil from the environment, and would avoid the use of chemical

dispersants. Dispersants would be considered only in cases where their use would clearly result in reduced environmental impacts.

#### *3.6.2.1.6 Impacts of Brine Spills to Surface Water*

Accidental brine discharge could potentially occur along the brine pipelines, at the brine ponds located at the salt cavern sites, and at brine pumping facilities at SPR sites. Analysis of the causes of brine spills during the 22-year history of SPR operation (see section 3.2.2.1) indicates that spills typically were caused by corrosion or erosion of piping, equipment failure, operator error, and overtopping of brine ponds during periods of heavy precipitation. Brine released through brine spills could enter any of the surface water bodies identified in the following site-specific sections, which would be near brine-pumping facilities or brine ponds onsite, or would be crossed by brine pipelines. These water bodies include intermittent, small, moderate-sized, and larger streams and rivers, manmade canals (including the ICW), tidal rivers, estuaries, and the Gulf of Mexico.

Section 2.3.3 presents the control measures that would be used to minimize the likelihood of brine spills and the likelihood that these spills would reach surface waters. Measures to prevent leaks from brine ponds would include high-density polyethylene liners or concrete, underdrain systems to detect leakage, regular inspection and maintenance programs, and sufficient freeboard in ponds to prevent overflow. Brine pipelines would be concrete-lined to limit erosion and corrosion and would be pressure-tested to check integrity. Brine would be treated with ammonium bisulfite, which scavenges dissolved oxygen and reduces pipeline corrosion. Engineering controls and monitoring would allow rapid detection of leaks, and systems would be installed to quickly stop the pumping of brine if a leak occurred. These measures would reduce the likelihood of occurrence and limit the volume of brine spills.

Section 3.2.1.2 presents data for historical brine spills from the existing SPR sites, including the number of reportable spills per year and the total volume of brine spills per year. Section 3.2.1.2 also analyzes the risk of brine spills associated with each proposed SPR site.

As discussed in section 3.2.2.1, the immediate effect a brine spill would have on surface water would be an increase in chloride concentration in the receiving water body. Because the chloride concentration in brine is 10 to 100 times higher than in natural waters, brine spills would result in significantly elevated chloride concentrations in the receiving water body. This, in turn, could possibly exceed acute toxicity limits for some aquatic wildlife species.

**<u>Impacts to Low-Energy Water Bodies</u>**

In low-energy water bodies, such as ponds and creeks that wind through marshlands, dilution of the brine spill would occur mainly through diffusion into surrounding waters and mixing by any tidal influx into the area. In marshland with poor water circulation, chloride concentrations returned to normal within 4 months at one spill site (Boeing Petroleum Services, Inc. 1990b)

**<u>Impacts to Higher Energy Water Bodies</u>**

In higher energy water bodies, such as rivers and areas subject to strong tidal influence near the coast, the brine would be diluted by incoming tides and spread out by outgoing tides. It would also be spread downstream and diluted by river currents. Elevated chloride concentrations would likely be localized in a surface water body near the point of brine entry. Chloride concentrations would decrease with distance from the point of brine entry to the water body, and over time, because of natural flushing and dispersion. Monitoring at the sites of past brine spills has demonstrated that even relatively high volumes of spilled brine have had little or no impact on large and well-flushed water bodies (e.g., the ICW). In moderately flushed marshland and ponds, chloride concentrations in surface waters and sediments return to normal (before the spill) levels within 2 months (Boeing Petroleum Services, Inc. 1990b).

Although a high-volume brine spill could result in moderate consequences to surface water resources, the probability of such a spill is very low. The consequences to water resources of the more likely low-volume spills would be expected to be minimal. The overall risk to water resources associated with brine spills from the proposed SPR sites and infrastructure would be low.

#### *3.6.2.1.7 Impacts on Floodplains*

A substantial portion of the proposed storage sites and associated infrastructure would be located in floodplains. The Bayou Choctaw, Chacahoula, Clovelly, Stratton Ridge, and Big Hill sites would be entirely or partially within floodplains, therefore their selection as preferred site(s) would entail new construction in a floodplain. The affected floodplain areas include both 100-year and 500-year floodplains, and in the case of the Clovelly and Chacahoula sites, include wetland areas that are normally inundated. Appendix B Floodplains and Wetlands Assessment provides the total area of floodplains that would be affected by the candidate alternatives, which includes the SPR site, pipelines, and power lines. This appendix also provides maps of the proposed SPR developments in relation to floodplains.

The amount of onsite construction in floodplain areas would vary from site to site, and would include developing 1 to 16 wellheads and pads; installing pumps and onsite pipelines; and constructing buildings, access roads, and related infrastructure. At the proposed Bayou Choctaw, Chacahoula, Stratton Ridge, and Big Hill sites, some filling as well may be required around cavern well pads, onsite facilities and buildings, and access roads. Proposed facilities at the Clovelly site would be on platforms above the inundated wetland area and floodplain, and would require less fill. New barge canals would be dredged at the Clovelly site.

The Big Hill, Chacahoula, and Stratton Ridge sites would all entail construction of offsite RWI and brine-disposal facilities, crude oil and water distribution pipelines, or a combination. Access roads would also need to be located entirely or partially in floodplains.

A comprehensive description of how each candidate site would affect floodplains, and maps indicating the location of the proposed new and expansion sites and associated infrastructure with respect to floodplains, are provided in appendix B. The following sections address individual SPR expansion sites and summarize key information regarding the potentially affected floodplains at each of the proposed new and expansion sites.

DOE regulations (10 CFR Part 1022) require assessment of the impacts of the proposed action on natural and beneficial floodplain values in accordance with Executive Order 11988 on Floodplain Management. These include impacts on the capacity of the floodplain to provide flood attenuation; preservation of diversity and stability of wildlife species and habitats; cultural resource values (e.g., archeological and historic sites); cultivated resource values (e.g., agriculture, aquaculture, forestry); aesthetic values (e.g., natural beauty); and other values related to the public interest. The potential impacts of the proposed SPR expansion on each of these aspects of floodplain value are assessed in this draft EIS. Section 3.7 (Biological Resources) assesses in detail the potential impacts of the proposed actions on wildlife and habitats, including within the floodplain areas that would be affected by the proposed developments. The impacts of SPR expansion on floodplains are also described in detail in appendix B.

Federal regulations also require assessment of the potential impacts of the proposed floodplain action on lives and property (10 CFR Part 1022). The key issue for lives and property is whether the proposed action would impact the ability of the affected floodplain area to assimilate or store flood waters, or if the proposed action would exacerbate risks to lives and property during flooding.

The impacts on the affected floodplains associated with the proposed SPR sites would be lessened because most of the proposed infrastructure would be built below ground level. The main impacts on flood storage and flooding attenuation would result from construction of some above-ground structures and placement of fill at new cavern facilities at Chacahoula, Bayou Choctaw, Stratton Ridge, and Big Hill. The development of onsite facilities and wellheads and the development of RWI facilities would involve fill of small areas of floodplain. However, these fill areas would be insignificant in comparison to the total areas of the floodplains where they are located. The Big Hill, Bruinsburg, Chacahoula, Richton, and Stratton Ridge sites are all located in floodplains that each extend over hundreds of acres (hectares), parts of the Neches-Trinity Coastal Basin, Louisiana Western Gulf Coastal Plain Province, and the San Jacinto-Brazos Coastal Basin, respectively. The Bayou Choctaw site is also located in a very extensive floodplain area. However, fill areas developed as part of the proposed action at these sites would have an insignificant impact on the flood storage capacity or hydraulic function of the related floodplains.

Construction of pipelines through floodplains would have only short-term, localized effect. Pipelines would be buried below grade, and the land would be returned to its original grade. Thus, pipeline construction is expected to have little or no impact on hydraulic function in the affected floodplains. Pump stations and the pump house for the RWI would be flood-proofed and built at an elevation above the **base flood** elevation (where practicable).

Although some impacts to floodplains cannot be avoided (e.g., removal of vegetation during site or pipeline construction), such impacts would be mitigated through the use of appropriate engineering designs and good operating procedures. DOE would lessen impacts to floodplains to the extent possible throughout construction of the new or expansion SPR sites. Control measures that DOE would use can be divided into three categories: (1) impact avoidance; (2) impact minimization, meaning the use of low-impact methods or containment measures; and (3) restoration, which includes replanting, rehabilitation, and other post-construction mitigation. These control measures and DOE's Floodplain Finding as required by Executive Order 11988 are described in appendix B.

DOE would comply fully with applicable local and state guidelines and regulations regarding floodplain construction, and would be further regulated by permits that must be obtained for any construction in a floodplain. In general, DOE would be required to evaluate the impact of placing fill or structures in a 100-year floodplain and demonstrate that the proposed fill/structures would not increase the base flood elevation. For any floodplains that are also wetlands, DOE would obtain permits from USACE and the state as required under Section 10 of the Rivers and Harbor Act and Section 404 of the Clean Water Act for any regulated action involving excavation or filling in wetland, inland waters, or navigable waters. USACE would take protection of floodplains into consideration in issuing these permits. For floodplain areas that are not also wetlands, local permits would be required. Both USACE and local permits would also require best management practices and facility designs that would protect the long-term floodplains function for hydraulic control in the drainage area.

Based on these constraints, DOE expects that overall impacts to floodplain hydraulic function, and therefore to lives and property, would not be significant.

Appendix B addresses whether a practicable alternative to SPR development in a floodplain exists. From the standpoint of individual storage sites, practicable alternatives do not exist because SPR facility locations are dictated by the location and configuration of the salt domes where storage capacity would be developed.

On a programmatic basis, alternatives to development of storage sites in a floodplain exist to the extent that SPR storage capacity could be developed practically in salt domes located outside of floodplains; however, the proposed project depends extensively on water for cavern leaching. It also must be near the

Gulf of Mexico or satisfactory deep subterranean formations that can accept brine discharge from the cavern leaching process. The linear nature of the proposed pipelines and the dispersed locations of salt domes, brine discharge capacity, and raw water sources means that some floodplain would be crossed by pipelines, access roads, and other infrastructure regardless of where the storage sites were located; therefore, floodplain impacts could not be avoided altogether. DOE is further constrained in site selection for the storage sites because of statutory requirements that DOE limits its consideration to sites that already have been studied, or to sites proposed by the Gulf Coast states.

In view of these practical and statutory constraints, DOE considers that a practicable alternative to development in floodplain areas does not exist. Further, the minimal impact that SPR development is expected to have on floodplain values would not justify moving SPR development to nonfloodplain sites that have other significant practical and cost disadvantages. Even with the development of SPR sites in floodplain areas, the overall project would still meet the requirement to avoid “adverse effects and incompatible development within floodplain,” as required under 10 CFR Part 1022 and Executive Order 11988.

##### *3.6.2.1.8 Impacts to Navigation*

Virtually all of the pipelines and power lines at all proposed sites would traverse surface waters. The affected areas would include many surface water bodies that are primarily low-energy, small, channels through the marshes. These smaller waterways are used mainly for hunting and fishing with canoes, kayaks, and airboats being the primary form of vessel used on these surface water bodies. A few moderate-sized water bodies, listed in the site-specific sections, also would be crossed by SPR infrastructure. In addition, the ICW, which is maintained by USACE and used for commercial transportation, would be crossed by pipelines. At all such pipeline crossings, impacts to navigation would be limited to the construction phase because all pipelines would be buried and would not impair navigation during operations and maintenance. Where directional drilling is used, impacts to navigation even during construction would be negligible. A Section 10 permit (under the Rivers and Harbors Act) and Section 404/401 permits (under the Clean Water Act) would be required for pipeline construction through navigable waterways. The permit conditions would include best management practices to minimize impacts to navigation during construction. For these reasons, the proposed pipeline crossings and permanent structures in the navigable waterways would be expected to have negligible impacts on navigation.

At the three proposed expansion sites (Big Hill, West Hackberry, and Bayou Choctaw), the proposed action would make use of existing raw water systems with no incremental effect on navigation. Pumps in the Big Hill RWI would be upgraded with no incremental effect on navigation.

New RWI structures would be placed in the ICW for the proposed Chacahoula and Stratton Ridge sites, in the Leaf River for the Richton site, in the Mississippi River for the Bruinsburg site, and within the LOOP complex for the Clovelly site. These new intakes would include a structure to house the pumps and submerged screened intake pipes. The structures would be designed to minimize impacts to navigation and built into the waterway bank to avoid impacts to navigation. A typical RWI would be placed along the shoreline with an area dredged from the shoreline that would contain the pumps and the submerged screen intake pipes. This would not impede boat traffic. As with pipelines, Section 10 and Section 404/401 permits would be required for any construction in navigable waterways, and would include best management practices to avoid impacts to navigation.

The proposed Big Hill and Clovelly sites would use existing brine discharge structures, while the Chacahoula, Richton, and Stratton Ridge sites would require new brine discharge structures. All of these discharge structures are or would be located in the Gulf of Mexico, which is heavily used for commercial and recreational boating. The pipelines would be buried and the brine-diffuser structures would be located in water at least 30-feet (9-meters) deep, which would not interfere with marine traffic. The diffuser structures would be constructed so as to protect shrimp nets from being entangled. Again, DOE would secure Section 404/401 and Section 10 permits, which require avoidance of impacts to navigation. The permit conditions for both the intake and brine discharge structure would require placement of all permanent structures at a depth below the draw of normal boat traffic and might require markers to warn boaters of the submerged structure.

The following is a list of some specific measures that DOE would undertake to prevent impacts to navigation:

- Design and build new RWI structures not to intrude into navigation channels;
- Install navigational hazard markers at the intake and discharge sites; and
- Install the pump house for the RWI outside the channel where the RWI structures are located on navigable waters.

##### *3.6.2.1.9 Impacts From On-Site Wastewater Treatment Plant Discharge*

DOE would install and operate an onsite wastewater treatment facility to treat sanitary waste at each of the proposed sites. NPDES permits, as well as applicable state and local permits, would be in place for each of these facilities. The permits would require that treated effluent water meet water quality criteria protective of the surface-water receiving bodies. Monitoring results indicate that the wastewater treatment facilities at existing SPR sites consistently meet their specific discharge requirements (DOE 2004f).

Although DOE would comply fully with discharge requirements, the potential would remain for treated sanitary waste discharge to have some impact on receiving water bodies during normal operation and in spills or upset conditions. Typical impacts associated with routine sanitary wastewater treatment plant discharge include a small elevation of nutrient levels, biochemical oxygen demand, and reduced dissolved oxygen levels in the water column of receiving waters. These impacts would be localized near waste discharge points. Beyond the mixing zones for these discharges, impacts would not be expected. Any water quality impacts would be within acceptable limits as established by NPDES permits. During spills or upset conditions, untreated wastewater could be released to surface waters, resulting in a one-time, short-lived elevation in nutrient levels, microbes, and biochemical oxygen demand in the receiving water body. The duration and severity of impact would depend on the size of the spill and size and flushing action of the receiving water body. However, the onsite wastewater treatment plants would be relatively small in size, precluding the possibility of very large-volume spills of untreated wastes. Historical operating data (DOE 2004f) indicate that the likelihood of such an occurrence would be very low.

##### *3.6.2.1.10 Impacts From Nonpoint Source Surface Water Discharge*

Nonpoint source surface-water discharges potentially could occur at the SPR sites during both construction and operations and maintenance periods in the form of contaminated runoff. Runoff from the sites potentially could contain traces of materials spilled or used in small quantities onsite including oil, brine, fuels, cleaning materials, solvents, pesticides, vehicle maintenance fluids, or other materials. Runoff also could contain sediment from disturbed ground surfaces. DOE would practice good housekeeping and management practices to minimize the occurrence and size of any spills, to clean up spilled materials, and to minimize runoff contamination by cleaners or pesticides. Control measures would be taken to prevent sediment in runoff, as described earlier in the discussion of erosion and sedimentation impacts. National or state Pollutant Discharge and Elimination System permits and Stormwater Pollution Prevention Plans, as well as other applicable state and local permits, would be required for all facilities. These permits would include requirements for monitoring and reporting of certain chemicals and water-quality parameters in overland discharge from the sites to adjacent receiving waters. Monitoring results indicate that existing SPR sites consistently meet discharge requirements (DOE 2004f).

Although DOE would comply fully with permit requirements, the potential would remain for contaminants contained in nonpoint source discharges to have some minor impact on receiving water bodies. The potential impacts of oil, brine, chemicals, and sediment releases to surface water bodies have been described in earlier sections and section 3.2.2. The same types of impacts could occur as a result of the release of these same constituents in nonpoint source discharges. The level of impact associated with nonpoint source discharges would be low because the above constituents, if present in runoff, would be present at very low concentrations.

##### *3.6.2.1.11 Impacts Associated with Potable and Miscellaneous Water Use*

Small amounts of water for drinking and sanitary purposes would be used at each proposed site. The proposed expansion sites at Bayou Choctaw, West Hackberry, and Big Hill would use the water sources currently used at those sites. Bayou Choctaw pumps and treats groundwater, West Hackberry obtains water from the larger Hackberry public water system, and Big Hill purchases treated (chlorinated) surface water from local suppliers (DOE 2004f). Considering the minimal amount of potable and sanitary water required at the sites, the potential impacts of water used at the proposed expansion and new sites would be negligible.

#### 3.6.2.2 Groundwater Common Impacts

The following paragraphs summarize the general groundwater impacts expected at all sites. These do not include groundwater impacts associated with the underground injection of brine, which are unique to the Bruinsburg, Bayou Choctaw, and West Hackberry sites and are evaluated in those site-specific sections below.

##### *3.6.2.2.1 Impacts of Brine Releases to Groundwater*

Section 3.2.2.1 and section 3.6.1.2.1 discuss the risk of brine spills associated with the proposed SPR sites. A larger-volume brine spill could have consequences for groundwater resources, including groundwater **salinization**; however, the probability of such a large-volume spill is very low. Low-volume spills are unlikely to reach groundwater. The overall risk to groundwater associated with brine spills is low.

Brine also could be released to groundwater via leaks from brine ponds. Measures to prevent leaking from brine ponds would include high-density polyethylene liners, underdrain systems to detect leakage, and sufficient freeboard to preclude overflow. These controls would guard against an uncontrolled, long-term discharge of brine to groundwater from the brine ponds. The brine ponds at the West Hackberry SPR facility did result in contamination of groundwater (DOE 2004f). At West Hackberry, the brine pond was removed and the brine-impacted groundwater was pumped from the aquifer. Also, brine leaks from pipelines at the Bayou Choctaw and Big Hill operating SPR sites have been reported (DOE 2004f). Groundwater monitoring programs at these sites indicate that the impacts to groundwater were localized.

The characteristics (such as salinity) and current and potential uses of groundwater, along with the geologic characteristics of each site as it relates to potential impacts from any brine discharges, are discussed in the site-specific sections.

##### *3.6.2.2.2 Impacts From Oil Storage Cavern Leakage*

Three mechanisms could lead to leakage of brine or oil from a salt cavern: (1) flow paths of sufficient permeability in the salt or associated natural seepage pathways such as faults and joints; (2) flow through hydraulic fractures generated in the walls of the cavern; or (3) leakage along the salt-cement interface in the cased well bore. The following paragraphs summarize the three mechanisms and collectively conclude that it is unlikely for brine or oil to leak from a salt cavern.

Rock salt is essentially impermeable (with a permeability about $10^{-21}$ to $10^{-19}$ meters squared). DOE would conduct a detailed geophysical survey for each proposed new site to ensure that the new SPR caverns would not intersect any natural seepage pathways and that the impermeability of the surrounding material meets design requirements; and thus, the leakage of brine or oil through the salt itself or associated natural seepage pathways would be unlikely.

Fractures may develop in the roof or crest of salt caverns if the cavern roof undergoes sufficient downward deflection or sag at the midpoint. With sufficient thickness of roof salt, these fractures would not extend through the whole roof salt and reach the caprock. The remaining unfractured roof salt and the caprock would prevent leakage of brine or oil from a salt cavern.

With the borehole and casing sealed properly following standard practices, the leakage brine or oil from a salt cavern along the salt-cement interface in the cased well-bore would be unlikely. Wells would be double-cased and grouted to prevent contamination of strata above the caverns. After installation, a nitrogen well-leak test, occurring over a period of five days, would be performed. This test is designed to detect small leaks in the well walls and wellhead. For additional protection, a dike would surround the wellhead area at each cavern. If any spills occur due to a manifold failure or blowout, drains on either side of the dike would contain the spill.

To protect against cavern leakage, the cavern would be pressure-tested before oil is injected. The test sensitivity level is leakage of up to 100 barrels of oil per year. DOE anticipates that the cavern integrity would surpass this limit. In addition, the caverns would be thousands of feet below sea level, and the rock aquifers at this depth would contain saline water that would be unusable as a potable source. The saline water of the rock aquifers likely would not affect shallow groundwater aquifers or surface waters.

### 3.6.3 Bruinsburg Storage Site

Development and operation of the proposed Bruinsburg site would involve the following activities:

- Construction and operation of 16 storage caverns and associated facilities, including a wastewater treatment plant;
- Construction and operation of a pipeline, RWI structure on the Mississippi River, and power line running along the raw water pipeline from the main site substation to the RWI:
- Construction and operation of a brine disposal pipeline to 60 offsite brine disposal wells spaced along the brine and crude oil pipeline ROW and a road along the brine pipeline for construction and maintenance activities associated with brine wells;

- Construction and operation of two crude oil pipelines—one to the Peetsville pump station and the other to the Anchorage bulk storage terminal;
- Construction and operation of two new tank farms—one at Anchorage and the other at Peetsville, each consisting of four 0.4 MMB capacity oil storage tanks;
- Addition of site support facilities including construction of a 7-foot (2.2-meter) security fence, clearing of a 300-foot (91-meter) security buffer beyond the security fence, and refurbishment of access roads to the site and RWI structure.

The following sections describe the potential affects on water resources and impacts at the Bruinsburg storage site and associated infrastructure. The common impacts described in section 3.6.2 also apply to the Bruinsburg site.

### 3.6.3.1 Bruinsburg Surface Water

#### *3.6.3.1.1 Bruinsburg Surface Water: Affected Environment*

The Bruinsburg site is located at an elevation of approximately 82 feet (25 meters) above sea level (measured at the USGS site, ID 072900650) 3 miles (4.8 kilometers) east of the Mississippi River. It is also located in the South Independent Streams Basin, which covers approximately $2.8 \times 10^6$ acres ($1.1 \times 10^6$ hectares). The major waterways located in this basin include Bayou Pierre, Coles Creek, Buffalo River, and Homochitto River. The land in the basin is gently rolling to hilly terrain, and it is categorized as 73 percent forested and 23 percent agricultural land. Elevations in the basin range from approximately 10 to 550 feet (3.1 to 170 meters) above sea level. Agriculture and silviculture (the agriculture of trees) are the predominant uses of the basin. The proposed SPR site area is also agricultural.

#### *3.6.3.1.2 Bruinsburg Surface Water: Construction Impacts*

The common impacts to surface water discussed in section 3.6.2.1 are applicable to the proposed Bruinsburg site. The raw water withdrawal impacts of this site are discussed in the following paragraphs. Brine from the Bruinsburg site would be disposed of through deep injection wells, creating no impacts to the Gulf of Mexico associated with this site.

Table 3.6.3-1 and figure 3.6.3-1 list the site location and some of the nearby surface water bodies and show specific surface water bodies that could be affected by this proposed site.

**Table 3.6.3-1: Potentially Impacted Surface Waters, Bruinsburg**

| Water Body Name and Relevant Segment | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| **Cavern Site** | | |
| Bayou Pierre | River through agricultural area; tributary to the Mississippi River; perennial | • Recreation<br>• Habitat-critical for the Bayou darter, which, because of silt and sedimentation, is a threatened species in Bayou Pierre<br>• Impaired for aquatic life support and primary and secondary recreational contact |
| **RWI from Mississippi River** | | |
| Mississippi River | Major drainage river | • Recreation<br>• Major commercial river |

## Table 3.6.3-1: Potentially Impacted Surface Waters, Bruinsburg

| Water Body Name and Relevant Segment | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| **Brine Disposal Pipeline to 60 offsite injection wells** | | |
| Coles Creek | Upland creek; perennial | • Impaired use for aquatic life support and secondary recreational contact<br>• Impairments are biological, nutrient, low DO, pesticides, sedimentation and siltation, salinity, pathogens |
| **Crude Oil Pipelines to Anchorage** | | |
| Homochitto River | Upland river; tributary to Mississippi River; perennial | • Recreation<br>• Impaired use for aquatic life support and secondary recreational contact<br>• Impaired for nutrients, low DO sediment and siltation, pathogens, and pesticides |
| Browns Creek | Upland stream; perennial | • Aquatic life support and secondary recreational contact.<br>• Evaluated for nutrients, low DO, siltation, pathogens, and pesticides |
| Middle Fork Thompson Creek | Upland stream; perennial | • Impaired use for aquatic life support;<br>• Cause of impairment unknown |
| Dry Fork | Upland stream; perennial | N/A |
| Buffalo River | Upland river; tributary to Mississippi River; perennial; 2004 average streamflow varies between 70 $ft/sec^3$ (March) to less than 2,000 $ft/sec^3$ (September) | • Impaired use for aquatic life support<br>• Impaired for biological, low DO, salinity, and pesticides |
| White Bayou | Upland stream; intermittent | N/A |
| Bayou Baton Rouge | Upland stream; intermittent | N/A |
| Thompson Creek | Upland river; tributary to Mississippi River; perennial | • Impaired use for aquatic life support<br>• Impaired for nutrients, biological, low DO, and salinity |
| Blueskin Creek | Upland stream; intermittent | N/A |
| Sandy Bayou | Upland stream; intermittent | N/A |
| St. Catherine Creek | Upland creek; perennial | • Impaired use for aquatic life support and primary and secondary recreational contact<br>• Impaired for salinity and chlorides and suspended solids |
| Dunbar Bayou | Upland stream; intermittent | N/A |
| Town Creek | Upland creek; intermittent | • Aquatic life support and secondary recreational contact<br>• Impaired use for aquatic life support<br>• Impaired for nutrients, low DO, pathogens, biological impairment, sedimentation/siltation, suspended solids, pesticides, turbidity, and other habitat alteration. |
| Hurricane Creek | Upland stream; intermittent | • Aquatic life support<br>• Impaired use for nutrients, low DO, biological impairment, sedimentation/siltation, pesticides, pH, and flow alteration |
| Second Creek | Upland creek; perennial | • Impaired use for aquatic life support<br>• Impaired for biological, low DO, salinity, siltation, and pesticides |
| Callahan Branch | Upland creek; intermittent | N/A |
| Fairchilds Creek | Upland creek; perennial | • Impaired use for aquatic life support<br>• Impaired use for nutrients, low DO, siltation, and pesticides |
| Perkins Creek | Upland creek; intermittent | N/A |
| Monte Sano Bayou | Upland stream; perennial | N/A |
| Mississippi River | Major river | • Aquatic life support, primary and secondary recreational contact, and public water supply |

## Table 3.6.3-1: Potentially Impacted Surface Waters, Bruinsburg

| Water Body Name and Relevant Segment | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| **Crude Oil Pipelines to Peetsville** | | |
| James Creek | Upland creek; perennial | • Impaired use for aquatic life support and secondary recreational contact<br>• Impaired for nutrients, low DO, pesticides, pathogens, biological impairment, unknown toxicity, flow alteration, suspended solids, and sediment/siltation |
| Widows Creek | Upland creek; intermittent | N/A |
| Willis Creek | Upland creek; perennial | • Impaired use for aquatic life support<br>• Impaired for nutrients, low DO, pesticides, and sediment/siltation |
| Clarks Creek | Upland creek; perennial | N/A |
| Hughes Creek | Upland creek; perennial | • Impaired use for aquatic life support<br>• Impaired for nutrients, low DO, other habitat alterations, and sediment/siltation |
| Whetstone Creek | Upland creek; intermittent | N/A |
| Bakers Creek | Upland creek; perennial | • Impaired use for aquatic life support and secondary recreational contact<br>• Impaired for nutrients, low DO, pathogens, biological impairment, and other habitat alteration |
| Caney Branch | Upland stream; perennial | N/A |
| Crow Creek | Upland creek; intermittent | N/A |
| Johnson Creek | Upland creek; perennial | • Impaired use for aquatic life support<br>• Impaired for nutrients, low DO, pesticides, sediment/siltation |
| Foster Creek | Upland creek; perennial | • Impaired use for aquatic life support<br>• Impaired for sediment/siltation |
| Homochitto River | Upland river; perennial | • Recreation<br>• Impaired use for aquatic life support and secondary recreational contact<br>• Impairment caused by sedimentation/siltation, pathogens, nutrients, low level pesticides |
| Cedar Creek | Upland creek; perennial | • Impaired use for aquatic life support<br>• Impaired for pesticides |
| Dry Creek | Upland creek; intermittent | • Impaired use for aquatic life support and secondary recreational contact<br>• Impaired for nutrients, pesticides, sediment/siltation, and pathogens |

Notes:

[a] All of the waters in Mississippi Department of Environmental Quality's (MDEQ) basin approach are classified as Fish and Wildlife. Basin waters carrying other classifications are noted accordingly (MDEQ 2006a).

DO = dissolved oxygen

The proposed SPR facility site at Bruinsburg would be located less than 1 mile east of Bayou Pierre. Bayou Pierre discharges to the Mississippi River 3 miles downstream of the proposed site. Bayou Pierre, the primary local drainage, would not be impacted directly by the proposed facility or the pipelines or RWI structure.

The proposed RWI in the Mississippi River would cross no water bodies. The brine disposal pipeline would cross only one upland creek, Coles Creek. The crude oil pipeline to Anchorage would cross several streams, including several that discharge downstream into the Mississippi River to the west. Most of these streams are identified by Mississippi as having impaired quality because of sedimentation, low dissolved oxygen, pesticides, and elevated nutrients, all of which are characteristic of agricultural runoff (MDEQ 2006b). The crude oil pipeline to Peetsville would also cross several upland water bodies, including the Homochitto River—a tributary of the Mississippi River—and Clark’s Creek, which discharges to the Homochitto River. Directional drilling would minimize impacts during construction activities, and it also would be implemented for some of the larger water bodies including the Homochitto River.

The extent of 100-year and 500-year floodplains in the project area were determined based on the Federal Emergency Management Agency’s flood insurance rate maps covering the project area. The potential impacts to floodplains are discussed at length in section 3.6.1.2.1. The Bruinsburg site is located in a predominantly undeveloped area that has numerous floodplains associated with the Mississippi River and Bayou Pierre, and tributaries listed in table 3.6.3-1. The pipelines associated with the proposed Bruinsburg project, also cross through the floodplains of the listed surface waters. Table 3.6.3-2 lists the total area of floodplains affected by the proposed project. In addition, floodplains along pipeline routes would be temporarily disturbed during construction, but would be brought up to original grade after construction.

**Table 3.6.3-2: Total Area of Floodplains Affected by the Bruinsburg 160 MMB Project**

| Bruinsburg 160 MMB Storage Site | | |
|---|---|---|
| **Floodplain** | **Area (acres)[a]** | **Area (hectares)[a]** |
| 100-year | 240 | 98 |
| 500-year | 21 | 9 |
| **Total** | **261** | **107** |

[a] Numbers have been rounded to two significant figures

The Bruinsburg site would withdraw water from the Mississippi River at a point 3.5 miles (5.7 kilometers) southwest of the proposed SPR site. At the proposed withdrawal point, the Mississippi River is approximately 0.50-miles (0.80-kilometers) wide, and it has an annual average flow rate of approximately $2.7 \times 10^5$ cubic feet per second ($7.5 \times 10^3$ cubic meters per second) (Data for Vicksburg, MS) (Riverweb 2004f). Six NPDES discharge permits have been issued in the Bruinsburg RWI area (EPA 2006c); at least one of these discharges is to the Mississippi River upstream of the RWI (the receiving waters for the remaining permits are not listed). Information about the volume of this discharge is unavailable. These discharges would not affect the proposed RWI because the water would not be used for potable water.

Raw water withdrawal from the Mississippi River for the Bruinsburg site would be 1 MMBD (480 gallons per second [1.8 cubic meters per second]) during drawdown, and 1.2 MMBD (78 cubic feet per second [2.2 cubic meters per second]) during solution mining. These measurements represent a small fraction (less than 0.003 percent) of the average river flow. The RWI would be expected to have no appreciable effect on water levels, downstream water flow, water availability for other users, dilution and assimilation capacity of the river for pollutants, or water quality.

If this proposed site is selected, DOE would apply for a Permit to Withdraw for Beneficial Uses from the Public Waters of Mississippi and coordinate with the Mississippi Office of Land and Water Resources to ensure that minimum instream flows are maintained during the period of withdrawal. This RWI also would be coordinated and permitted by USACE through the Section 404 process.

##### *3.6.3.1.3 Bruinsburg Surface Water: Operations and Maintenance Impacts*

Section 3.6.2 discusses potential impacts related to operations and maintenance at all sites. The impacts related to raw water withdrawal are also applicable to the operations and maintenance phase.

### 3.6.3.2 Bruinsburg Groundwater

#### *3.6.3.2.1 Bruinsburg Groundwater: Affected Environment*

The proposed Bruinsburg site is located over a shallow aquifer, the Southern Hills Aquifer; and a deep aquifer, the Mississippi Embayment Aquifer System (MEAS). The Southern Hills Aquifer system extends from near Vicksburg, MS at its northernmost point to Baton Rouge, LA at its southern extent, and is bounded on the east and west by the Pearl and Mississippi rivers (USEPA 2006g, 2004h; USGS 2002b). This system consists of four aquifer units, including a Shallow Alluvial (Pleistocene) aquifer and Pliocene, Miocene, and Oligocene units (LAGS 2000)[1].

The different units of the Southern Hills Aquifer system originate in outcroppings that run in roughly east-west bands across southern Mississippi. The aquifers dip downward towards the coastline and the Mississippi River Valley. Groundwater flow in the aquifer system is generally to the south, i.e., down-dip or downgradient.

The Southern Hills Aquifer system is an important groundwater resource in the region. It is designated by EPA as a sole source aquifer and is the primary groundwater resource aquifer for southwestern Mississippi and southeastern Louisiana. It is the only source of drinking water for more than 50 percent of the residents in a large area of southeastern Louisiana (EPA 2006f, 2004g, 2004h). The Shallow Alluvial aquifer and the Miocene unit of the Southern Hills Aquifer system serve as water resources for much of southern Mississippi and southeastern Louisiana (MDEQ 2004b; USGS 1981; USGS 2005b; Walley 2006). Thus, Bruinsburg is located in the origination area or recharge zone of the Southern Hills Aquifer system, and is upgradient of the great majority of the system. In the vicinity of the Bruinsburg site, the bottom of the Southern Hills aquifer system is approximately 800 feet (244 meters) below grade (USGS 1982). Most of the Miocene outcropping area is covered by an overlying confining layer of loess, up to 90 feet (27 meters) thick. This overlying confining layer greatly reduces vertical recharge to the Miocene unit (MDEQ 2004b).

[1] Some references (USGS 2005b) refer to five aquifer units, including a lower Pliocene to upper Miocene unit. The aquifer units or permeable zones within the Southern Hills Aquifer system and the larger Coastal Lowlands Aquifer system (of which the Southern Hills system is a part) are heterogeneous and discontinuous across the system. The system is generally devoid of widespread confining units, and permeable zones are distinguished by their different hydraulic conductivities rather than their separation by confining units. Stratigraphic comparisons and identification of permeable zones across the entire system are difficult, and in some areas arbitrary (USGS 2005b). Due to the absence of confining layers these permeable zones or aquifer units are extensively interconnected and effectively form a single large aquifer system.

Examples of the uses of the Southern Hills Aquifer downgradient of the Bruinsburg site include the designated source water protection area and municipal supply wells in Russo, MS, located approximately 10 miles downgradient from Bruinsburg. Other major pumping centers in Mississippi relying on the Miocene unit include Natchez, Brookhaven, Hazlehurst, Colombia, McComb, Moss Point, Picayune, Ellisville, Hattiesburg, Laurel, Biloxi, Gulfport, and Pascagoula (MDEQ 2004b), at distances of 30 to 190 miles (48 to 310 kilometers) downgradient of Bruinsburg. Smaller wells exist throughout the area of Mississippi downgradient of Bruinsburg.

In Louisiana, the area of Baton Rouge (approximately 100 miles (160 kilometers) downgradient of Bruinsburg) withdrew 131 million gallons (0.50 million cubic meters) per day from the Southern Hills Aquifer system in 2000. This withdrawal was largely from the Pliocene unit, but also to a lesser extent from other units in the system (USGS 2002b; USGS 2005b). Other major pumping centers relying on the Southern Hills Aquifer system include St. Franksville, Amite, Franklinton, Bogalusa, Hammond, Covington, Denham Springs, and Slidell, LA (USGS 2002b), at distances of 80 to 145 (130 to 230 kilometers) miles downgradient from Bruinsburg. Hundreds of smaller wells tap the Southern Hills Aquifer system in Louisiana. Many of these wells are located along the border with Mississippi, within roughly 60 miles (97 kilometers) of Bruinsburg (USGS 2002b).

Total withdrawal from the Southern Hills Aquifer system in 2000 was 290 million gallons per day (1.1 million cubic meters per day), of which 49 percent was used for public water supply, 39 percent was used for industrial uses, and the remainder was used for power generation, rural domestic use, and other uses (USGS 2002b).

In the Bruinsburg area, the Southern Hills Aquifer system is underlain by a thick confining layer known as the Vicksburg-Jackson confining unit, or locally as the Yazoo Clay layer. Below this confining layer is a second major aquifer system, the MEAS. Bruinsburg is located over the southernmost, downgradient, down-dipping section of the MEAS, which is a large system extending from southeastern Arkansas eastward into northeastern Mississippi and southern Tennessee, and southward into central Louisiana and just south of the southern Mississippi border, into southeastern Louisiana.

The MEAS comprises six aquifer units with outcropping zones extending in arch-shaped bands across northern Louisiana, southeastern Arkansas, northeastern Mississippi, and southern Tennessee (USGS 2005b). Thus, the MEAS is at or near the surface in areas significantly northeast, north, and northwest (and upgradient) of Bruinsburg. The MEAS aquifer units increase in thickness, and the lower units increase in depth below grade, with distance to the south, and as they approach the central axis of the aquifer system along the Mississippi river corridor (USGS 2005b). Groundwater flow in the MEAS is driven by gravity in the downgradient direction; i.e., towards the central axis of the MEAS along the Mississippi River, and to the south (USGS 2005b).

In southern Mississippi and central Louisiana, an extensive, thick, clay confining unit (Vicksburg-Jackson confining unit) separates the MEAS from the overlying potable water aquifers of the Southern Hills Aquifer system (USGS 2005b). In the vicinity of the Bruinsburg site, this thick clay confining layer is 300- to 500-feet (91- to 150-meters) thick (Taylor 2005; USGS 2005b). This confining layer precludes movement of water between the upper Southern Hills Aquifer system and the lower MEAS.

Of particular interest within the MEAS is the Middle Claiborne unit, which is composed largely of the Sparta Sands aquifer, and is generally referred to as the Sparta aquifer. The Sparta aquifer is an important source of water in its northern sections (i.e., in southeastern Arkansas, northern Louisiana, northeastern Mississippi, and southern Tennessee), where this aquifer is relatively near the surface and contains fresh water. In 2000, water was withdrawn from the Sparta aquifer in Louisiana at the rate of 68 million gallons (257 thousand cubic meters) per day (USGS 2002b). This water was used for public water supply

(55 percent), industry (40 percent), and other uses (5 percent) (USGS 2002b). Significant amounts of water are withdrawn from the Sparta/Central Claiborne Aquifer in the cities of Stuttgart, Pine Bluff, El Dorado, and Magnolia, Arkansas; Ruston, Jonesboro, Monroe, and Bastrop, Louisiana; and Yazoo City and Jackson, Mississippi. Large withdrawals are also made in the Memphis, Tennessee area (USGS 2005b).

All of these Sparta withdrawal areas are upgradient (from 35 to over 240 miles [56 to 390 kilometers]) of the Bruinsburg site. The freshwater limit (1,000 parts per million dissolved solids concentration isopleth) of the Sparta aquifer extends in an arch upgradient of Bruinsburg, roughly 60 miles (97 kilometers) to the northwest, 50 miles (81 kilometers) to the north, and 35 miles (56 kilometers) to the northeast. The 10,000 parts per million dissolved solids concentration isopleth extends in an arch upgradient of Bruinsburg, approximately 45 miles (72 kilometers) to the northwest, 40 miles (64 kilometers) to the north, and 20 (32 kilometers) miles to the northeast (USGS 2005b). Thus, the usable portions of the aquifer are many miles upgradient of the Bruinsburg site.

The MEAS aquifer units increases in dissolved solids content in the downgradient direction, and with depth below grade. These units contain fresh water in the northern areas where they are relatively near the surface, but become saline downgradient. Bruinsburg is located in the downgradient portion of the MEAS. The top of the Sparta aquifer is 1,900 feet (580 meters) below grade at this point. The dissolved solids concentration within the aquifer at this point is over 10,000 parts per million (USGS 2005b).

#### *3.6.3.2.2 Bruinsburg Groundwater: Construction Impacts*

All of the general groundwater-related impacts discussed in section 3.6.2.2 are applicable to the proposed Bruinsburg site. However, impacts to the Miocene aquifer unit from surface or near-surface discharges at Bruinsburg would not be likely because of the presence of the thick overlying, low permeability layer of loess. This confining layer would act as a barrier to infiltration of spilled contaminants to the underlying Miocene aquifer.

The crude oil pipeline to Vicksburg would pass through one surface water protection area (SWPA) in the Town of Raymond, MS. The SWPA delineates a groundwater protection area around three public supply wells. This pipeline is approximately 0.50 miles (0.80 kilometers) from another public water supply well (ID-110026-01) in the Town of Ingleside, MS. The crude oil pipeline to Peetsville would cross through one SWPA in the town of Russum, MS, where there are three public supply wells. The crude oil pipeline to Anchorage would pass through three SWPAs in the towns of Washington and Fenwick, MS. Potential impacts to groundwater resources in these SWPAs are unlikely, considering the low probability of an uncontrolled spill from pipelines within the SWPA that would subsequently penetrate to groundwater.

Brine from the Bruinsburg site would be disposed of through deep well injection. The proposed brine injection rate would require a complex of 60 injection wells spaced 1,000 feet (300 meters) apart, resulting in an 11-mile (18-kilometer) injection corridor or injection field, which would begin approximately 3 miles (5 kilometers) from the storage site.

Based on review of well log information, DOE has identified two formations in the MEAS beneath Bruinsburg, the Sparta and Wilcox units, as potentially suitable disposal formations for injected brine. At the northern end of the proposed injection area, the top of the Sparta unit is at approximately 1,900 feet (580 meters) below grade, and the unit is approximately 750 to 1,000 feet (230 to 300 meters) thick. The top of the Wilcox unit is approximately 3,300 feet (1,000 meters) below grade, and this unit is approximately 3,700 feet (1,100 meters) thick.

The total disposal capacity of these formations, and the pressure buildup likely to occur as a result of brine injection, are not known at this time. If DOE were to select this alternative, the total disposal capacity and pressure build up would be determined during the development of the detailed design. Based on review of currently available well logs, DOE has concluded that the Sparta formation alone may not have adequate capacity to handle the proposed brine injection volumes and rates, necessitating development of injection wells in both the Sparta and Wilcox formations. Considering the likely heterogeneity of the proposed injection formations over the length of the disposal corridor, additional testing would be required to assess the capacity of these formations for receiving injected brine at the proposed rates, as well as to provide confidence that brine injection would not adversely affect the quality of either the overlying water supply aquifer or the upgradient freshwater portions of the formations that would receive the brine.

The proposed injection area would be located at least 35 miles (56 kilometers) downgradient of the freshwater portions and withdrawal areas of the Sparta and Wilcox units, and both of these aquifers have dissolved solids concentrations greater than 10,000 parts per million at the proposed brine disposal area (USGS 2005b). Brine injected into these aquifers at Bruinsburg would travel further downgradient with the general direction of groundwater flow, and also by gravity along the bedding that dips towards the south. Thus the injected brine would be carried into increasingly saline portions of the aquifers, and away from the freshwater portions of the aquifers that constitute current or potential sources of fresh water. Permitting for the proposed brine-disposal system would be subject to the requirements of the Underground Injection Control (UIC) Program regulations, including the prohibition on injection into formations that contain waters of 10,000 parts per million total dissolved solids or less (40 CFR Parts 144-146). Permitting would require a determination that injection would not adversely impact freshwater portions of the injection formations.

The Yazoo Clay formation, approximately 300- to 500-feet (91- to 152-meters) thick, separates the Sparta aquifer (the uppermost of the two proposed injection aquifers) from the overlying potable water aquifers of the Southern Hills Aquifer system. Quantitative performance data are not available for the Yazoo Clay layer. However, this layer is characterized as very low permeability (Taylor 2005) and could therefore be expected to serve as an effective barrier to the migration of brine upward into the potable Southern Hills Aquifer system.

Brine would be injected into a portion of the aquifer with dissolved solid concentrations in excess of 10,000 parts per million and would travel into an increasingly saline portion of the aquifer. As a result of this, and the presence of the Yazoo Clay formation serving as a barrier to upward migration, there would be no impact on potable portions of the Sparta or Wilcox aquifers from brine disposal at Bruinsburg.

There is a low potential that injected brine potentially could discharge to the shallow water source aquifer through leaks in the brine disposal wells. Moreover, these wells would be sealed, and pressure tested to assure that leakage would not occur. DOE would also implement a shallow groundwater monitoring program at the site to ensure protection of groundwater quality. Also, permitting of the brine disposal facility would be subject to UIC Program regulations, which specifically prohibit the over pressuring of injection zones to the point that the injected brine could rise into overlying aquifers (40 CFR Parts 144-146).

#### *3.6.3.2.3 Bruinsburg Groundwater: Operations and Maintenance Impacts*

Potential impacts from operation and maintenance activities would be similar to those discussed above for construction. The brine disposal wells also would be used during drawdown events.

### 3.6.4 Chacahoula Storage Site

The proposed new Chacahoula SPR project would include the following activities:

- Construction and operation of storage caverns, well pads, and associated facilities including a wastewater treatment plant, a security fence and buffer, and access roads to the site and RWI structure;
- Construction and operation of an RWI structure on the ICW and an RWI pipeline;
- Construction and operation of a brine disposal pipeline and brine diffuser discharge system in the Gulf of Mexico; and
- Construction and operation of two crude oil pipelines, a pipeline to the existing St. James terminal on the Mississippi River and a pipeline to LOOP's Clovelly Terminal in Galliano.

The following sections describe the potentially affected water resources and potential impacts specific to the Chacahoula storage site and associated infrastructure. The common impacts described in section 3.6.2 also apply to the Chacahoula site.

#### 3.6.4.1 Chacahoula Surface Water

##### *3.6.4.1.1 Chacahoula Surface Water: Affected Environment*

The Chacahoula site is located in the Louisiana portion of the Western Gulf Coastal Plain Province. This low-lying area is composed of the Mississippi River floodplain, coastal marshes, and a series of terraces and low hills. The site would be located at an elevation of 6 to 7 feet (1.8 to 2.1 meters) above sea level in a permanently inundated swamp, in the Terrebonne sub-basin of the Mississippi River Drainage Basin. Local drainage at the Chacahoula site is to Bubbling Bayou to the south and a canal that runs north-south, just east of the site. The proposed SPR site and the proposed pipeline routes would be located primarily in marshlands and would cross numerous small and some larger water bodies. However, the proposed oil pipeline running north to the oil terminal adjacent to the Mississippi River would cross some land at slightly higher elevation.

##### *3.6.4.1.2 Chacahoula Surface Water: Construction Impacts*

The common impacts to surface water discussed in section 3.6.2.1 are applicable to the proposed Chacahoula site. The particular surface water bodies that would be crossed or potentially impacted by this alternative are listed below in table 3.6.4-1. A map showing the location of most of these waters is presented in figure 3.6.4-1.

Surface water in the region is typically used for recreational boating and fishing. For example, Bayou Black is used for recreational boating and commercial boat tours; Bay Junop is used for recreation and fishing; and the ICW is used for recreational boating and fishing. The ICW also has considerable commercial activity, as barges haul petroleum, petroleum products, foodstuffs, building materials, manufactured goods, and other materials up and down that water body. To support this commercial traffic, USACE maintains navigable depths in the ICW through dredging and locks.

Some of the water bodies are recognized by the EPA and Louisiana as having "impaired" water quality. For example, Bayou Black is listed as impaired based on low dissolved oxygen concentrations; Lost Lake is listed as impaired based on high organic content and low dissolved oxygen levels; and Bayou

### Table 3.6.4-1: Potentially Impacted Surface Waters, Chacahoula

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| **Cavern Site** | | |
| Bubbling Bayou | Channel through marsh; perennial | • Primary contact recreation, secondary contact recreation, and fish and wildlife propagation |
| Canals running along western and eastern sides of site | Canal/ditch | N/A |
| **Exit Row Raw Water Intake and Brine P/L** | | |
| Bayou Black | Channel through marsh; perennial | • Uses: recreational boating, boat tours, aquatic life<br>• Impaired by low DO |
| **RWI Pipeline to ICW** | | |
| Canal running along eastern edge of site | Canal/ditch | N/A |
| Tributary to Bubbling Bayou 0.5 miles from site | Small stream | N/A |
| Shell Canal | Canal; Perennial | N/A |
| Bubbling Bayou | Channel through marsh | • Primary and secondary contact recreation and fish and wildlife propagation |
| Bayou Black | River through developed agricultural and oil fields | • Substantial surface water body used for recreational boating and commercial boat tours. Bayou Black is listed as "impaired," based on dissolved oxygen concentrations |
| Bayou de Cade | Canal through marsh; perennial | N/A |
| Bayou Cocodrie | Channel through marsh; perennial | • Agriculture, primary and secondary contact recreation, fish and wildlife propagation, outstanding natural resource waters, and limited aquatic life and wildlife use |
| Several unnamed canals | Small canals through marsh | N/A |
| Intracoastal Waterway | Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial | • The ICW is used for both recreational boating and for commerce<br>• Primary and secondary contact recreation and fish and wildlife propagation<br>• The ICW has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods<br>• The USACE maintains navigable depths in the water way through dredging and locks |
| **Brine Disposal Pipeline** | | |
| Bayou Penchant | River (major drainage) through marsh; 30-mile long river with peak stream flows of up to 13,000 cfs | • 30-mile long river with peak stream flows of up to 13,000 cfs<br>• Classified as "impaired" by EPA based on turbidity, oil and grease concentrations, and total organic solids concentrations<br>• The Penchant Basin is currently the focus of a USGS ecological restoration program |
| Bayou Cocodrie | Channel through marsh; perennial | • Agriculture, primary and secondary contact recreation, fish and wildlife propagation, outstanding natural resource waters, and limited aquatic life and wildlife use |

**Table 3.6.4-1: Potentially Impacted Surface Waters, Chacahoula**

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| Coulee Michel | Stream; perennial | N/A |
| Bay Junop | Coastal bay | • Recreation and fishing |
| Intracoastal Waterway | Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial | • The ICW is used for both recreational boating and for commerce<br>• Primary and secondary contact recreation and propagation of fish and wildlife<br>• The ICW has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods<br>• The USACE maintains navigable depths in the water way through dredging and locks |
| **St. James Crude Oil Pipeline** | | |
| St. James Parish Canal | N/A | N/A |
| Mississippi River | Upland channel, perennial | • Primary/secondary contact recreation, propagation of fish and wildlife, and drinking water supply |
| Baker Canal | N/A | N/A |
| Citamon Bayou | Channel through marsh; perennial | Primary and secondary contact recreation, agriculture, propagation of fish and wildlife |
| Cutgrass Coulee | N/A | N/A |
| Bayou Verrett | Channel through marsh; perennial | Primary and secondary contact recreation, agriculture, propagation of fish and wildlife |
| **Clovelly Crude Oil Pipeline** | | |
| Petit Bois Bayou | Channel through marsh; perennial | N/A |
| Intracoastal Waterway | Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial | • The ICW is used for both recreational boating and for commerce<br>• Primary and secondary contact recreation and propagation of fish and wildlife<br>• The ICW has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods<br>• The USACE maintains navigable depths in the water way through dredging and locks |
| Bayou Terrebone | Upland channel; perennial | • Primary and secondary contact recreation, propagation of fish and wildlife; oyster propagation |
| Bayou LaFourche | Channel through marsh; perennial | • Primary and secondary contact recreation, propagation of fish and wildlife; domestic raw water supply |
| Petit Chackbay Bayou | Channel through marsh; perennial | N/A |

### Table 3.6.4-1:  Potentially Impacted Surface Waters, Chacahoula

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| Company Canal | Canal; ditch | • Agriculture, fish and wildlife propagation, drinking water, primary and secondary contact recreation |
| Canal Tisamond Foret | Canal; ditch | N/A |

Notes:

[a] State designations are defined as follows:

Primary Contact Recreation:  "any recreational or other water use in which there is prolonged and intimate body contact with the water involving considerable risk of absorbing waterborne constituents through the skin or of ingesting constituents from water in quantities sufficient to pose a significant health hazard."

Secondary Contact Recreation:  "any recreational or other water use in which body contact with the water is either incidental or accidental, and in which the probability of ingesting appreciable quantities of water is minimal."

Fish and Wildlife Propagation:  "the use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment.  This use also includes the maintenance of water quality at a level that prevents damage to indigenous wildlife and aquatic life species associated with the aquatic environment and contamination of aquatic biota consumed by humans."

Drinking Water Supply:  "refers to the use of water for human consumption and general household use."

Oyster Propagation:  "the use of water to maintain biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected."

Agriculture:  "the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption."

Outstanding Natural Resource Waters:  "include water bodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes, such as those designated under the Louisiana Natural and Scenic Rivers System or those designated by the department as waters of ecological significance. Characteristics of outstanding natural resource waters include, but are not limited to, highly diverse or unique in stream and/or riparian habitat, high species diversity, balanced trophic structure, unique species, or similar qualities."

cfs = cubic feet per second; N/A = not available; 1 mile = 1.609 kilometers

Source:  LDEQ 2005

Terrebonne is listed as impaired based on a variety of contaminants and the presence of invasive, noxious plant species. Bayou Penchant is also classified as impaired based on turbidity, oil and grease concentrations, and total organic solids concentrations. The Penchant Basin is currently the focus of a USGS ecological restoration program. Similarly, Bay Junop is the subject of an ongoing ecological restoration program, including an oyster restoration project supported by EPA.

The RWI pipeline would run to the south through mostly undeveloped marsh land, and would cross one substantial water body, Bayou Black, before reaching the ICW. The brine disposal pipeline would run along the same route, but then would continue south to the Gulf of Mexico through mostly undeveloped marshland, crossing several substantial water bodies. The crude oil pipeline to St. James Terminal on the Mississippi River to the north would cross several creeks and run primarily through marshlands. The crude oil pipeline to Clovelly would cross upland rivers and streams, and then streams through costal marsh as it approaches the Clovelly LOOP. The majority of the potentially affected surface water for the Chacahoula site would be fresh water, except where the brine pipeline and the Clovelly crude oil pipeline approach the coastline.

Directional drilling would be used to minimize the impacts of crossing water bodies at some of the larger rivers, including Bayou Penchant, Bayou Lafourche, Bayou Terrebonne, and the ICW.

The Chacahoula site would withdraw raw water from the ICW. Surface water impacts associated with raw water withdrawal from the ICW are addressed in section 3.6.2.1.1, and would be expected to be insignificant.

The extent of 100-year and 500-year floodplains in the project area were determined based on the FEMA Flood Insurance Rate maps covering the project area. The potential impacts to floodplains are discussed in section 3.6.2.1.8 and in appendix B. Table 3.6.4-2 provides a summary of the floodplains located within the proposed project area.

**Table 3.6.4-2: Total Area of Floodplains Affected by the Chacahoula Project**

| Chacahoula Storage Site | | |
|---|---|---|
| **Floodplain** | **Area (acres)[a]** | **Area (hectares)[a]** |
| 100-year | 140 | 55 |
| 500-year | N/A | N/A |
| **Total[b]** | **140** | **55** |

Notes:

[a] Numbers have been rounded to two significant figures
[b] Numbers may not equal total due to rounding

With respect to floodplains, the Chacahoula site, terminal, and RWI structure would result in a disturbance of approximately 140 acres (55 hectares) of the 100-year floodplain. All onsite construction for the storage area, therefore, would occur within a floodplain. To minimize wetland and floodplain impacts, just the areas of the onsite facilities, access road, and around the cavern pads would be filled, the remainder of the site will remain at current grade. Offsite construction in floodplain would include temporary disturbances during pipeline construction.

The floodplain in which the Chacahoula site is located extends over thousands of acres, and is part of the Louisiana Western Gulf Coastal Plain Province.

#### *3.6.4.1.3 Chacahoula Surface Water: Operations and Maintenance Impacts*

The potential effects of discharging brine through diffusers into the Gulf of Mexico are discussed in Section 3.6.2.1.2. The impacts were modeled based on monitoring data at operating SPR brine diffuser sites in the Gulf of Mexico, and the impacts from the Chacahoula discharge would be very localized. As discussed in section 3.6.2.1.2 above, the proposed location of the brine diffuser is at the base of a 10-foot (3-meter) escarpment called Ship Shoal. As for the other proposed sites, the salinity impacts of the Chacahoula brine discharge on the Gulf of Mexico were estimated based on an empirical model. However, the empirical plume model does not show effects of bottom topography, such as Ship Shoal. At Chacahoula, the brine plume movement is restricted by the increasing depth to the north (shoreward), west, and south (Ship Shoal). Flow along the bottom to the east is possible, as the water bottom slopes downward to the east along Ship Shoal. The **bathymetry** (which is the ocean bottom equivalent to land's topography) at the Chacahoula diffuser would likely result in pooling of approximately 2 feet (0.6 meters) of above-ambient salinity water near the bottom.

> Mitigation: A preconstruction survey should be undertaken to evaluate the possibility of avoiding Ship Shoal. Following this measure, if required, a more detailed model may be required to define the impacts to water quality and the potential effects on biological resources.

### 3.6.4.2 Chacahoula Groundwater

#### *3.6.4.2.1 Chacahoula Groundwater: Affected Environment*

In the Chacahoula salt dome area, the subsurface water system is the Mississippi River Alluvial Aquifer, which is principally comprised of interconnected fresh-water-bearing sands and gravels, overlain by a 100-foot (30-meter) confining layer of clay and silt to form an artesian aquifer system (Arthur 2001). This aquifer is the most heavily pumped in Mississippi, and 98 percent of the groundwater pumped is used for agriculture.

The aquifer depth ranges from approximately 800 feet (244 meters) below ground surface near Bayou Choctaw to roughly 1,400 feet (427 meters) near the Chacahoula dome. Depth to the base of fresh water is approximately 250 feet (76 meters) below ground surface at the site. The depth to salt in the site area is approximately 1,100 feet (335 meters) below ground surface, and the top of the caprock is at a depth of about 875 feet (267 meters) at its highest point (DOE 1978b). The cavern system will be hundreds of feet below the base of the fresh water aquifer.

> An **aquifer** is a body of rock or soil that is capable of transmitting groundwater and yielding usable quantities of water to wells or springs.

According to the Louisiana Department of Transportation and Development water well registry, several groundwater wells are located in the vicinity of the Chacahoula site (LADOTD 2005). The identified wells are primarily screened (i.e., draw water from) within an interval that is between 150 and 200 feet (46 and 61 meters) below the ground surface, and consist almost exclusively of oil rig supply and industrial-use wells. Depth to groundwater at these wells is generally less than 10 feet (3 meters) below the ground surface, with reported well yields up to 3.34 cubic feet per second (0.0946 cubic meters per second). The general groundwater flow direction at the Chacahoula site is expected to be to the south. These wells are screened hundreds of feet above the proposed storage depth. Also, they are protected from surface and near surface discharges by the upper low-permeability layer.

Water use in Lafourche Parish, where the Chacahoula site is located, would be dominated by surface water sources, and groundwater use represents an average of about 2 percent of the total water usage, and is primarily associated with industrial and livestock usage.  Groundwater is not used for public water supplies in Lafourche Parish (Whelan 2006; EPA 2006a).

##### *3.6.4.2.2 Chacahoula Groundwater:  Construction Impacts*

All of the general groundwater-related impacts discussed in section 3.6.2.2 are applicable to the proposed Chacahoula site.  However, the likelihood of impacts to groundwater at Chacahoula would be further minimized because of the presence of a 100-foot (30-meter) clay confining layer above the aquifer layer at the site (DOE 1978b).  This clay layer would impede any infiltration of spills to the aquifer.  This alternative would not use groundwater or discharge through underground injection wells to the groundwater.  There would be no significant impact to groundwater.

##### *3.6.4.2.3 Chacahoula Groundwater:  Operations and Maintenance Impacts*

The evaluation of potential impacts from construction of the proposed Chacahoula project above would also apply to the operations and maintenance impacts.

### 3.6.5 Clovelly Storage Site

Development and operations at the Clovelly site would include the following activities:

- Construction and operation of storage caverns and associated infrastructure;
- Expansion and operation of an existing RWI structure in an unnamed canal at the site.  Expansion would include four additional freshwater intake pumps, six additional injection pumps, and raw water pipeline/cavern headers to each cavern;
- Operation of an existing brine disposal pipeline, brine pond, and brine diffuser discharge system in the Gulf of Mexico (adding three new brine disposal pumps); and
- Operation of an existing oil distribution system (adding four new oil injection pumps).

The following sections describe the potentially affected water resources and potential impacts specific to the Clovelly storage site and associated infrastructure.  The common impacts described in section 3.6.2 also apply to the Clovelly site.

#### 3.6.5.1 Clovelly Surface Water

##### *3.6.5.1.1 Clovelly Surface Water:  Affected Environment*

The Clovelly Salt Dome is located in tidally influenced marsh/swamplands within the Barataria drainage basin of Louisiana (USGS 2005a).  The entire system drains generally to the south, towards Barataria Bay and the Gulf.  The proposed Clovelly cavern site is approximately 320 acres (130 hectares) in size and is mostly covered by unnamed drainages and canals, marshlands, and manmade uplands.  West Fork Bayou is located 0.7 miles (1.1 kilometers) to the southwest and is likely the primary drainage for the site.

##### *3.6.5.1.2 Clovelly Surface Water:  Construction Impacts*

Figure 3.6.5-1 is a map showing the site location and some of the nearby surface water bodies.
Water bodies that could be affected by the proposed action are listed below in table 3.6.5-1.

**Table 3.6.5-1: Potentially Impacted Surface Waters, Clovelly**

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| **Cavern site** | | |
| Unnamed drainages and canals through marsh | N/A | N/A |
| West Fork, Bayou L'Ours | N/A | N/A |
| **RWI (only flow increase, no new pipeline)** | | |
| Unnamed canal onsite | N/A | N/A |
| **Brine disposal pipeline (increase rate, no new pipeline)** | | |
| Gulf of Mexico | Open water | N/A |

Notes:
[a] State Designations are uses designated by the state. None were published for these water bodies
N/A = not available
Source: LDEQ 2005

Because existing infrastructure for pipelines and brine discharge would be used, construction impacts would be limited to those associated with cavern development and the RWI. Because the site is located within a surface water body (flooded marshlands) some dredging would be required. Dredging impacts, including bottom disturbance and suspension of sediment, would be short lived during the construction phase. This candidate alternative would result in some filling of flooded marshland to create the storage site and its associated infrastructure. Best management practices and compliance with the Section 404/401 permit would be strictly followed. Compensation would be implemented in accordance with the permit for the impacts to waters, see Appendix B.

The potential effects of discharging brine through diffusers into the Gulf of Mexico are discussed in section 3.6.2.1.2. The impacts were modeled based on monitoring data at operating SPR brine diffuser sites in the Gulf of Mexico, and the impacts from Clovelly discharge would be very localized.

Raw water demand for the Clovelly site would be up to 1.2 MMBD during drawdown and 500 MBD during leaching. Raw water would be obtained from an unnamed canal on the LOOP property. This unnamed canal is connected to and part of a complex network of canals, both manmade and natural, which interlace the proposed Clovelly site, as well as the wetlands in the vicinity and throughout the region. The unnamed canal from which raw water would be withdrawn is part of 180 acres (72 hectares) of open water within the proposed Clovelly site, and connects directly to Bayou L’Ours, which in turn connects via various canals and wetlands to Brusle Lake, Bay L’Ours, and ultimately Three Bayou Bay and Barataria Bay (USGS 2005a). The site is located on the western edge of the Barataria Drainage Basin, an immense wetland system containing over 950 square miles (2,500 square kilometers) of wetlands, draining generally to the south toward Barataria Bay (USGS 2005a).

The reservoir of water available to the site is immense and highly complex. During raw water withdrawal, the unnamed canal from which water would be withdrawn would be replenished by water from the network of canals and large open water bodies to which it is connected. The area is tidally influenced and the water withdrawn would be replenished by tidal flushing.

Models of the impacts of raw water withdrawal on much smaller and more simple water systems (for an example of the discussion of RWI impacts on the ICW, see section 3.6.2.1.1, and of RWI-related impacts at Bayou Choctaw, see section 3.6.9.1.2) demonstrate that changes in water depths, flow velocities, and salinities associated with raw water withdrawal would be minimal, and constitute insignificant impacts on the affected water bodies. Given the immense reservoir and large, interconnected web of water bodies that would replenish the Clovelly RWI site, the impacts of raw water withdrawal at this site would be minimal.

The extent of 100-year and 500-year floodplain in the project area were determined based on the FEMA flood insurance rate maps covering the project area. The potential impacts to floodplains are discussed in section 3.6.1.2.1 and in appendix B. The Clovelly storage site is located in a predominantly developed area associated with the existing LOOP Clovelly Dome Storage Terminal. The Clovelly storage site would intersect one floodplain associated with the marsh the existing facility is located within. Table 3.6.5-2 provides a summary of the floodplains located within the proposed storage site.

**Table 3.6.5-2: Total Area of Floodplains Affected by the Clovelly Project**

| Clovelly Storage Site | | |
|---|---|---|
| **Floodplain** | **Area (acres)** | **Area (hectares)[a]** |
| 100-year | 21 | 9 |
| 500-year | N/A | N/A |
| **Total** | **17** | **9** |

Notes:
[a] Numbers have been rounded to two significant figures
N/A = not available

This site would use existing infrastructure where practicable to minimize floodplain impacts.

##### *3.6.5.1.3 Clovelly Surface Water: Operations and Maintenance Impacts*

As with impacts from construction operations at the proposed Clovelly site, potential impacts from operations and maintenance activities may be increased due to the location within a surface water body. Any discharges during operations at the site, particularly from either leaking brine or oil pipelines, could enter directly into the surface water system, and result in negative impacts. Surface water in this tidally influenced area would have varying levels of salinity, and is not suitable for potable use. The best management practices outlined in section 3.6.2 would be followed to minimize the likelihood of a discharge of significant magnitude.

#### 3.6.5.2 Clovelly Groundwater

##### *3.6.5.2.1 Clovelly Groundwater: Affected Environment*

The Clovelly salt dome area is underlain by the confined Mississippi River Alluvial Aquifer. A relatively impermeable clay/silt layer of varying thickness overlies the aquifer system, which consists of **alluvial** deposits that consist of fining upwards sequences of gravel, sand, silt and clay (USGS 2006a; LDEQ 1996).

The Clovelly site is located within tidally influenced marsh/swamplands and therefore groundwater depth is at or close to the ground surface. There are very few freshwater aquifers in the southern half of the Barataria Basin, including the vicinity of the Clovelly site (Tomaszewski 2005). Limited fresh water resources are present in localized point bar deposits, but the aquifer consists primarily of saline water.

According to the Louisiana Department of Transportation and Development's water well registry, no groundwater wells are located within a 3-mile (5-kilometer) radius of the Clovelly site (LADOTD 2005). The registry indicates that there are several groundwater wells located farther than 3 miles (5 kilometers) to the northwest, west, and south of the Clovelly site, primarily along the Route 1 corridor. These identified wells are primarily screened about 150 to 300 feet (46 to 91 meter) below ground surface, and consist primarily of irrigation, rig supply, and industrial-use wells. Groundwater depths reported for these wells are generally less than 10 feet (3.0 meters) below the ground surface with reported well yields up to 0.45 cubic feet per second (0.013 cubic meters per second). Well yields in the Chacahoula project area, located approximately 50 miles (80 kilometers) to the northwest of Clovelly, and in the same aquifer, have been reported to be greater than 11 cubic feet per second (0.31 cubic meters per second). Hydraulic conductivities of the Mississippi River Alluvial Aquifer reportedly range from 10 to 530 feet per day (3.0 to 160 meters per day). Groundwater flow direction data are not available for the Clovelly site. However, based on topography and nearby water bodies, the general groundwater flow direction is expected to be to the south toward the Gulf of Mexico.

Water use in Lafourche Parish, where the Clovelly site is located, is dominated by surface water sources. Groundwater supplies an average of about 2 percent of the total water usage, and is primarily associated with industrial and livestock usage. This is confirmed by the data in the Louisiana Department of Transportation and Development water well registry, as discussed above. Groundwater is not used for public water supplies in Lafourche Parish (USGS 2006a; LDEQ 1996).

##### *3.6.5.2.2 Clovelly Groundwater: Construction Impacts*

The Clovelly site is mostly flooded, tidally influenced marshlands. Its shallow groundwater cannot be used as a potable source, and any discharge to groundwater would have little impact on water use in the area. Additionally, construction at Clovelly would be limited to the new storage caverns and wells for the solution mining process because other infrastructure is already in place.

##### *3.6.5.2.3 Clovelly Groundwater: Operations and Maintenance Impacts*

Potential impacts to surface water during operation and maintenance would be similar to those described above for the construction phase.

### 3.6.6 Clovelly-Bruinsburg Storage Sites

The Clovelly-Bruinsburg proposed alternative would include development of 80 MMB capacity of caverns at Bruinsburg and 80 MMB or 90 MMB capacity at Clovelly. The only difference between the Clovelly 80 MMB-Bruinsburg (160 MMB total storage) alternative and the Clovelly 90 MMB-Bruinsburg (170 MMB total storage) alternative is that the RWI withdrawal and brine discharge would occur over a slightly longer timeframe during storage cavern construction.

The development and operation of the proposed Clovelly-Bruinsburg project would involve the same elements as the individually proposed Bruinsburg and Clovelly projects described previously, except that the cavern capacities would be 80 MMB at Bruinsburg or 80 MMB or 90 MMB at Clovelly (compared to 160 MMB for the Bruinsburg alternative and 120 MMB for the Clovelly alternative). This would result in the following differences:

- Reduction in the anticipated brine flow rates to the brine disposal wells at Bruinsburg and the offshore brine diffuser for Clovelly;
- Decrease in the amount of raw water required at each of the sites (smaller RWI structure constructed at Bruinsburg);
- Decrease in the footprint of each of the cavern sites (12 new caverns at Clovelly and eight new caverns at Bruinsburg);

- Omission of the Peetsville and Anchorage crude oil pipelines from Bruinsburg;
- Construction and operation of two crude oil pipelines from Bruinsburg—one to Jackson, and one to the Vicksburg Entergy facility; and
- Construction and operation of a bulk storage facility in Jackson, which includes a storage terminal tank farm.

#### 3.6.6.1 Clovelly-Bruinsburg Surface Water

##### *3.6.6.1.1 Clovelly-Bruinsburg Surface Water: Affected Environment*

The affected environment would be the same as the separate alternatives, with the exception that the Peetsville and Anchorage pipelines would be replaced by the Jackson and Vicksburg pipelines.

##### *3.6.6.1.2 Clovelly-Bruinsburg Surface Water: Construction Impacts*

Impacts to surface water from construction activities would be similar to those discussed for the separate Clovelly and Bruinsburg alternatives. The differences are discussed below, and the potentially affected surface waters are listed in table 3.6.6-1. See figure 3.6.6-1.

**Table 3.6.6-1: Potentially Impacted Surface Waters, Clovelly-Bruinsburg**

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| **Crude Oil Pipelines to Vicksburg and Jackson** | | |
| Bayou Pierre | Stream through agricultural area, tributary to the Mississippi River; perennial | • Recreation<br>• Critical habitat for the Bayou Darter, which is a threatened species in Bayou Pierre due to sediment/silt<br>• Impaired use for aquatic life support and primary and secondary recreational contact |
| Big Black River | Major river; primary drainage for area; perennial | • Fish and wildlife<br>• Impaired use for aquatic life support<br>• Types of impairment: nutrients, low DO, pesticides, and sediment/siltation |
| Fourteen Mile Creek | Upland creek; perennial | • Fish and wildlife<br>• Impaired use for aquatic life support<br>• Types of impairment: nutrients, low DO, pesticides, sediment/siltation, and biological impairment |
| Bakers Creek | Upland creek; perennial | • Fish and wildlife<br>• Impaired use for aquatic life support<br>• Types of impairment: nutrients, low DO, and pathogens |
| Turkey Creek | Upland creek; perennial | • Impaired use for aquatic life support and secondary recreational contact<br>• Types of impairment: pathogens (for recreational contact), pH, nutrients, low DO, suspended solids (for aquatic life support) |
| Willis Creek | Upland creek; perennial | • Impaired use for aquatic life support<br>• Type of impairment: nutrients, low DO, pesticides, sedimentation/ siltation |

**Table 3.6.6-1: Potentially Impacted Surface Waters, Clovelly-Bruinsburg**

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| James Creek | Upland creek; perennial | • Impaired use for aquatic life support and secondary recreational contact<br>• Types of impairment: pathogens (for recreational contact), nutrients, low DO, pesticides, sedimentation/ siltation (for aquatic life support) |
| Price Creek | Upland creek; perennial | N/A |
| Markham Creek | Upland creek; perennial | N/A |
| Hamer Bayou | Upland creek; perennial | • Impaired use for aquatic life support<br>• Type of impairment: nutrients, pesticides, sedimentation/ siltation |
| Snake Creek | Upland creek; perennial | • Impaired use for aquatic life support<br>• Type of impairment: nutrients, low DO |
| Hennesseys Bayou | Upland creek; perennial | N/A |
| Paces Bayou | Upland creek; perennial | N/A |
| Coon Island Lake | Lake; perennial | N/A |

Notes:

[a] All of the waters in the Mississippi Department of Environmental Quality's basin approach are classified as Fish and Wildlife. Basin waters carrying other classifications are noted accordingly (MDEQ 2006a).

DO = dissolved oxygen; N/A = not available

Source: MDEQ 2005

DOE determined that withdrawal of raw water from the Mississippi River for the Bruinsburg 160 MMB alternative would represent less than 0.003 percent of the total river flow, and would have no appreciable impacts. The Clovelly-Bruinsburg option would also have no appreciable impacts.

The potential effects of discharging brine from the Clovelly site to the Gulf of Mexico was evaluated based on the 120 MMB alternative and found to be localized. The 80 MMB or 90 MMB alternative would produce a lower volume of brine and would result in a shorter duration of impact.

The footprint of the 80 MMB and 90 MMB Clovelly site would be the same and would be slightly smaller than the 120 MMB alternative, but the impacts to floodplains and wetlands would be roughly commensurate.

The reservoir of raw water from the source at the LOOP property was deemed sufficient to supply a raw water source for the 120 MMB Clovelly option without resulting in significant impacts to the water body. This would also be true for the 80 MMB or 90 MMB Clovelly site.

The potential impacts to floodplains associated with the proposed Clovelly-Bruinsburg project are discussed in section 3.6.2.1.8 and in appendix B. The total area of floodplains that would be affected by the Bruinsburg proposed project is listed in table 3.6.6-2. The area for the Clovelly portion is discussed in section 3.6.5.1.2. As discussed, impacts associated with pipelines would be limited to the construction phase.

**Table 3.6.6-2: Total Area of Floodplains Affected by Proposed Bruinsburg 80 MMB Project**

| Bruinsburg 80 MMB Storage Site | | |
|---|---|---|
| **Floodplain** | **Area (acres)[a]** | **Area (hectares)[a]** |
| 100-year | 101 | 41 |
| 500-year | 21 | 9 |
| **Total[b]** | **120** | **50** |

Notes:

[a] Numbers have been rounded to two significant figures
[b] Numbers may not equal total due to rounding

#### *3.6.6.1.3 Clovelly-Bruinsburg Surface Water: Operations and Maintenance Impacts*

Impacts from operations and maintenance to surface water are similar to those described above for construction and for the separate alternatives.

### 3.6.6.2 Clovelly-Bruinsburg Groundwater

The affected groundwater environment is similar to that described for the separate alternatives.

#### *3.6.6.2.1 Clovelly-Bruinsburg Groundwater: Construction Impacts*

The number of brine injection wells at Bruinsburg would be reduced from 60 to 30 for this 80 MMB alternative. Testing and modeling have not yet been carried out to determine the capacity of the proposed injection formations to accept injected brine. The total disposal capacity of these formations and the pressure buildup that would likely occur because of brine injection are not yet known. DOE determined that based on an available well-log study it would be likely that the Sparta formation alone would not have adequate capacity to handle the proposed brine injection volumes and rates for the 160 MMB alternative, necessitating development of injection wells in both the Sparta and Wilcox formations. Log study indicates that the Wilcox formation varies in thickness and permeability. Given the likely nonhomogeneity of the proposed injection formations over the length of the disposal corridor, additional testing would be required to assess the capacity of these formations for receiving injected brine at the rates, even for the 80 MMB alternative.

However, regardless of the capacity of the formations to receive the brine, the available well-log data indicate that injection of brine into the Sparta and Wilcox formations would not adversely impact the drinking water source aquifer in the area. The 300- to 500-feet (91- to 150-meter) thick Yazoo Clay formation between the top of the Sparta and the bottom of the drinking water source aquifer would serve as a highly effective barrier and prevent the migration of brine upward into the drinking water source aquifer. Because of the elastic properties of clay formations, this barrier would be expected to withstand very high hydraulic pressures without fracturing or allowing the upward movement of brine. The only avenue by which injected brine could potentially penetrate upward into the drinking water source aquifer would be via any abandoned wells in the proposed injection area. Any such wells could be located and sealed, thereby eliminating the risk that brine could pass through them.

The injection well would be properly constructed to prevent groundwater migration from the lower injection zone to the upper aquifer zones. DOE would also obtain an underground injection permit, which will require specific well testing and measures to protect groundwater resources.

Mitigation: A groundwater monitoring program would be implemented at the site to ensure protection of groundwater quality.

##### *3.6.6.2.2 Clovelly-Bruinsburg Groundwater: Operations and Maintenance Impacts*

Impacts to groundwater from operations and maintenance for the Clovelly-Bruinsburg alternative would be similar to those for the two separate alternatives. The discussion of impacts on groundwater from brine injection for the 80—MMB alternative discussed above would also apply to the operational phase.

### 3.6.7 Richton Storage Site

Construction and operation of the proposed SPR site at Richton would involve the following activities:

- Construction and operation of 16 storage caverns with a combined capacity of 160 MMB and associated facilities including a wastewater treatment plant and access road;
- Construction and operation of a raw water pipeline and intake structure on the Leaf River;
- Installation of a utility line from the substation at the RWI to the new power lines providing electricity to the main site and construction of a new, wide, gravel access road along the pipeline ROW from Old Augusta Road to the RWI;
- Construction and operation of two dual purpose oil/brine pipelines to Pascagoula and brine diffuser discharge system in the Gulf of Mexico;
- Construction of a bulk oil storage marine terminal at Pascagoula, which includes modifications to barge dock, storage tanks, utilities (following new and existing roads to sites), and associated support facilities; and
- Construction and operation of pipeline to Liberty and bulk storage terminal in Liberty, which includes construction of storage tanks, utilities (following new and existing roads to sites), associated support facilities, and a mid-station pump station along the crude oil pipeline to Liberty.

The following sections describe the potentially affected water resources and potential impacts specific to the Richton storage site and associated infrastructure. The common impacts described in section 3.6.2 also apply to the Richton site.

#### 3.6.7.1 Richton Surface Water

##### *3.6.7.1.1 Richton Surface Water: Affected Environment*

The Richton site would be located within the Thompson's Creek drainage sub-basin of the Leaf River drainage basin and within the Mississippi portion of the Gulf Coastal Plain Province. The cavern site is in an uplands area, at about 250 feet (76 meters) above sea level elevation, and the majority of surface waters affected would be uplands and fresh water systems. Water may become increasing brackish in the coastal, marshy areas as the brine disposal pipeline approaches the Gulf of Mexico.

#### *3.6.7.1.2 Richton Surface Water: Construction Impacts*

The common impacts described in section 3.6.2.1 are applicable to the Richton site. Primary surface water bodies that could potentially be affected by development of the Richton site are listed in table 3.6.7-1 and shown in figures 3.6.7-1 and 3.6.7-2.

Since the Richton SPR site and most of the pipelines would be located outside the coastal area, any of the impacts to surface water would impact fresh water systems, rather than brackish systems. The majority of the water bodies that would be crossed by pipelines are listed by the State as impaired due to runoff issues, including sediment/siltation, low-oxygen levels and elevated nutrient levels.

DOE would use directional drilling techniques to minimize impacts of laying pipeline across rivers at some of the larger rivers. Some of the rivers where this method could be employed include Thompson Creek, Chickasawhay River, Bogue Homo, Leaf River, Pearl River, and Bogue Chitto River.

The potential effects of discharging brine through diffusers into the Gulf of Mexico are discussed in section 3.6.2.1.1. The impacts were modeled on monitoring data at operating SPR brine diffuser sites in the Gulf of Mexico, and the impacts from Richton discharge would be very localized. The plume of increased salinity would extend into the Pascagoula Ship Channel. Under typical conditions, the resultant salinity would only be elevated by 1 part per thousand in the channel. Under low current velocity conditions, salinity could be elevated by 4 parts per thousand in the ship channel. It is possible that elevated salinity water could accumulate at the bottom of the dredged channel under certain conditions.

Raw water demand for the Richton site would be 1.2 MMBD (at 42 gallons per barrel, equivalent to 78 cubic feet per second [50,409,000 gallons per day] or 2.2 cubic meters per second) during drawdown, and 1.2 MMBD during leaching. The RWI structure for Richton would be located along the north bank of the Leaf River approximately 450 feet (140 meters) downstream of the confluence with the Bogue Homo, and approximately 4 miles (6.4 kilometers) east of New Augusta. The RWI point is well upstream of the fall line, and the water is fresh.

The flow rate of the Leaf River at this point is highly variable. From December 1983 to September 1991, discharge of the river at New Augusta ranged from 590 to 74,000 cubic feet per second (17 to 2,100 cubic meters per second). Average discharge for the period was 4,100 cubic feet per second (120 cubic meters per second), average annual minimum and maximum discharges were 720 cubic feet per second (20 cubic meters per second), and 30,100 cubic feet per second (850 cubic meters per second), respectively (DOI 1980).

Mississippi regulations establish the minimum instream flow at which water withdrawal is permitted from state waters. This minimum threshold is set at the $7Q_{10}$ flow rate (the 7-day, 10-year low flow rate). Only flow in excess of the $7Q_{10}$ can be withdrawn. Based on flow data for the period 1939–1991 from stream gauges upstream of the proposed RWI site, MDEQ has estimated a $7Q_{10}$ for the Leaf River at New Augusta of 503 cubic feet per second (14 cubic meters per second). Thus, the river flow rate would have to be at least 581 cubic feet per second (16 cubic meters per second) to allow withdrawal at the full demand rate of 78 cubic feet per second (2.2 cubic meters per second). Over the 52-year period investigated by MDEQ, there were 160 days in which the Leaf River flow rate fell below the $7Q_{10}$. Overall, MDEQ results indicate that flow in the river would be sufficient to meet the raw water demand of the Richton site 99 percent of the time, although there could be dry years during which the river flow would be below the $7Q_{10\ flow}$ rate for as much as 15 percent of the time (MDEQ 1992). Cavern development, when the maximum amount of raw water would be required, would take up to 5 years. Based on the 52-year record, it is unlikely that a sustained period of low water would occur during cavern

**Table 3.6.7-1: Potentially Affected Surface Waters, Richton**

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| **Cavern Site** | | |
| Drains to Harper Branch to west | Upland channel; perennial | N/A |
| Fox Branch to north | Upland channel; perennial | N/A |
| Pine Branch to south | Upland channel; perennial | N/A |
| **RWI (south to the Leaf River)** | | |
| Leaf River (pipeline crosses river and RWI in river) | Upland channel; perennial; New Augusta (closest gauge to site) $7Q_{10}$ is 497 cfs and downstream at Mclain $7Q_{10}$ is 598 cfs | N/A |
| Bogue Homo | Upland channel; perennial | N/A |
| Merritt Springs Branch | Upland channel; perennial | N/A |
| Mill Creek | Upland channel; perennial | • Impaired use for aquatic life support<br>• Types of impairment: biological impairment, nutrients, low DO/organic enrichment, pesticides, salinity, and sedimentation/siltation |
| **Crude Oil Pipeline to Liberty** | | |
| Lotts Creek | Upland stream; perennial | N/A |
| Bogue Homo | Upland channel; perennial | N/A |
| Gardner Creek | Upland channel; perennial | N/A |
| Collins Creek | Upland channel; intermittent | • Impaired use for aquatic life support<br>• Types of impairment: nutrients, low DO, pesticides, and sediment/siltation |
| Silver Creek | Upland channel; perennial | • Impaired use for aquatic life support and secondary recreational contact<br>• Types of impairment: biological impairment, pathogens, nutrients, low DO, pesticides, and sediment/siltation |
| Upper Little Creek | Upland channel; perennial | • Impaired use for aquatic life support and secondary recreational contact<br>• Types of impairment: biological impairment, nutrients, low DO, pesticides, pathogens, and sediment/siltation |
| Gully Creek | Upland channel; perennial | N/A |
| Boggy Prong | Channel through marsh; Intermittent | N/A |
| Graves Creek | Upland channel; perennial | N/A |
| Tallahala Creek | Upland channel; perennial; 2004 peak stream flow of 337 cfs | • Impaired use for aquatic life support and secondary recreational contact<br>• Types of impairment: suspended solids, unionized ammonia, metals, pH, bio impairment, nutrients, low DO, pathogens, pesticides, and sediment/siltation |
| Burleman Branch | Upland channel; intermittent | N/A |
| Reese Creek | Upland channel; perennial | N/A |
| Rice Patch branch | Intermittent | N/A |

## Table 3.6.7-1: Potentially Affected Surface Waters, Richton

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| Jakes Creek | Intermittent | N/A |
| Little Black Creek | Intermittent | • Impaired use for aquatic life support and secondary recreational contact<br>• Types of impairment: bio impairment, nutrients, low DO, pesticides, pathogens, and sediment/siltation |
| Parkers Creek | Perennial | N/A |
| Black Creek | Perennial; 2004 peak stream flow of 1,516 cfs | • Recreation;<br>• Impaired use for aquatic life support and primary and secondary recreational contact<br>• Types of impairment: nutrients, low DO pesticides, pathogens, and sediment/siltation |
| Perkins Creek | Perennial | N/A |
| Burketts Creek | Perennial | N/A |
| Sandy Run | Perennial | N/A |
| Love Creek | Upland channel; perennial | N/A |
| Lake Serene | Lake; perennial | N/A |
| Tangipahoa River | Upland channel; perennial; 2003 peak stream flow of 300 cfs | • Impaired use for aquatic life support and primary and secondary recreational contact<br>• Types of impairment: metals, pH, biological impairment, nutrients, low DO, pesticides, pathogens, and sediment/siltation |
| Minnehaha Creek | Upland channel; intermittent | • Impaired use for secondary recreational contact<br>• Type of impairment: pathogens |
| Hominy Creek | Upland channel; perennial | N/A |
| Martin Creek | Upland channel; intermittent | N/A |
| Little Tangipahoa River | Upland channel; perennial | • Impaired use for aquatic life support and secondary recreational contact<br>• Types of impairment: bio impairment, nutrients, low DO, pesticides, pathogens, sediment/siltation, and unknown toxicity |
| Bars Branch | Upland channel; perennial | • Impaired use for aquatic life support<br>• Type of impairment: unknown |
| Magees Creek | Upland channel; perennial | • Recreation<br>• Impaired use for aquatic life support and primary recreational contact<br>• Type of impairment: nutrients, pesticides, and sediment/siltation |
| Dry Creek | Upland channel; perennial | • Impaired use for aquatic life support and primary and secondary recreational contact<br>• Type of impairment: biological impairment, pathogens, nutrients, low DO, pesticides, and sediment/siltation |

**Table 3.6.7-1: Potentially Affected Surface Waters, Richton**

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| Leaf River | Upland river; perennial; annual average streamflow is 2,600 cfs | • Impaired use for aquatic life support and primary and secondary recreational contact<br>• Type of impairment: nutrients, pathogens, pesticides, and sediment/siltation |
| Black Creek | Upland river; perennial | • Wild and scenic river<br>• Recreation<br>• Impaired use for aquatic life support and primary and secondary recreational contact<br>• Type of impairment: pathogens, nutrients, low DO, biological impairment, pesticides, sediment/siltation, suspended solids, thermal modifications, and turbidity |
| Pearl River | Upland river, primary drainage for area (drainage area at Columbia is 5,720 square miles); perennial; annual average flow is 8,000 to 10,000 cfs | • Recreation<br>• Impaired use for aquatic life support, primary and secondary recreational contact, and fish consumption<br>• Types of impairment: mercury, pathogens, nutrients, low DO, biological impairment, pesticides, pH, sediment/siltation, and suspended solids |
| Bogue Chitto River | Upland channel, primary drainage for area (drainage area near Tylertown is 492 square miles); Perennial; average annual flow is 500 to 1,000 cfs | • Impaired use for aquatic life support and primary and secondary recreational contact<br>• Types of impairment: biological impairment, low DO, pH, nutrients, pesticides, sediment/siltation, mercury, pathogens, and metals |
| East Fork Amite River | Upland channel; intermittent | • Impaired use for aquatic life support and primary recreational contact<br>• Types of impairment: biological impairment, low DO, pH, nutrients, pesticides, sediment/siltation, and pathogens |
| **Dual-purpose Pipeline to Pascagoula** | | |
| Thompson Creek | Upland channel; perennial | • Impaired use for aquatic life support<br>• Types of impairment: biological impairment, nutrients, low DO/organic enrichment, pesticides, salinity, and sedimentation/siltation |
| Big Island Branch | Upland channel; perennial | N/A |
| Gaines Creek | Upland channel; perennial | • Impaired use for aquatic life support<br>• Type of impairment: sediment/siltation |
| Atkinson Creek | Upland channel; perennial | N/A |

**Table 3.6.7-1: Potentially Affected Surface Waters, Richton**

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| Chickasawhay River | Upland channel; perennial | • Recreation<br>• Impaired use for aquatic life support and primary and secondary recreational contact<br>• Types of impairment: biological impairment, nutrients, sediment/siltation, pesticides, pathogens, suspended solids, pH, and salinity |
| Several small creeks | N/A | N/A |
| Big Creek | Upland channel; perennial | N/A |
| Escatawpa River | Upland channel; perennial; average annual flow is 750 to 1,000 cfs | • Fish and Wildlife with a DO requirement (>3.0 mg/L) |
| Black Creek | Upland river; perennial | • Recreation<br>• Impaired use for aquatic life support and primary and secondary recreational contact<br>• Types of impairment: pathogens, nutrients, low DO, biological impairment, pesticides, sediment/siltation, suspended solids, thermal modifications, and turbidity |
| Mill Creek | Upland channel; Perennial | • Impaired use for aquatic life support<br>• Types of impairment: biological impairment, nutrients, low DO/organic enrichment, pesticides, salinity, and sedimentation/siltation |
| Crane Creek | Channel; perennial | • Impaired use for aquatic life support<br>• Types of impairment: nutrients, pesticides, sediment/siltation |
| White Creek | Channel; perennial | N/A |
| Indian Creek | Channel; perennial | • Impaired use for aquatic life support<br>• Types of impairment: biological impairment, nutrients, low DO, pesticides, and other habitat alterations |
| Big Cedar Creek | Channel; perennial | N/A |
| Big Oktibee Creek | Channel; perennial | N/A |
| Waterhole Branch | Channel; perennial | N/A |
| Holy Creek | Channel; perennial | N/A |
| McSwain Branch | Channel; perennial | N/A |
| Courthouse Creek | Channel; perennial | N/A |
| Wilson Lake | Lake; perennial | N/A |

Notes:

[a] All of the waters in the Mississippi Department of Environmental Quality's basin approach are classified as Fish and Wildlife. Basin waters carrying other classifications are noted accordingly (MDEQ 2006a).

cfs = cubic feet per second (1 cfs = 0.03 cubic meters per second); DO = dissolved oxygen; $7Q_{10}$ = 7-day, 10-year low flow rate; N/A = not available;

Source: MDEQ 2005

development. However, if a drought occurred during the solution mining process, the withdrawal may have an adverse affect on the Leaf River.

There are three NPDES permits on record permitting discharge into the Leaf River in the area of the Richton RWI structure. These three sources are permitted to discharge a total of 50,000 gallons per day (0.071 cubic feet or 0.002 cubic meters per second) (EPA 2006c). Reduction in the Leaf River flow associated with raw water withdrawal by the Richton SPR site would reduce the capacity of the river to assimilate wastes. This could result in higher concentrations of wastes in the river water column for waste streams that enter the river immediately downstream of the RWI station. The potential impacts to these discharges would also be considered during the permitting process for the RWI.

According to a permit database search conducted by the Mississippi DEQ, Mississippi has issued five current surface water withdrawal permits for the Leaf River. The permitted withdrawal amounts range from 0.0014 cubic feet per second ($3.9x10^{-5}$ cubic meters per second) for livestock usage to 178 cubic feet per second (5.05 cubic meters per second) for industrial use. The total amount of Leaf River water withdrawal currently permitted is approximately 221 cubic feet per second (6.3 cubic meters per second) (Crawford 2006). Additional parties withdraw small amounts of water from the Leaf River, but are not required to obtain withdrawal permits, so there are no data available on these withdrawals (MDEQ 2006c).

The largest user of Leaf River water is the Eaton Plant of the Mississippi Power Company in Petal, MS. This plant is approximately 25 miles upstream of the Richton site. Its permit allows up to 178 cubic feet per second (5.05 cubic meters per second) to be withdrawn from the Leaf River. According to periodic NPDES permit (MS0002917) monitoring, however, the facility returns most or all of the withdrawn water to the river because it is used for cooling purposes. The next largest user of Leaf River water is Leaf River Cellulose, a pulp and paper mill in Richton. Its permit allows for up to 40.23 cubic feet per second (1.14 cubic meters per second) (Crawford 2006). Leaf River Cellulose holds a NPDES permit (MS0031704, as Georgia Pacific) and, like the Mississippi Power Company, most or all of this water is used for cooling purposes and is recycled back into the river.

Withdrawal of water from the Leaf River for the Richton site would have minimal impacts on the river while it is flowing near or above its average flow rate of 4,100 cubic feet per second (116 cubic meters per second). At such times, raw water withdrawal would constitute less than 2 percent of river flow. However, the river flow can be expected to fall to near or below its average annual minimum discharge rate of 720 cubic feet per second (20 cubic meters per second) at some point every year. At this average annual minimum flow rate, water demand for the Richton site would constitute 11 percent of river flow. Although the probability is relatively low, the possibility exists that the river flow rate could drop to or below the minimum flow rate of 581 cubic feet per second (16 cubic meters per second) that would be required to meet the water demands for cavern development and maintain the minimum flow rate of 503 cubic feet per second (14 cubic meters per second) under the state $7Q_{10}$ regulation. In such a case, water demand for the Richton site would constitute nearly 14 percent of the river's flow. Therefore, reduction in river flow by 11 percent during average annual low-flow periods and by up to 14 percent during particularly dry periods would potentially occur in the Leaf River.

If the Richton SPR site would continue to withdraw water at its full maximum leaching or drawdown rate at times when the Leaf River flow falls below the $7Q_{10}$ minimum withdrawal level, withdrawal would exceed 14 percent of the river flow rate. This would lead to the withdrawal of a significant portion of the river flow during drought periods.

If this candidate site is selected, DOE would apply for a Permit to Withdraw for Beneficial Uses from the Public Waters of Mississippi and coordinate with the Mississippi Office of Land and Water Resources to ensure that minimum instream flows are maintained during the period of withdrawal. The withdrawal would also be coordinated with and permitted by USACE and the USFWS through the Section 404 permit process.

DOE has evaluated potential impacts to floodplains in section 3.6.2.1.8 of appendix B. The extent of 100-year and 500-year floodplains in the Richton project area, including the site and pipelines, was determined based on the FEMA Flood Insurance Rate maps covering the project area. The Richton storage site is located in a predominantly undeveloped area with rolling topography. The proposed storage site is not located within the 100-year or 500-year floodplain, but all 63 acres (25 hectares) of the Pascagoula terminal would be located within the 100-year floodplain. Additionally, some of the pipelines do cross floodplains. However, as previously discussed, impacts associated with pipelines would be limited to the construction phase.

> Mitigation: To ensure adequate flow and assimilative capacity in the Leaf River, DOE would commit to withdrawing only that flow that is in excess of the $7Q_{10}$ minimum level. DOE would secure an agreement with Federal and state regulatory agencies that requires water conservation, supplemental sources, or agreements with upstream users to ensure that adequate instream flow is maintained in the river.

##### *3.6.7.1.3 Richton Surface Water: Operations and Maintenance Impacts*

Potential impacts due to operations and maintenance activities would be similar to those discussed above for construction. The RWI and brine discharge would also be operating occasionally during the operational phase.

#### 3.6.7.2 Richton Groundwater

##### *3.6.7.2.1 Richton Groundwater: Affected Environment*

In the Richton storage site area, the aquifers are in descending order by depth: the Upper Aquifer, Upper Claiborne, and Wilcox. Each of these aquifers is separated by a very low-permeability confining unit. The salt dome has pushed through the aquifers, so that only the Upper Aquifer is above the dome. It begins just below the surface and extends to a depth of 1,100 feet (350 meters), just slightly above the domal caprock. The groundwater table is approximately 10 to 30 feet (3 to 9 meters) below land surface. The aquifer contains abundant freshwater, which grades with depth to moderately saline water to brine near the salt dome (PB-KBB 1991).

The Upper Claiborne aquifer abuts the side of the salt dome structure, and is characterized by a low permeability of 12 inches (320 millimeters) per year and moderately saline water that grades to brine. The base of the freshwater zone is approximately 590 feet (180 meters) below land surface. The Upper Claiborne is 1,500 to 2,000 feet (460 to 620 meters) below land surface and entirely below the base of the fresh-water zone at the site. The virtually confined Wilcox Aquifer, where not pierced by the dome, extends from approximately 1,900 to 5,300 feet (590 to 1,600 meters) below land surface. The Wilcox groundwater is brackish throughout the basin and very saline to brine near the Richton salt dome.

Groundwater flows south or southeast in each aquifer. In the Upper Aquifer, groundwater flows almost directly to the south, following the down dip of the aquifer toward local discharge into the Leaf River and other streams, and eventual discharge into the Gulf of Mexico.

The Upper Aquifer is the only aquifer used within a 6-mile (10-kilometer) radius of the site. Eight wells in this area tap the Upper Aquifer for a variety of uses—municipal, domestic, agricultural, and industrial purposes. The proposed SPR site does not appear to be within the SWPA for the Richton well field (Dunn 2005).

The pipeline to Liberty River would pass through or adjacent to the following groundwater supplies:

- Upgradient of the SWPA for the town of Quinlivan, MS;
- Downgradient of the SWPA at Fernwood, MS;
- Upgradient of the SWPA in Foxworth, MS;
- Downgradient of the SWPA at Columbia, MS;
- Downgradient of the SWPA at Oak Grove, MS;
- Through the SWPA at Pine Grove, MS; and
- Through the SWPA at Tylertown, MS.

The pipeline to Pascagoula would pass through or run adjacent to the following groundwater SWPA:

- Adjacent to the SWPA at Central, MS;
- Adjacent to the SWPA at Helena, MS; and
- Through the SWPA at Pascagoula, MS.

##### *3.6.7.2.2 Richton Groundwater: Construction Impacts*

The potential groundwater impacts associated with construction of the proposed Richton site and infrastructure are as described in the section 3.6.2.2. Although pipelines would be constructed through and adjacent to several groundwater SWPA areas, as described above, the probability of contaminant discharge during pipeline and facility construction is very low. There would be no brine disposal wells at this site, and wells installed to support cavern dissolution at the SPR facility would be grouted and pressure-tested to assure that leaks would not occur.

Four new oil storage tanks would be constructed at each of the Pascagoula and Liberty terminals. Construction of these tanks would not impact groundwater resources. Potential impacts from these types of tanks are discussed in the section 3.6.2.1.5. The tanks would be constructed with berms to avoid discharge and would be integrity-tested on a regular basis. Also, they would be used for buffering capacity, and only filled at specific times during cavern drawdown and filling.

##### *3.6.7.2.3 Richton Groundwater: Operations and Maintenance Impacts*

Potential sources of groundwater contamination include the brine ponds and pipelines, leakage of oil from the storage caverns, and other material spills. Potential impacts of each of these sources associated with the Richton site are comparable to those described above for construction and in section 3.6.2.2.

Discharge during operations and maintenance from the new oil storage tanks at Pascagoula and Liberty is unlikely. These tanks would be used as buffer for capacity, and would only be filled with oil during selected operational events, such as drawdown or cavern filling.

### 3.6.8 Stratton Ridge Storage Site

The Stratton Ridge site would involve the following activities:

- Construction and operation of 16 storage caverns for a combined capacity of 160 MMB and associated facilities including a wastewater treatment plant and access road;

- Construction and operation of a raw water pipeline and an intake structure on the ICW;
- Construction and operation of two brine ponds, a brine disposal pipeline, and brine diffuser discharge system in the Gulf of Mexico, including an offshore section with diffuser; and
- Construction and operation of a pipeline to Texas City, an extension to BP Facility, and a new tank farm in Texas City.

The following sections describe the potentially affected water resources and potential impacts specific to the Stratton Ridge storage site and associated infrastructure. The general impacts described in section 3.6.2 also apply to the Stratton Ridge site.

#### 3.6.8.1 Stratton Ridge Surface Water

##### *3.6.8.1.1 Stratton Ridge Surface Water: Affected Environment*

The westernmost of the candidate new sites, Stratton Ridge would be located approximately 7 miles (11 kilometers) from the Texas shoreline. It is located east of the mouth of the Brazos River in the San Jacinto-Brazos Coastal Basin, within the Austin-Oyster Creek watershed. The site drains into Oyster Creek to the south. Oyster Creek flows through the urban areas of Lake Jackson and Clute, and then southeast through the coastal marshes to the Gulf of Mexico. No perennial streams were observed on the site during an October 2005 site visit. However, there was evidence of temporary water channels during periods with greater amounts of precipitation. One permanent small pond less than 1 acre (0.4-hectares) in size is located in the northwestern corner of the site (Fisher, et al. 1972).

##### *3.6.8.1.2 Stratton Ridge Surface Water: Construction Impacts*

The general impacts to surface water discussed in section 3.6.2.1 are applicable to the proposed Stratton Ridge site. Specific surface water bodies that could be affected by the proposed site are listed in table 3.6.8-1 and primary water bodies are shown in figure 3.6.8-1.

The predominant surface water quality problems in the San Jancinto-Brazos Coastal Basin are elevated fecal coliform bacteria and depressed dissolved oxygen levels (H-GAC 2005). The tidal portion of Oyster Creek has experienced a fish kill in the past due to low-oxygen conditions and has previously been listed on Texas's 303d list for elevated bacteria levels (TCEQ 2004c). Other streams within the coastal basin have elevated levels of nitrogen, phosphorus, metals, volatile organic compounds, and suspended sediments (TCEQ 2004c).

The proposed Stratton Ridge site and associated pipelines would be located in the coastal marshlands of Texas, except where the Texas City oil pipeline would enter the developed area as it approaches the terminal. Except for the ICW, most of the water bodies that would be crossed by pipelines are small. DOE would use directional drilling to lay pipeline below the ICW to minimize impacts during construction.

The Stratton Ridge site would withdraw raw water from the ICW. Impacts associated with this withdrawal are addressed in section 3.6.2.1.1 and would be insignificant.

The potential effects of discharging brine through diffusers into the Gulf of Mexico are discussed in section 3.6.2.1.2. The impacts were modeled based on monitoring data at operating SPR brine diffuser sites in the Gulf of Mexico, and the impacts from Stratton Ridge discharge would be localized.

## Table 3.6.8-1: Potentially Affected Surface Waters, Stratton Ridge

| Water Body Name (and Relevant Segment) | Description | State Uses, Categories[a], and Impaired Segments |
|---|---|---|
| **Cavern Site** | | |
| Oyster Creek (runs along southern property boundary) | Stream through marsh; primary drainage for the area; perennial | • Aquatic life use, contact recreation use, general use, fish consumption use, and public water supply use<br>• Category 5b: aquatic life use not supported in 2004 due to depressed DO |
| Several isolated ponds present within the proposed facility footprint | N/A | N/A |
| **RWI to Intracoastal Waterway** | | |
| Ridge Slough | Channel through marsh; intermittent | N/A |
| Bastrop Bayou | Channel through marsh; intermittent | • Aquatic life use, contact recreation use, general use, and fish consumption use<br>• No category listed: aquatic life, contact recreation, and general uses are fully supported, but the fish consumption use was not assessed |
| Little Slough | Channel through marsh; perennial | N/A |
| Intracoastal Waterway | Major commercial and recreational waterway; USACE maintains navigable depths in the waterway through dredging and locks; perennial | • Used for both recreational boating and for commerce<br>• Primary and secondary contact recreation and propagation of fish and wildlife<br>• Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods |
| Salt Bayou | Channel through marsh; intermittent | N/A |
| Essex Bayou | Channel through marsh; intermittent | N/A |
| **Brine Disposal Pipeline Gulf of Mexico** | | |
| Bastrop Bayou | Channel through marsh; intermittent | • Aquatic life use, contact recreation use, general use, and fish consumption use<br>• No category listed: the aquatic life, contact recreation, and general uses are fully supported, but the fish consumption use was not assessed |
| Little Slough | Channel through marsh; perennial | N/A |
| Ridge Slough | Channel through marsh; intermittent | N/A |
| Intracoastal Waterway | Major commercial and recreational waterway; USACE maintains navigable depths in the waterway through dredging and locks; perennial | • Used for both recreational boating and for commerce<br>• Primary and secondary contact recreation and propagation of fish and wildlife<br>• Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods |
| Salt Bayou | Channel through marsh; intermittent | N/A |
| Essex Bayou | Channel through marsh; intermittent | N/A |

## Table 3.6.8-1: Potentially Affected Surface Waters, Stratton Ridge

| Water Body Name (and Relevant Segment) | Description | State Uses, Categories[a], and Impaired Segments |
|---|---|---|
| **Crude Oil Pipeline to Texas City (Parallel to Existing DOE Pipeline)** | | |
| Halls Bayou | Channel through marsh; perennial | • Aquatic life use, contact recreation use, fish consumption use<br>• Category 5a: contact recreation use not supported in 2004 due to bacteria. |
| Willow Bayou | Channel through marsh; intermittent | N/A |
| Highland Bayou | Channel through marsh; intermittent | • Aquatic life use, contact recreation use, and fish consumption use<br>• Category 5c: contact recreation use not supported and aquatic life use partially supported in 2002 due to bacteria and low dissolved oxygen. Fish consumption use was not assessed in 2002. |
| Austin Bayou | Channel through marsh; intermittent | N/A |
| Chocolate Bayou | Channel through marsh; perennial; annual average drainage flow = 88 cfs in 2003 | • Aquatic life use, contact recreation use, and fish consumption use<br>• No category listed: the aquatic life, contact recreation, and general uses are fully supported, but the fish consumption use was not assessed<br>• Low DO killed 10,000 fish in 1998 |
| Big Slough | Channel through marsh; intermittent | N/A |
| Bastrop Bayou | Channel through marsh, intermittent | • Aquatic life use, contact recreation use, general use, and fish consumption use<br>• No category listed: the aquatic life, contact recreation, and general uses are fully supported, but the fish consumption use was not assessed |
| New Bayou | Channel through marsh; intermittent | N/A |
| Cottonwood Bayou | Channel through marsh; perennial | • Maintain waterfowl habitat |
| Persimmon Bayou | Channel through marsh; intermittent | N/A |
| Little Slough | Channel through marsh; perennial | N/A |

Notes:

[a] Texas Commission on Environmental Quality (TCEQ) assigns each assessed water body to one of five categories to provide information to the public, EPA, and internal agency programs about water quality status and management activities. The categories indicate the status of the water body, how the state will approach identified water quality problems, and include the following:

Category 1 – Attaining the water quality standard and no use is threatened.

Category 2 – Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened.

Category 3 – Insufficient or no data and information to determine if any designated use is attained.

Category 4 – Standard is not supported or is threatened for one or more designated uses but does not require development of a Total Maximum Daily Load (TMDL).

Category 4a – TMDL has been completed and approved by EPA.

Category 4b – Other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future.

Category 4c – Nonsupport of the water quality standard is not caused by a pollutant.

Category 5 – The water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants. Category 5 water bodies comprise the 303(d) List.

Category 5a – A TMDL is under way, is scheduled, or will be scheduled.

Category 5b – A review of the water quality standards will be conducted before a TMDL is scheduled.

Category 5c – Additional data and information will be collected before a TMDL is scheduled.

DO = dissolved oxygen; cfs = cubic feet per second (1 cfs = 0.03 cubic meters per second); N/A = not available

Source: TCEQ 2004a

The potential impacts of floodplains associated with the Stratton Ridge project is discussed in section 3.6.2.1.8 and in Appendix B. The extent of 100-year and 500-year floodplains in the project area, including the site and pipelines, was determined based on the FEMA flood insurance rate maps covering the project area. The Stratton Ridge storage site is located in a predominantly undeveloped wetland area. Table 3.6.8-2 provides a summary of the floodplains located within the project area.

**Table 3.6.8-2: Total Area of Floodplains Impacted by the Stratton Ridge Project**

| Stratton Storage Site | | |
|---|---|---|
| **Floodplain** | **Area (acres)[a]** | **Area (hectares)[a]** |
| 100-year | 120 | 50 |
| 500-year | 190 | 75 |
| **Total[b]** | **310** | **130** |

Notes:

[a] Numbers have been rounded to two significant figures
[b] Numbers may not equal total due to rounding

All of the Stratton Ridge site lies within either the 100-year or the 500-year floodplain. A portion of the offsite pipeline construction would occur within a floodplain, but would only result in temporary impacts during construction. The floodplain in which the Stratton Ridge site is located extends over hundreds of square miles, and is part of the San Jacinto-Brazos Coastal Basin.

##### *3.6.8.1.3 Stratton Ridge Surface Water: Operations and Maintenance Impacts*

Potential impacts from operations and maintenance are similar to those from construction. Brine would be discharged to the Gulf of Mexico and raw water would be taken from the ICW during the operational phase, although at lower rates than during the construction phase.

#### 3.6.8.2 Stratton Ridge Groundwater

##### *3.6.8.2.1 Stratton Ridge Groundwater: Affected Environment*

Ground surface elevation at the proposed SPR site is approximately 17 feet (5.2 meters) above sea level. Table 3.6.8-3 characterizes the aquifer system underlying Stratton Ridge. The Upper Chicot is an important aquifer in the region, is the most widespread source of fresh groundwater in Brazoria County, and the only one in the Stratton Ridge area. It is primarily used for irrigation and aquaculture, and there has been concern about decreasing water levels in the Chicot Aquifer over the past decade.

**Table 3.6.8-3: Aquifers Underlying the Proposed Stratton Ridge SPR Site Area**

| Aquifer | Depth to Top of Aquifer (depth below land surface) | Overlying Soils/ Permeability (centimeters/second)[a] | Water Quality; Degree of Salinity[b] |
|---|---|---|---|
| Upper Chicot | 10 feet (3 meters) | Beaumont clays at surface; $5.0\times10^{-5}$ at surface to $9.0\times10^{-2}$ in sands | Fresh water to slightly saline |
| Lower Chicot | 300 feet (90 meters) | Discontinuous clay beds; sands, $1.0\times10^{-2}$ | Slightly saline to saline |

**Table 3.6.8-3: Aquifers Underlying the Proposed Stratton Ridge SPR Site Area**

| Aquifer | Depth to Top of Aquifer (depth below land surface) | Overlying Soils/ Permeability (centimeters/second)[a] | Water Quality; Degree of Salinity[b] |
|---|---|---|---|
| Evangeline | Away from dome 1,100 feet (340 meters) | Clay beds, join intermittently; $1.0 \times 10^{-2}$ average in sands | Saline to brine |
| Jasper (Miocene) | Away from dome > 2,000 feet (> 600 meters) | Burkeville aquiclude; highly impermeable | Saline to brine |

Notes:

[a] 1 centimeter = 0.394 inches
[b] Salinity determined by dissolved solids content, in parts per thousand (ppt): Fresh water, Less than 1 ppt; Slightly saline, 1–3 ppt; Moderately saline, 3–10 ppt; very saline, 10–35 ppt; brine, more than 35 ppt

##### *3.6.8.2.2 Stratton Ridge Groundwater: Construction Impacts*

All of the general groundwater impacts discussed in section 3.6.2.2 are applicable to the proposed Stratton Ridge site.

The oil pipeline to Texas City would pass adjacent to or through the following groundwater source areas:

- The 100-year capture zone for the public water system in Hitcock, TX (in the vicinity of the Texaco City Terminal);
- The Area of Primary Influence for the Peterson Landing, TX public water system; and
- The Oyster Creek public water system in Oyster, TX (Owojori 2006).

The brine pipeline to the Gulf of Mexico and the RWI pipeline would pass adjacent to or through four public water systems in Oyster Creek, TX. Freeport, a major center of development, is located 6.0 miles (9.7 kilometers) south of the site, and reportedly draws their drinking water from the Brazos River (Meeks 2005). However, some residents in the smaller coastal towns in the vicinity of the project, including Liverpool, Danbury, Angleton, Lake Jackson, Clute, and Oyster Creek, draw water from wells. Groundwater in the area is also used for rice farm irrigation, livestock, and industry.

The underlying Chicot Aquifer is an important groundwater resource, and any potential contaminant discharges from the SPR could result in degradation of water quality. However, best management practices outlined in section 3.6.2.2 should mitigate such an occurrence. Overall, the probability of discharges along the brine or oil pipelines is low, and there should be no impacts to these groundwater uses.

##### *3.6.8.2.3 Stratton Ridge Groundwater: Operations and Maintenance Impacts*

Impacts due to operations and maintenance activities at Stratton Ridge are discussed in section 3.6.2.2. The site specific factors affecting any impacts are discussed above for construction impacts.

### 3.6.9 Bayou Choctaw Storage Site and Associated Infrastructure

Proposed expansion of the Bayou Choctaw site would include the following activities:

- Construction of two new storage caverns and associated well pads and access roads;

- Possible additional acquisition of one existing storage cavern and minor upgrades of existing infrastructures used, which would include new roads, bridge replacement, and modifications to onsite pipelines;
- Expansion of the capacity of the existing RWI system, which currently withdraws water from Cavern Lake located north of the site;
- Construction of an offsite brine disposal pipeline and six new brine injection wells; and
- Installation of new onsite pipelines.

The following sections describe the potentially affected water resources and potential impacts specific to the Bayou Choctaw storage site and associated infrastructure. The common impacts described in section 3.6.2 also apply to the Bayou Choctaw site.

#### 3.6.9.1 Bayou Choctaw Surface Water

##### *3.6.9.1.1 Bayou Choctaw Surface Water: Affected Environment*

The proposed expansion of Bayou Choctaw site includes new cavern and road construction activities at the existing SPR site, a new offsite brine pipeline and brine injection wells south of the existing SPR site, and an increase in RWI and brine discharge. Surface water bodies that could potentially be affected by development of the Bayou Choctaw site include the following:

- Cavern Lake and connected surface water bodies near the point of RWI; and
- Various streams and bayous draining the inland Bayou Choctaw site.

The Bayou Choctaw SPR site, brine pipeline, and brine injection wells are located in the east-central portion of Iberville Parish and the Louisiana portion of the Western Gulf Coastal Plain Province. This low-lying area, approximately 5 feet (1.5 meters) above sea level, is composed of the Mississippi River floodplain, coastal marshes, and a series of Pleistocene terraces and low hills. The undeveloped portions of the Bayou Choctaw SPR site consist of forested (cypress swamp) and open-water wetlands connected to Bull Bay and Bayou Borbeux west of the site.

Bayou Bourbeaux and several small canals are connected to the forested and open-water wetlands on the SPR site and drain excess water from the site into Bull Bay and wetlands in the southern portion of the site that extend to the south. These surface water bodies drain into the ICW (also called Bayou Choctaw) to the west, and to the marsh to the south via drainage streams.

Additionally, a manmade pond, Cavern Lake, is located at the site, adjacent to Bayou Bourbeaux. This pond resulted from the collapse of former Cavern No. 7. The pond is approximately 26 meters (85 feet) deep with a surface area of about 12 acres (4.9 hectares), and is connected to the ICW via a canal. It is assumed that the lake is conical in shape containing a volume of 338 acre-feet ($4.17 \times 10^5$ cubic meters) of water (DOE 1978b).

##### *3.6.9.1.2 Bayou Choctaw Surface Water: Construction Impacts*

The proposed Bayou Choctaw expansion project would utilize existing facilities, develop two new storage caverns and possibly also acquire an existing third cavern. Offsite construction would include installing a new brine disposal pipeline and adding six new brine injection wells to the existing brine-injection well network. All of the potential impacts general to SPR sites listed in section 3.6.2.1 are applicable to Bayou Choctaw. Bayou Choctaw would inject brine into the subsurface and would not discharge to the Gulf of Mexico, as discussed below. Potential impacts of extracting raw water from an onsite lake are described below.

Surface waters that could potentially be affected by the project are listed below in table 3.6.9-1 and shown in figure 3.6.9-1. The facility site is located within a swampy area. The brine pipeline would originate from the existing brine injection wells and extend to the new area; no specific surface water bodies would be crossed by the brine disposal pipeline.

The Bayou Choctaw SPR facility would have a maximum raw water demand of 0.615 MMBD to achieve the planned maximum drawdown rate. Raw water demand during leaching would be considerably lower at 0.110 MMBD. Raw water for the site would be withdrawn from Cavern Lake, which would be replenished by flow from the ICW by way of two canals (the north-south and east-west canals) that connect Cavern Lake to the ICW.

Potential impacts to these surface waters associated with raw water withdrawal for the Bayou Choctaw site were studied in detail in the 1976 EIS for the Bayou Choctaw SPR facility (DOE 1976 and appendix G.1). This study assumed a water withdrawal rate of 0.667 MMBD. Based on the 1976 study, maximum depth change (height differentials) in any of the affected bodies of water resulting from raw water withdrawal would be in the order of several thousandths of a foot (i.e., less than a millimeter). Flow velocities induced by RWI would range from 0.18 feet per second (0.20 kilometers per hour) in the north-south canal, to 0.23 feet per second (0.25 kilometers per hour) in the ICW. The raw water withdrawal would slightly affect salinity levels in Cavern Lake and possibly in the smaller connecting water bodies (north-south canal, east-west canal). Modeling conducted for the 1976 EIS (DOE 1976) indicates that overall salinity changes would be less than 1 part per thousand in Cavern Lake.

DOE has evaluated the impacts to floodplains in section 3.6.2.1.8 and appendix B. Because the entire site is located within the 100-year floodplain and the undeveloped portions consist of forested and open water wetlands, all new onsite and offsite pipeline and brine disposal well construction would occur within the floodplain. Construction of the pads for the two new caverns and the new access roads would require filling approximately 5 acres (2 hectares) of floodplains. The floodplain in which the Bayou Choctaw site is located is an extensive floodplain, part of the West Gulf Coastal Plain. Table 3.6.9-2 provides a summary of the floodplains located within the project area.

##### *3.6.9.1.3 Bayou Choctaw Surface Water: Operations and Maintenance Impacts*

The potential impacts on surface water from the expanded Bayou Choctaw site would be similar to those described above for construction. The RWI will be operational during the life of the facility.

#### 3.6.9.2 Bayou Choctaw Groundwater

##### *3.6.9.2.1 Bayou Choctaw Groundwater: Affected Environment*

In the Bayou Choctaw Dome area, the subsurface water system is principally comprised of Pleistocene-aged, interconnected freshwater bearing sands that form the Plaquemine artesian aquifer system. The Plaquemine aquifer is highly permeable with porosities of 40 percent and permeability coefficients of approximately 1,000 to 2,000 gallons per day (3.8 to 7.6 cubic meters per day). The aquifers in the vicinity of the Bayou Choctaw site are able to deliver large quantities of slightly-to-moderately-saline water (DOE 1978b, pp. 3.2-8, 3.2-9). Although the underlying aquifer is an important groundwater

## Table 3.6.9-1: Potentially Affected Surface Waters, Bayou Choctaw

| Water Body Name (and Relevant Segment) | Description | State Designations,[a] Uses, and Impaired Segments |
|---|---|---|
| **Cavern Site** | | |
| Drained by several creeks flowing through and around site into wetlands on southern portion of site and to the south, and then into Bayou Choctaw (ICW). The site is at 5 feet (1.5 meters) above sea level. | Creeks through marsh; perennial | N/A |
| Cavern Lake | Manmade pond resulting from the collapse of former Cavern No. 7; connected to the ICW via canal | N/A |
| Bayou Borbeux runs north-south through site | Creek through marsh; perennial | N/A |
| Bull Bay (drains Bayou Borbeux west of site) | Coastal bay | N/A |
| **RWI (only flow increase, no new pipeline)** | | |
| Intracoastal Waterway (also called Bayou Choctaw) | Major commercial and recreational waterway | • Used for both recreational boating and for commerce<br>• Primary and secondary contact recreation and propagation of fish and wildlife<br>• Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods<br>• USACE maintains navigable depths in the waterway through dredging and locks |

Notes:

[a] State designations are defined as:

Primary Recreation: "any recreational or other water use in which there is prolonged and intimate body contact with the water involving considerable risk of absorbing waterborne constituents through the skin or of ingesting constituents from water in quantities sufficient to pose a significant health hazard."

Secondary Recreation: "any recreational or other water use in which body contact with the water is either incidental or accidental, and in which the probability of ingesting appreciable quantities of water is minimal."

Fish and Wildlife Propagation: "the use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment. This use also includes the maintenance of water quality at a level that prevents damage to indigenous wildlife and aquatic life species associated with the aquatic environment and contamination of aquatic biota consumed by humans."

Drinking Water Supply: "refers to the use of water for human consumption and general household use."

Oyster Propagation: "the use of water to maintain biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected."

Agriculture: "the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption."

Outstanding Natural Resource Waters: "include water bodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes, such as those designated under the Louisiana Natural and Scenic Rivers System or those designated by the department as waters of ecological significance. Characteristics of outstanding natural resource waters include, but are not limited to, highly diverse or unique in stream and/or riparian habitat, high species diversity, balanced trophic structure, unique species, or similar qualities."

Source: LDEQ 2005

**Table 3.6.9-2: Total Area of Floodplains Impacted by the Bayou Choctaw Project**

| Bayou Choctaw Storage Site | | |
|---|---|---|
| **Floodplain** | **Area (acres)[a]** | **Area (hectares)[a]** |
| 100-year | 24 | 10 |
| 500-year | N/A | N/A |
| **Total** | **24** | **10** |

[a] Numbers have been rounded to two significant figures

resource, there are no Groundwater Protection Areas in the vicinity of the Bayou Choctaw site, indicating that groundwater use is fairly limited in this geographic area, especially as a potable source.

According to the Louisiana Department of Transportation and Development water well registry, a number of groundwater wells are located in the vicinity of the Bayou Choctaw site (LADOTD 2005). The identified wells are primarily screened at depths ranging from approximately 120 to 250 feet (37 to 76 meters) below ground surface, and consist of industrial, rig supply-, and public supply wells. Some shallower monitoring wells are installed at depths ranging from 3 to 40 feet (0.91 to 12 meters) below ground surface. Groundwater depths reported from the identified wells generally range from 1 to 5 feet (0.30 to 1.5 meters) below ground, and have reported well yields up to 2.7 cubic feet per second (0.076 cubic meters per second).

#### *3.6.9.2.2 Bayou Choctaw Groundwater: Construction Impacts*

The general impacts to groundwater discussed in section 3.6.2.2 are applicable to the Bayou Choctaw site. Although the aquifer underlying the site is used as a drinking water supply by Baton Rouge to the northeast, groundwater from the site is expected to flow toward the ICW to the west and to the marsh to the south. Thus, any contaminant discharges from the site should not impact groundwater quality in Baton Rouge. There would be no use of groundwater for this proposed candidate alternative.

Proposed new and existing injection wells would be used to dispose of brine from cavern development. The Bayou Choctaw proposed expansion would utilize the existing brine-disposal injection system with the addition of a new, brine filtration system and six new injection wells.

The brine would be disposed of via injection into subsurface saline strata at two injection areas located south of the dome. The existing system is comprised of a well field with 10 disposal wells and was designed to accommodate a maximum of 0.01 MMB per hour of displaced brine. The proposed new injection area would be located approximately 3,000 feet (900 meters) south of the existing area and would inject brine into the same receiving formation. According to previous studies, the proposed receiving formation for injection of brine ranges in depths from 5,000 to 7,000 feet (1,500 to 2,100 meters), which is significantly below any aquifers containing fresh or slightly saline water. (DOE 1978b, pp. A.4—10, C.6—8). The aquifers used for potable water and those used for brine injection are confined aquifers that are separated by impermeable strata. The potential impacts of brine disposal in the existing disposal wells has been extensively studied in previous EIS studies (DOE 1976; DOE 1978b) and were found to be minimal. Therefore development of six new brine disposal wells that would inject brine into the same formation would result in minimal impacts on groundwater. The brine disposal rate would remain at the permitted rate of 0.110 MMBD. Thus, impacts to groundwater associated with the disposal of brine by deep well injection would be minimal.

According to the USGS, large withdrawals from the aquifer system in the Baton Rouge area have altered groundwater flow patterns. Saltwater now encroaches into formerly fresh-water areas and local officials are concerned about the impacts of increasing salinities on public water supplies (USGS 2006). The proposed Bayou Choctaw project would not contribute to saltwater encroachment into fresh groundwater resources, since the brine would be injected into the deep saline strata, far below fresh groundwater. Also, the aquifers used for potable water and those used for brine injection are confined aquifers that are separated by impermeable strata (DOE 1976; DOE 1978b).

##### *3.6.9.2.3 Bayou Choctaw Groundwater: Operations and Maintenance Impacts*

Potential impacts due to operations and maintenance at Bayou Choctaw would be similar to those described above for the construction phase. Use of brine injection wells would continue through the operational phase.

### 3.6.10 Big Hill Storage Site and Associated Infrastructure

The Big Hill site would take advantage of the existing infrastructure, but still require an expansion or upgrade of several major systems, including the following activities:

- Construction and operation of new storage caverns;
- Installation of a new RWI and injection pumps as well as new motors to the existing RWI system, which draws water from the ICW;
- Construction of an additional anhydrite pond for brine disposal adjacent to the existing ponds;
- Replacement of a segment of the existing brine pipeline to repair corrosion damage;
- Construction and operation of pipeline to Sun Terminal in Nederland and new onsite oil injection pumps; and
- Site-support facilities including construction of a security fence, clearing a security buffer beyond the security fence, and construction of access roads.

The following sections describe the potentially affected water resources and potential impacts specific to the Big Hill storage site and associated infrastructure. The general impacts described in section 3.6.2 also apply to the Big Hill site.

#### 3.6.10.1 Big Hill Surface Water

##### *3.6.10.1.1 Big Hill Surface Water: Affected Environment*

The existing Big Hill SPR site is located within the Neches-Trinity Coastal Basin in the Texas portion of the Gulf Coastal Plain Province. The proposed cavern expansion site is located on a local topographic high between elevations of 10 to 30 feet (3 to 9 meters) above sea level. DOE would construct 6, 7, 8, or 9 caverns to expand capacity by 72, 80, 96, or 108 MMB. Surface drainage is toward a pond and unnamed stream to the north and a wetland-stream complex to the south.

The predominant surface water quality problems for the Neches-Trinity Coastal Basin include depressed dissolved oxygen levels, high nutrient concentrations, and elevated concentrations of aluminum (Lower

Neches Valley Authority (LNVA 2004). These deficiencies are related to the sluggish water flow, point and nonpoint source pollution, and industrial contamination. Most water bodies are designated for fish consumption use, contact recreation, and aquatic life support (TCEQ 2004). The construction of artificial shipping channels and pipeline canals to serve these industries has facilitated saltwater encroachment into previously fresh waters.

##### *3.6.10.1.2 Big Hill Surface Water: Construction Impacts*

The particular water bodies in the area are listed below in table 3.6.10-1 and shown in figure 3.6.10-1. The existing brine disposal pipeline runs from the cavern site, crosses the ICW and continues through an extensive coastal marsh complex that includes the McFaddin National Wildlife Refuge to the Gulf of Mexico. Only the initial 1.3 miles (2.1 kilometers) of the brine disposal pipeline would be replaced with the proposed expansion of Big Hill, so construction would not extend into the ICW for the National Wildlife Refuge. The new crude oil pipeline would cross several perennial and intermittent canals and bayous.

Brine would be discharged to the Gulf of Mexico through an existing brine-diffuser system, and potential impacts are described in section 3.6.2.1.2. The most currently available NPDES monitoring report (2003) indicates that discharge water quality is consistently within permit requirements at Big Hill (DOE, 2004f). Brine discharge would result in localized elevations in salinity.

As in the past, the Big Hill site would withdraw raw water from the ICW. Impacts associated with raw water withdrawal from the ICW are addressed in Section 3.6.2.1.1 and would be expected to be minimal.

DOE has evaluated potential impacts to floodplains in section 3.6.2.1.8 and in appendix B. The proposed Big Hill expansion site is located partially in a predominantly undeveloped, extensive floodplain system. However, a large percentage of this proposed expansion site would be located outside of the 100-year and the 500-year floodplain. The proposed expansion would utilize areas that are already built up above the floodplain elevations from previous construction activities. The expansion site would affect 11 acres (5 hectares) of the 100-year floodplain and approximately 27 acres (11 hectares) for the 500-year floodplain associated with the onsite facilities (wellpads, roads, anhydrite pond, and well heads). The floodplain in which the Big Hill site is located extends over hundreds of square miles, and is part of the Neches-Trinity Coastal Basin.

##### *3.6.10.1.3 Big Hill Surface Water: Operations and Maintenance Impacts*

Operations and maintenance activities would have the same potential impacts as described above for the construction phase and in section 3.6.2. The RWI and the Gulf of Mexico brine discharge diffuser would also be active during the operational phase.

#### 3.6.10.2 Big Hill Groundwater

##### *3.6.10.2.1 Big Hill Groundwater: Affected Environment*

Table 3.6.10-2 characterizes the aquifers underlying the Big Hill site. The groundwater surface varies from a depth of approximately 6.6 feet (2.0 meters) below land at the center of the hill to almost ground level near the base of the hill 26 feet (8.0 meters) above sea level. The fresh water base of the upper unit of the Chicot aquifer, which normally sits at approximately 1,200 feet (370 meters) below land surface, has been uplifted to as high as 98 feet (30 meters) below land directly above the salt dome. Slightly saline groundwater exists in the lower unit of the Chicot at a depth of 300 feet (90 meters). The interface of the Upper Chicot and Lower Chicot is virtually unconfined at the site. Both the semi-confined

### Table 3.6.10-1: Potentially Affected Surface Waters, Big Hill

| Water Body Name (and Relevant Segment) | Description | State Uses, Categories[a], and Impaired Segments |
|---|---|---|
| **Cavern Site** | | |
| The cavern site drains to unnamed pond and stream to the north and wetlands-stream complex to the south | N/A | N/A |
| **RWI (flow increase only; no new pipeline)** | | |
| Intracoastal Waterway | Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial | • Used for both recreational boating and for commerce<br>• Primary and secondary contact recreation and propagation of fish and wildlife<br>• No category listed: the aquatic life, contact recreation and general uses are fully supported, but the fish consumption use was not assessed in 2004<br>• Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods |
| Spindletop Marsh | Swamp | N/A |
| Salt Bayou Marsh and Salt Bayou | Swamp | N/A |
| **Brine Disposal Pipeline (upgrade of 7,000 feet)** | | |
| Un-named canal | N/A | N/A |
| Intracoastal Waterway | Major commercial and recreational waterway; USACE maintains navigable depths in the water way through dredging and locks; perennial | • See above; used for both recreational boating and commerce<br>• Primary and secondary contact recreation and propagation of fish and wildlife<br>• No category listed: the aquatic life, contact recreation and general uses are fully supported, but the fish consumption use was not assessed in 2004<br>• Has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods |
| Tributary to Star Lake | Marshlands upstream of the McFaddin National Wildlife Refuge | • Areas of concern: nitrate+nitrite nitrogen, depressed DO, orthophosphorus, and total phosphorus |
| Spindletop Marsh | Swamp | N/A |
| Salt Bayou Marsh and Salt Bayou | Swamp | N/A |
| McFaddin National Wildlife Refuge | Extensive coastal marsh | • 55,000-acre national wildlife refuge |
| **Crude Oil Pipeline to Sun Terminal at Nederland (23-mile)** | | |
| Several Unnamed canals | N/A | N/A |
| Taylor Bayou (above tidal) | Lake, perennial | • Aquatic life use, contact recreation use, general use, fish consumption use<br>• Category 5c: aquatic life use not supported in 2004 due to depressed DO |

**Table 3.6.10-1: Potentially Affected Surface Waters, Big Hill**

| Water Body Name (and Relevant Segment) | Description | State Uses, Categories[a], and Impaired Segments |
|---|---|---|
| Willow Marsh Bayou | Channel through marsh; perennial | • Aquatic life use, contact recreation use, fish consumption use<br>• No category listed: the aquatic life use is fully supported, but the contact recreation and fish consumption uses were not assessed in 2004 |
| Hildebrant Bayou | Channel through marsh, perennial | • Aquatic life use, contact recreation use, general use, fish consumption use<br>• Category 5c: aquatic life use partially supported in 2004 due to depressed DO |

Notes:

[a] TCEQ assigns each assessed water body to one of five categories to provide information to the public, EPA, and internal agency programs about water quality status and management activities. The categories indicate the status of the water body, and how the state will approach identified water quality problems:

Category 1 – Attaining the water quality standard and no use is threatened.

Category 2 – Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened.

Category 3 – Insufficient or no data and information to determine if any designated use is attained.

Category 4 – Standard is not supported or is threatened for one or more designated uses but does not require the development of a Total Maximum Daily Load (TMDL).

Category 4a – TMDL has been completed and approved by EPA.

Category 4b – Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.

Category 4c – Nonsupport of the water quality standard is not caused by a pollutant.

Category 5 – The water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants. Category 5 water bodies comprise the 303(d) List.

Category 5a – A TMDL is under way, is scheduled, or will be scheduled.

Category 5b – A review of the water quality standards will be conducted before a TMDL is scheduled.

Category 5c – Additional data and information will be collected before a TMDL is scheduled.

DO = dissolved oxygen; N/A = not available; 1 acre = 0.404 hectare; 1 foot = 0.30 meters; 1 mile = 1.609 kilometers

Source: TCEQ 2004a

### Table 3.6.10-2: Characterization of Aquifers Underlying the Big Hill Site

| Aquifer | Depth to Top of Aquifer (Below Land Surface) | Overlying Soils/ Permeability (cm/sec) | Degree of Salinity[a] |
|---|---|---|---|
| Upper Chicot | 7.0 feet (2.0 meters) | Porous; west and south surface edges less porous, $1.0x10^{-2}$ | Mostly fresh water |
| Lower Chicot | 300 feet (90 meters) | Intermittent clay bed, $1.0x10^{-6}$ to $1.0x10^{-4}$; sands $1.0x10^{-2}$ | Slightly saline |
| Evangeline | Away from dome, 1,500 feet (460 meters) | Discontinuous thick clay bed, $1.0x10^{-6}$ to $1.0x10^{-4}$ | Moderately saline to brine |
| Jasper | Away from dome, > 2,000 feet (600 meters) | Burkeville Aquiclude, highly impermeable | Moderately saline to brine |

Notes:

[a] Salinity determined by dissolved solids content, in parts per thousand (ppt): fresh water, less than 1 ppt; slightly saline, 1–3 ppt; moderately saline, 3–10 ppt; very saline, 10–35 ppt; brine, more than 35 ppt

cm/sec = centimeters per second

Sources: Barbie 1991a and 1991b; Hart 1981; TWDB 1971; Davies 1984

Evangeline and the totally-confined Jasper are pierced by the salt dome. Both aquifers are too deep and too saline to be used as a water supply or affected by surface operations.

#### *3.6.10.2.2 Big Hill Groundwater: Construction Impacts*

Potential impacts general to the SPR sites are discussed in section 3.6.2.2, and are applicable to the Big Hill site expansion.

The Chicot Aquifer is an important groundwater resource in Louisiana and Texas. It is a sole source aquifer, and according to the Louisiana Department of Environmental Quality, there is a concern about over-pumping, which results in salt water intrusion into the aquifer (Jennings 2006). Use of the aquifer for irrigation of rice farms, in addition to other uses, in this area puts pressure on the groundwater resource. According to the EPA's Federal Reporting Data System, no municipal wells are within 5 miles (8 kilometers) hydraulically downgradient of the Big Hill site. Since the land surrounding the site is swampy and contains many oil fields, extensive development of groundwater resources in the near future appears unlikely, and any impacts from the proposed project are unlikely.

The existing water intake and brine discharge pipelines run through coastal marsh, south from Big Hill to the ICW and the Gulf of Mexico, respectively. There is little population or established use of groundwater in the area between Big Hill and the ICW and Gulf of Mexico region. No towns or major withdrawal centers are along the pipelines' path toward the Gulf of Mexico. Impacts to groundwater along the pipeline route would be unlikely, but if they did occur, there would be none to minimal impact to current groundwater usage.

##### *3.6.10.2.3 Big Hill Groundwater: Operations and Maintenance Impacts*

Likewise, the general impacts discussion in section 3.6.2.2 captures the anticipated operations and maintenance impacts to groundwater at Big Hill. The site specific groundwater conditions discussed above in construction impacts would also apply to operations and maintenance impacts. The ongoing groundwater monitoring program at the Big Hill SPR site indicates that groundwater has not been impacted by brine releases from the brine pond (DOE 2004f). One small release was identified from an underground brine pipeline, but it was quickly remediated (DOE 2004f). This historic data indicates very low probability of any impacts to groundwater from the proposed project.

### 3.6.11 West Hackberry Storage Site

The proposed West Hackberry expansion would use the existing infrastructure, including the existing RWI system, crude oil distribution system, and brine disposal system, without the need for significant upgrades. The only changes would be the following:

- Acquisition and use of three existing 5—MMB caverns adjacent to the site (no new cavern leaching or drilling would be required);
- Construction of new onsite pipelines to connect the acquired caverns to the existing onsite water, brine, and crude oil systems;
- Installation of firewater main line and string flush and oily water lines; and
- Addition of site support facilities including construction of a security fence, clearing a security buffer beyond the security fence, construction of cavern spill containment features, and new site access road.

The following sections describe the potentially affected water resources and potential impacts specific to the West Hackberry storage site and associated infrastructure. The general impacts described in section 3.6.2.2 also apply to the West Hackberry site.

#### 3.6.11.1 West Hackberry Surface Water

##### *3.6.11.1.1 West Hackberry Surface Water: Affected Environment*

The West Hackberry site would include no new offsite pipelines and no significant upgrades to the RWI facility, crude oil distribution capabilities, or the brine disposal system. Surface water bodies that could potentially be affected by the West Hackberry expansion site include inland water bodies surrounding or downstream of the West Hackberry site. In addition, the ICW would continue to serve as the source of raw water for the site, as it has in the past.

The West Hackberry site is located approximately 6.0 miles (10 kilometers) west of Calcasieu Lake within the estuarine part of the Calcasieu River Basin. Local drainage is to Black Lake and Black Lake Bayou, which surround the site to the north, west, and southwest. The site is approximately 5.0 to 10.0 feet (1.5 to 3.0 meters) above sea level. The surface water system in the vicinity of the site is comprised of brackish marsh interconnected with a network of bayous and canals that connect to Black Lake, Calcasieu Lake, Calcasieu River, Calcasieu Ship Channel, and the ICW. In general, the surface waters in the area are brackish, with a salinity of approximately 12 parts per thousand (Nipper et al. 2005).

The surface water system in the area is used for a variety of purposes, including transportation, industrial activities, commercial fishing, rice farming, livestock watering, irrigation of crops, and as habitat for wildlife (DOE 1978d, p. 3.2-6). The major water quality issues in this area result from saltwater intrusion into freshwater systems, priority organics, and indicators of pathogens. For example, the Louisiana Department of Environmental Quality issued an informal fish consumption advisory primarily related to organic contamination for the Calcasieu River **estuary** to the Gulf of Mexico.

##### *3.6.11.1.2 West Hackberry Surface Water: Construction Impacts*

The proposed expansion at West Hackberry would involve acquisition of existing storage caverns adjacent to the existing SPR site. As noted above, the expansion would utilize the existing brine disposal, RWI, crude oil intake, and oil distribution systems. Brine would be disposed of in subsurface injection wells, and raw water would be withdrawn from the ICW.

The primary water bodies in the area are listed in table 3.6.11-1 and shown in figure 3.6.11-1.

Because there is no offsite pipeline construction associated with this proposed site, potential construction impacts to surface water would be limited to the vicinity of the West Hackberry site itself. Brine would be disposed of via deep well injection, and would not affect surface water. The West Hackberry site would withdraw raw water from the ICW. Impacts associated with raw water withdrawal from the ICW are addressed in section 3.6.2.1, and would be expected to be minimal.

DOE has evaluated impacts to floodplains in section 3.6.2.1.8 and appendix B. The West Hackberry expansion would involve acquisition of existing storage caverns adjacent to the existing SPR site. While a very small portion of the land to be acquired is within a floodplain, no new onsite construction would be required within the floodplain. As noted above, the proposed expansion would utilize the existing brine disposal, RWI, crude oil intake, and oil distribution systems. It would not require any new offsite construction in the floodplain. Therefore, no impacts to floodplains in the project area would result from project construction or operation.

##### *3.6.11.1.3 West Hackberry Surface Water: Operations and Maintenance Impacts*

The potential impacts general the SPR sites discussed in section 3.6.2.1 are applicable to the West Hackberry site. No additional site-specific issues regarding impacts on surface water were identified.

#### 3.6.11.2 West Hackberry Groundwater

##### *3.6.11.2.1 West Hackberry Groundwater: Affected Environment*

The site is underlain by the Chicot Aquifer, which extends from the ground surface to over 1,000 feet (305 meters) below grade in the site area. In general, the Chicot is mostly fresh water in the upper reaches, but becomes increasingly saline with depth (DOE 1992a). The aquifer is underlain by the Evangeline and Jasper Aquifers, as summarized in table 3.6.11-2 below.

The underlying Chicot Aquifer is a sole source aquifer, and according to the Louisiana Department of Environmental Quality, there is concern about over-pumping, which could result in saltwater intrusion into the aquifer (Jennings 2006). Use of the aquifer for irrigation of rice farms, in addition to other uses, puts pressure on the groundwater resource. Although groundwater only provides 20 percent of total water usage in the area, with surface water providing the remaining 80 percent, the Chicot Aquifer is an important water resource.

### Table 3.6.11-1: Potentially Impacted Surface Waters, West Hackberry

| Water Body Name (and Relevant Segment) | Description | State Designations, Uses,[a] and Impaired Segments |
|---|---|---|
| **Cavern Site** | | |
| Black Lake | Lake; perennial | • Primary and secondary contact recreation and fish and wildlife propagation |
| Black Lake Bayou | Stream through marsh; perennial | • Agriculture, primary and secondary contact recreation, and outstanding natural resource water<br>• Portions of Black Lake Bayou are used recreationally and are classified as natural and scenic by the Louisiana Department of Wildlife and Fisheries |
| **RWI (flow increase)** | | |
| Intracoastal Waterway | Major commercial and recreational waterway; USACE maintains navigable depths in the waterway through dredging and locks; perennial | • Used for both recreational boating and commerce<br>• Primary and secondary contact recreation and fish and wildlife propagation<br>• The ICW has a good deal of commercial activity; barges haul petroleum, petroleum products, foodstuffs, building materials, and manufactured goods |

Notes:

[a] State designations are defined as:

Primary Recreation: "any recreational or other water use in which there is prolonged and intimate body contact with the water involving considerable risk of absorbing waterborne constituents through the skin or of ingesting constituents from water in quantities sufficient to pose a significant health hazard."

Secondary Recreation: "any recreational or other water use in which body contact with the water is either incidental or accidental, and in which the probability of ingesting appreciable quantities of water is minimal."

Fish and Wildlife Propagation: "the use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment. This use also includes the maintenance of water quality at a level that prevents damage to indigenous wildlife and aquatic life species associated with the aquatic environment and contamination of aquatic biota consumed by humans."

Drinking Water Supply: "refers to the use of water for human consumption and general household use."

Oyster Propagation: "the use of water to maintain biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected."

Agriculture: "the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption."

Outstanding Natural Resource Waters: "include water bodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes, such as those designated under the Louisiana Natural and Scenic Rivers System or those designated by the department as waters of ecological significance. Characteristics of outstanding natural resource waters include, but are not limited to, highly diverse or unique in stream and/or riparian habitat, high species diversity, balanced trophic structure, unique species, or similar qualities."

Source: LDEQ 2005

**Table 3.6.11-2: Aquifers in Vicinity of West Hackberry Expansion Site**

| Aquifer | Groundwater Description | Depth of Aquifer |
|---|---|---|
| Chicot | Mostly fresh water north of Cameron Parish and saline water in the coastal region | Ranges from less than 100 feet thick in Beauregard Parish to more than 7,000 feet under the Gulf of Mexico; extends from the surface to 1,100 feet below land surface |
| Evangeline | Freshwater north of Calcasieu Parish and saline water from southern Calcasieu Parish to the coast | Not available for site |
| Jasper | Saline water from the middle of Beauregard Parish south to the coast | Not available for site |

1 foot = 0.30 meters

Source: DOE 1978c

There are a number of groundwater wells located in the vicinity of the West Hackberry site (LADOTD 2005). Louisiana Department of Transportation and Development records indicate that the wells are screened at depths ranging from 10 to 500 feet (3.0 to 150 meters) below land surface within the Chicot Aquifer system, and consist of industrial, monitoring, and domestic use wells. Groundwater depths reported from the shallower wells generally range from 3.0 to 15 feet (0.90 to 4.6 meters) below land surface. Groundwater depths from the wells screened in the deeper intervals (e.g., 200 to 500 foot [61 to 150 meters] below land surface) range from approximately 30- to 60-feet (9- to 18-meters) deep, and have reported well yields up to 4.46 cubic feet per second (0.13 cubic meters per second). Hydraulic conductivities of the Chicot Aquifer reportedly range from 40 to 220 feet per day (12 to 67 meters per day). The general groundwater flow direction at the West Hackberry site is expected to be south towards the Gulf of Mexico.

#### *3.6.11.2.2 West Hackberry Groundwater: Construction Impacts*

The general impacts to groundwater discussed in section 3.6.2.2 are applicable to the West Hackberry site. Given that the site is underlain by a sole source aquifer, any impacts to the aquifer could result in impacts to water use in the area. Also, the aquifer is found at shallow depths, making it more susceptible to any surface discharges of contaminants during construction. However, best management practices described in section 3.6.2.2 would result in very low probability of a discharge or significant impact to groundwater.

In addition to the general impacts, deep injection wells would be used to dispose of brine at the West Hackberry site. The injection wells would be used during cavern filling operations as the caverns already exist. The potential impacts of brine disposal via deep well injection were assessed and modeled in detail in the 1977 final EIS for the West Hackberry site (FEA 1977). This study determined that brine disposal would not result in negative impacts to groundwater resources. The West Hackberry expansion would use the existing SPR brine disposal facilities and the proposed maximum brine disposal rate for the West Hackberry expansion would be well below the disposal rate considered for the 1977 EIS.

#### *3.6.11.2.3 West Hackberry Groundwater: Operations and Maintenance Impacts*

The general impacts associated with operations and maintenance discussed in section 3.6.2.2 would be applicable to West Hackberry, as discussed in the previous subsection. There have been some brine discharges to groundwater and soils from a former brine pond at the operating West Hackberry SPR. However, the current site monitoring there includes 11 monitoring wells and 15 recovery wells, which are showing improvement in groundwater quality (DOE 2004f). If there should be a release at the West Hackberry site in the future, this monitoring network would help with early identification and rapid remedial response.

#### 3.6.12 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site and if the proposed site could be developed by a commercial entity for oil and gas purposes, some spill risk to water resources could exist. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity, which could involve brine spill risk to water resources. The onshore Clovelly Dome Storage system would continue to operate unchanged as a component of LOOP with the exception of any expansion that LOOP might undertake.

For the portions of the proposed storage site pipelines that follow existing ROWs, the risk of a spill associated with the no-action alternative would be limited to spill risk to water resources that already exists from the existing pipelines. For the portions of the pipeline in new ROW, the no-action alternative would not have any spill risk to water resources. For the sites of terminals that are in developed petroleum storage areas, it is possible that a commercial entity could develop them for storage and some spill risk to water resources could occur as a result. Terminal sites in undeveloped areas are unlikely to be developed as terminals and present no foreseeable risk.

Potential impacts to surface and groundwater would not occur as a result of the selection of the no-action alternative.

## 3.7 BIOLOGICAL RESOURCES

This section addresses the potential impacts of SPR expansion on the following types of biological resources:

- Plant communities, wetlands, and wildlife;
- **Special status species** to include threatened and endangered species and their designated critical habitat;
- Migratory birds, bird nests, and eggs regulated by the Migratory Bird Treaty Act;
- EFH; and
- Protected areas including federal and state parks, forests, wildlife refuges, conservation areas, and other areas of ecological importance.

This section presents the methodology for characterizing the affected environment and analyzing the potential and common impacts associated with a new or expansion SPR site. Following the common impacts, DOE presents the affected environment and associated impacts specific to each proposed new and expansion site. This section discusses the plants, wetlands, and wildlife, the special status species, the EFH, and the special status areas associated with each proposed expansion and new site and its associated infrastructure. Each site section is organized by major SPR facility component—namely storage site and associated facilities, pipeline, access road, and power line ROWs, RWI structure, and brine diffuser or injection systems. DOE has adopted this approach because different types of biological resources may be located at each of these often distant locations. The evaluation considered whether the proposed action would be compliant with numerous state and federal regulations and executive orders on the protection of wetlands, special status species, managed fisheries, migratory birds, fish and wildlife resources, and controlling invasive species. These are described in detail in appendices B, D through H, and I.

### 3.7.1 Methodology

This section describes DOE's approach and assumptions for characterizing the affected environment and analyzing potential impacts on biological resources from construction and operations and maintenance at each proposed new and expansion site and the associated infrastructure.

#### 3.7.1.1 Plants, Wetlands, and Wildlife

DOE first identified the areas that could be affected by the development or expansion of possible storage sites and associated infrastructure based on their conceptual designs. The potentially affected areas include all construction-related areas including equipment lay-down, staging areas, and temporary access roads. To describe the vegetation and wetland communities present in the potentially affected areas, DOE compiled geospatial data from the following sources:

- National Land Cover Dataset (USGS 1992), which is a land classification system for the entire United States;
- State GAP Analysis Program (USGS 2003) land cover datasets, which include a state-specific land classification system; and

- National Wetlands Inventory (USFWS 2005), which describes approximate wetland location and type according to the Cowardin classification system.

DOE performed a site walkover of each proposed new storage site plus portions of pipeline and power line ROWs to verify and update the spatial data and observe firsthand the ecological context. Aerial photographs, site descriptions, and available literature and databases were used to describe the biological conditions at the proposed expansion sites. DOE also conducted a geospatial analysis to supplement information gathered during site visits and agency consultation.

To assess the potential impacts on the various plant communities and wildlife, DOE calculated the area of each land classification type that could be affected during construction and operation and identified the vegetation types and wildlife species that could be affected. DOE used the construction easement and permanent ROWs for the pipelines, power lines, and access roads presented in chapter 2 to calculate the acreage of vegetation and wetland types associated with the potentially affected area of each site. The conceptual site plans, pipeline and power line ROWs, brine diffuser or injection sites, and RWI locations were then modified or shifted to avoid environmental resources to the extent practicable within engineering and cost constraints. A pipeline alignment was selected that followed existing utility/pipeline/roadway and canal corridors as much as feasible and practicable. The Least Environmentally Damaging and Practicable Alternatives for the ROW corridors were developed (where data allowed) by applying a least impact model that identified a route that utilizes existing utility corridors and best avoids wetlands, especially high value forested wetlands. Details on the methodology used in the model and developing the Least Environmentally Damaging and Practicable Alternatives are provided in appendix B. Appendix B also includes figures showing the footprint of the proposed storage sites, terminals, ROWs, off-site facilities, and National Wetlands Inventory maps of wetland types.

This process resulted in an estimate of the potentially affected area to account for all direct and indirect impacts of constructing and maintaining an ROW based on the existing vegetation. DOE used the USFWS National Wetlands Inventory maps to identify the wetlands potentially affected. To provide a summary of the major types of wetland systems, DOE consolidated the categories of the National Wetlands Inventory maps into the categories presented in table 3.7.1-1.

**Table 3.7.1-1: Wetland Types and Description**

| Wetlands Type | Description |
|---|---|
| Palustrine – forested | Tidal and nontidal wetlands dominated by woody vegetation greater than or equal to 16 feet (5 meters) in height, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 5 parts per thousand. Total vegetation coverage is greater than 20 percent. This wetland category includes fresh-water swamps and bottomland hardwood forest. |
| Palustrine – scrub-shrub | Tidal and nontidal wetlands dominated by woody vegetation less than 16 feet (5 meters) in height, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 5 parts per thousand. Total vegetation coverage is greater than 20 percent. The species present could be true shrubs, young trees and shrubs, or trees that are small or stunted due to environmental conditions. |
| Palustrine – emergent | Tidal and nontidal wetlands dominated by persistent emergent vascular plants, emergent mosses or lichens, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 5 parts per thousand. Plants generally remain standing until the next growing season. Total vegetation cover is greater than 80 percent. This category is also referred to as fresh-water marsh. |

**Table 3.7.1-1: Wetland Types and Description**

| Wetlands Type | Description |
|---|---|
| Estuarine – forested | Tidal wetlands dominated by woody vegetation greater than or equal to 16 feet (5 meters) in height, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 5 parts per thousand. Total vegetation coverage is greater than 20 percent. |
| Estuarine – scrub-shrub | Tidal wetlands dominated by woody vegetation less than 16 feet (5 meters) in height, and wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 5 parts per thousand. Total vegetation coverage is greater than 20 percent. |
| Estuarine – emergent | Tidal wetlands dominated by erect and rooted plants that can live in water, excluding mosses and lichens. Wetlands that occur in tidal areas where salinity due to ocean-derived salts is equal to or greater than 5 parts per thousand and that are present for most of the growing season in most years. Perennial plants usually dominate these wetlands. Total vegetation cover is greater than 80 percent. This wetland category includes saltwater marsh. |
| Palustrine – aquatic bed | Tidal and nontidal wetlands and deepwater habitats in which salinity due to ocean-derived salts is below 5 parts per thousand and that are dominated by plants that grow and form a continuous cover principally on or at the surface of the water. These include algal mats, detached floating mats, and rooted vascular plant assemblages. Total vegetation cover is greater than 80 percent. |
| Lacustrine | These include wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses, or lichens with greater than 30 percent areal coverage; and (3) total area exceeds 20 acres (8 hectares). |
| Riverine | These include all wetlands and deepwater habitats contained in natural or artificial channels periodically or continuously containing flowing water or water that forms a connecting link between the two bodies of standing water. Upland islands or palustrine wetlands may occur in the channel, but they are not part of the riverine system. |
| Marine | Open ocean and high energy coastlines with salinities exceeding 30 parts per thousand and little or no dilution except outside the mouths of estuaries. |
| Palustrine – unconsolidated bottom | These include wetlands and deepwater habitats with at least 25 percent cover of substrate particles smaller than stones and a vegetative cover less than 30 percent. Water regimes are restricted to permanently flooded, intermittently exposed, and semi-permanently flooded. Characterized by the lack of large stable surfaces for plant and animal attachment. Salinity is below 5 parts per thousand. |
| Palustrine – unconsolidated shore | These wetland habitats have three characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders, or bedrock; (2) less than 30 percent areal cover of vegetation other than pioneering plants; and (3) any of the following water regimes: irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded. Salinity is below 5 parts per thousand. |
| Palustrine – open water | Small, shallow bodies of open fresh water lacking significant emergent vegetative cover. |

Wetlands provide multiple functions and values including groundwater recharge and discharge areas; flood flow alteration; fish and shellfish habitat; food production for aquatic species and wildlife; sediment retention; nutrient removal, transformation, and export; shoreline stabilization; wildlife habitat; recreation; and visual or aesthetic values. DOE considered these functions and values in assessing the impacts on wetlands, although no formal assessment for permitting of wetland functions and values was conducted. The evaluation of the significance of the potential impact takes into account both direct and indirect impacts, local uniqueness of the resources that would be affected, duration of the impact, and mitigation or compensation measures that would be implemented.

DOE also considered the proposed action in terms of compliance with Executive Order 11990 Protection of Wetlands, 10 CFR Part 1022 (DOE's regulations for complying with the E.O.), Sections 404 and 401 of the CWA, and relevant state regulations.

#### 3.7.1.2 Special Status Species

DOE took special consideration of biological resources regulated by specific regulatory programs, including but not limited to the following:

- Federally listed threatened, endangered, and **candidate species** and designated critical habitat regulated by the federal Endangered Species Act (ESA);
- State-listed threatened and endangered species regulated by laws in each state;
- Species included in the U.S. Forest Service's Regional Forester Sensitive Species List;
- Marine mammals regulated by the Marine Mammal Protection Act; and
- Managed fisheries regulated by the Magnuson-Stevens Fishery Conservation and Management Act (EFH and managed species).

Detailed analysis of each resource is provided as follows in a separate appendix, along with other background information:

- Appendix B on wetlands (as well as floodplains);
- Appendix C on brine discharges to the Gulf Coast;
- Appendix D on species names;
- Appendix E on EFH;
- Appendices F, G, and H on federally listed species in Louisiana, Mississippi, and Texas, respectively; and
- Appendix I on state-listed species.

DOE assessed potential impacts on federally and state endangered and threatened species, managed fisheries, and marine mammals, respectively, based on information provided by and Section 7 Consultation with the USFWS, the National Oceanic and Atmospheric Administration (NOAA) Fisheries, and various state agencies. DOE reviewed the life characteristics, designated critical habitat, and preferred habitat of each special status species against the actions and locations associated with each proposed new and expansion site.

**Special status species**

State and federally listed threatened, endangered, and candidate species; marine mammals; federally managed fisheries; and the U.S. Forest Service's Regional Forester Sensitive Species.

DOE evaluated the potential impacts of the proposed candidate alternatives and no-action alternative on the federally listed species (see appendices F, G, and H) to prepare and document its findings of "no effect" and "may affect" in accordance with the definitions found in the Final ESA Section 7 Consultation Handbook (Consultation Handbook) dated March 1998 and a letter from USFWS dated September 29, 2005 (see appendix K), as presented below. For the purpose of the evaluation, DOE has defined "may affect" to include "is not likely to adversely affect" or "is likely to adversely affect."

- **No effect.** The proposed action would not affect federally listed species or designated critical habitat because individuals or suitable habitat for the species are not present in or adjacent to the action area.

- **Is not likely to adversely affect.** The project may affect listed species and/or designated critical habitat; however, the effects would be discountable, insignificant, or beneficial. Certain avoidance and minimization measures may be needed in order to reach this level of effect.

- **Is likely to adversely affect.** Adverse effects to listed species or designated critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect would not be discountable, insignificant, or beneficial. If the overall effect of the proposed action would be beneficial to the listed species, but also would be likely to cause some adverse effects to individuals of that species or designated critical habitat, then the proposed action "is likely to adversely affect" the listed species.

The evaluation of significance of the potential impact takes into account both direct and indirect impacts, the duration of the impact, cumulative impacts, and mitigation measures that would be implemented. For the finding of "may affect," DOE acknowledges that it has not completed onsite surveys where potential habitat exists for a special status species. In those cases, DOE cannot reach a finding of "is not likely to adversely affect" or "is likely to adversely affect." Therefore, DOE can reach only a finding of "may affect" in the draft EIS. DOE has initiated informal Section 7 Consultation with and secured agreement in principle from USFWS concerning this approach. Once DOE has issued a Record of Decision and selected a specific new site and expansion sites for development, DOE would perform site- and species-specific habitat screenings and/or surveys for all the species that received a finding of "may affect" under that alternative. If any part of the selected action may adversely affect a listed species, DOE would complete a formal consultation with USFWS and/or NOAA Fisheries as mandated under Section 7 of the ESA. If the action may adversely affect a species proposed for listing, DOE would complete a conference with the USFWS and/or NOAA Fisheries. DOE would also consider impacts of the proposed action on candidate species. DOE would prepare a Biological Assessment if the proposed action had the potential to affect a federally listed species or habitat that is designated critical to their survival. DOE would implement any requirements that are contained in the Biological Opinion prepared during formal consultation by USFWS and/or NOAA Fisheries.

For the state-listed special status species, DOE consulted with state agencies (see appendix K) and reviewed the NatureServe Global Conservation Status of the species (NatureServe 2005) to obtain a broader perspective. NatureServe and natural heritage member programs have developed a method for evaluating the relative peril of species. Conservation status ranks are based on a one-to-five scale ranging from critically imperiled (G1) to secure (G5). The global status assessments are based on the best available information and consider a variety of factors such as abundance, distribution, population trends, and threats. Once DOE has issued a Record of Decision and selected a specific new site for development, it would perform site- and species-specific surveys or habitat screenings for all the state-listed species that received a finding of "may affect" under the alternative. DOE would evaluate the impacts on the listed species in consultation with the appropriate state agency. If the selected action would involve a take of a state-listed species, DOE would secure permits from the appropriate state agency and complete any mitigation required by the permit.

#### 3.7.1.3 Essential Fish Habitat

DOE generated GIS maps with EFH boundaries layered according to each of the offshore elements associated with the proposed new and expansion SPR sites to determine the potentially affected area and assess potential impacts on EFH and managed species in the Gulf of Mexico. The proposed new and expansion SPR sites with offshore elements include Big Hill, Stratton Ridge, Chacahoula, Clovelly, Clovelly-Bruinsburg, and Richton. Based on data from NOAA Fisheries, the composition of species managed under the Magnuson-Stevens Fishery Conservation and Management Act is identical for four of the potential brine diffusion sites and their accompanying pipeline ROWs. EFH data for the Clovelly site is not available; however, given that the environmental conditions at Clovelly are very similar to the other four diffuser sites, DOE assumed that the species composition was similar at all potential SPR sites.

DOE evaluated potential impacts on EFH by defining the spatial boundaries of the EFH close to offshore pipelines and brine diffuser and reviewing the life characteristics and preferred habitat of each managed species with a designated EFH against the offshore actions and locations associated with each proposed new and expansion site. Appendix E is the EFH Assessment Report required by the Magnuson-Stevens Fishery Conservation and Management Act. It provides a more detailed description of the process used by DOE to evaluate the impacts to EFH.

#### 3.7.1.4 Special Status Areas

DOE defined the special status areas to include federally controlled lands (national forests, national parks, national wildlife refuges, wilderness areas, and national marine sanctuaries), wild and scenic rivers, and lands managed by states, including state forests, state parks, bird rookeries, and wildlife management areas. DOE identified these special status areas through geo-referenced data sources including the Texas Colonial Waterbird Census (USFWS 2006a) and ESRI's street map. DOE reviewed the location of such areas in relation to the actions and locations associated with each proposed new and expansion site.

The evaluation of the severity of the potential impact takes into account the uniqueness of the local resources that would be affected, the duration of the impact, direct and indirect impacts, and potential mitigation measures that would be implemented.

### 3.7.2 Impacts Common to Multiple Sites

This section describes the direct and indirect impacts of the activities that are common at proposed new and expansion sites. The discussion of the common impacts associated with each proposed new and expansion site presents the magnitude of the impacts that would be similar at all locations, thereby avoiding the need to discuss the same impact on a site-by-site basus. Subsequent sections analyze the magnitude of these impacts in the context of the site-specific environment.

The construction and operations and maintenance of a new or expansion SPR site or its associated infrastructure would involve many similar activities across all proposed sites or associated infrastructure. These activities generally would have the same types of impacts, although the scale of those impacts would vary from site to site. For example, clearing a site for construction would result in a loss of vegetation and disturbance to wildlife. The nature and magnitude of these impacts would depend on the size of the area and the specific plant and animal community in and around it. In this section, DOE describes how common activities could generally affect biological resources. The section reflects the general characteristics (upland and wetlands and open water) of an area where a new facility (the storage site, RWI structure, wastewater treatment plant, tank farm, marine terminal, brine injection diffuser or well injection field, and access road) would be constructed. Because pipeline and power line ROWs represent narrow linear corridors that would be allowed to revegetate, DOE prepared a separate discussion of the common impacts associated with the ROWs. The discussion of the common impacts includes mitigation measures specific to impacts and a discussion of the common mitigation measures that DOE may implement. At the conclusion of the construction impacts section, DOE presents a discussion of common wetland mitigation measures that would be implemented as appropriate. Where appropriate, the unique context and severity of these potential impacts and associated mitigation measures are presented in the site-specific analysis.

#### 3.7.2.1 Construction Impacts

The following subsections present the common impacts associated with construction of all the proposed facilities with the exception of pipeline and power line corridors. The ROWs involve linear construction activities, resulting in short- and long-term impacts that differ from construction of the other facilities. A discussion of the common impacts in proposed ROWs is presented after the discussion of impacts on uplands, wetlands, and open water.

##### *3.7.2.1.1 Clearing, Grading, and Construction Activities*

The upland and wetlands portions of all new and expansion storage sites, RWIs, access roads, brine diffusers or injection wells, and terminals would require clearing, grubbing, and grading activities within the proposed site boundary or construction footprint. Additional clearing of a 300-foot (91-meter) security area would be completed around the new storage sites. For existing SPR sites, the additional clearing would occur only around the expansion area. Because no land expansion would occur at the Bayou Choctaw storage site under the proposed action, no additional clearing would be required.

The clearing and grading activities would result in direct and indirect impacts on the upland and wetland communities. Direct impacts would include the conversion of forests and alteration of plant communities. DOE would convert upland and wetland communities within the site boundary into managed lawns, managed fields, emergent wetlands, or open water. Woody vegetation would generally not be permitted to remain at the site or be re-established.

The dust and increased runoff associated with construction activities could affect adjacent plant and wetland communities and affect downstream wetlands by increasing siltation and turbidity. Clearing, grubbing, and grading activities and the loss or alteration of upland plant and wetland communities would also affect some wildlife. Mobile wildlife species, such as deer and birds, would be displaced while less mobile species, such as turtles, snakes, and small rodents, might be unable to escape. Displaced species and species that are not tolerant of human disturbances would migrate from the construction area to suitable surrounding areas if they are able to do so. The displacement could, at least temporarily, increase the density of wildlife in the surrounding areas and increase the inter- and intra-specific competition for available resources, including foraging and nesting areas. Although some individuals would be affected, no changes in wildlife populations are expected to occur on a regional scale. Small animal species, such as reptiles, amphibians, and small mammals, would be excluded from areas that are cleared because of loss of habitat.

In addition to clearing and grading, DOE would import and place fill materials to support permanent infrastructure such as well heads, brine ponds, package wastewater treatment plants, buildings, and access roads. Placement of fill in wetlands would cause a permanent loss of wetland functions and would have the potential to increase erosion and sedimentation into the surrounding areas. Increases in turbidity could decrease the concentration of dissolved oxygen in the water column of nearby water bodies. For aquatic species, the increase in runoff and erosion and the associated increase in suspended particles during construction could interfere with the ability of those species to respire, feed, and find suitable habitat.

Open water construction, primarily dredging, would affect some **benthic** organisms and their habitat.  It could also release sediments into the water column, thereby increasing turbidity and decreasing the concentration of dissolved oxygen.  Because of the increased turbidity and reduced concentration of dissolved oxygen, fish and other mobile organisms would likely avoid such areas.

The temporary impacts such as siltation from construction are expected to be relatively small because the construction would be temporary and would use appropriate best management practices required by the approved Erosion and Sediment Control Plan and Stormwater Pollution Prevention Plan and NPDES stormwater permit for construction activities.  As described in chapter 2, DOE would adhere to all relevant and applicable state and federal best management standards to minimize erosion and sedimentation.  Standard construction operating procedures—including dust suppression, use of silt fencing, silt curtains/cofferdams, sediment detention basins, reseeding, stabilization of denuded areas, slope protection, and use of hay bales—would be employed to reduce impacts.

The impact on wetlands and uplands due to temporary disturbance, permanent conversion, or filling is discussed in the site-specific discussions and appendix B.  For the selected alternative, DOE would conduct a delineation of waters of the United States, including wetlands in accordance with the USACE Wetland Delineation Manual (1987) and subsequent regulatory guidance.  A wetland delineation is a survey conducted by a qualified person to determine the extent of a jurisdictional wetland and the types of wetland that would be affected by a project.  A jurisdictional wetland must exhibit water tolerant vegetation, hydric soils, and wetland hydrology.  Wetlands would be delineated on the selected new and expansion sites, along all ROWs, and at all locations for proposed ancillary facilities such as storage terminals and brine disposal well fields.  Only wetlands that are regulated under Section 404 and 401 of the Clean Water Act would be delineated.  Isolated wetlands are generally not considered within the jurisdiction of the USACE.  DOE would coordinate with the appropriate USACE District to secure a jurisdictional determination (or confirmation) of the delineation.

DOE would prepare the appropriate application for a Section 404 Permit from the USACE and the 401 Water Quality Certificate from the relevant state agency.  This permit process requires a comprehensive analysis of alternatives to avoid impacts to jurisdictional wetlands and waters of the United States, an analysis of measures taken to minimize impacts, and a compensation plan to mitigate for unavoidable impacts to jurisdictional waters of the United States, including wetlands.  Avoidance and minimization strategies could include measures such as refinement or modification of facility footprints to avoid wetlands, minimization of slopes in fill areas, use of geotechnical fabric under wetland fills to minimize mudwave potential, and restoration of the disturbed wetlands outside the permanent footprint of the facility.  The compensation plan would be developed by DOE and submitted with the permit application.  Compensation for unavoidable impacts to jurisdictional wetlands could take the form of preservation, restoration, or creation of wetlands in the project area or within the watersheds affected.  DOE could also use payment of an lieu-of fee where the USACE and state allow such payment or the purchase of mitigation credits from an approved wetland mitigation bank in the appropriate service area (region or watershed).  The compensation plan would include provisions for protecting the mitigation site through a conservation easement or similar mechanism and postconstruction mitigation monitoring to evaluate the success of the mitigation.  Additional detail on the compensation plan is included section 3.7.2.1.3.

The USACE and state agency would review and approve the compensation plan through the Section 404/401 permit process.  DOE's mitigation plan would be consistent with the EPA and USACE proposed rulemaking on wetland mitigation entitled *Compensatory Mitigation for Losses of Aquatic Resources*, *Proposed Rule* (33 CFR Parts 325 and 332). DOE's mitigation actions would ensure that the proposed action is compliant with Executive Order (E.O.) 11990 on Wetlands Protection and 10 CFR Part 1022, which are DOE's implementing regulations for the E.O. Dredge spoils, if generated, would be disposed of in a manner approved by the USACE. DOE would identify beneficial uses for the dredge spoil (such as wetland restoration) as appropriate. DOE would secure section 10 permits wherever required for proposed obstructions in navigable waterways that are regulated by the U.S. Coast Guard and USACE under the Rivers and Harbors Act.

#### *3.7.2.1.2 Right-of-Way Construction Activities*

DOE would construct power lines, temporary construction access roads, and pipeline ROWs under many of the alternatives considered for the proposed action. Power line construction activities would involve clearing and grubbing, while pipeline construction activities would involve clearing, grubbing, trenching, and grading. Because of its linear nature, an ROW may pass through an array of upland, wetlands, and open-water communities, which dictate different methods of construction. DOE located the ROWs along existing power line, pipeline, canal, and road corridors wherever possible and practicable in order to minimize the disturbance to undisturbed and higher value plant communities and wetlands. As presented in chapter 2, DOE would use specific methods for construction in the following areas:

- Uplands,
- Wetlands without standing water,
- Inundated wetlands (wetlands with standing water),
- Inland open water, and
- Offshore (these methods are presented in terms of brine disposal and offshore pipelines).

DOE would coordinate construction in the ROW, from initial surveying and clearing to backfilling and grading, to minimize habitat disturbance and erosion. These temporary disturbances, at any single point along the new ROW, would last about 6 to 10 weeks. During construction, wildlife would be displaced from within and adjacent to the construction ROW due to the noise, traffic, human activity, and habitat disruption. A small number of animals and **invertebrates** would be unable to escape the construction and would be killed.

<u>Construction of ROWs in upland areas</u> would result in the same common construction impacts as those presented under upland clearing, grading, and construction activities, with some exceptions. During construction, the ROW would be graded where necessary to create a level working surface to allow for safe passage of construction equipment and materials. Trees would be cut to grade. Stumps would be removed only if within 15 feet (4.6 meters) of the pipeline trench, the centerline of a power line, or where safety concerns would dictate. For pipeline trenches, topsoil would be segregated and stockpiled for use as the final backfill material to aid in postconstruction revegetation activities. After the pipeline has been placed and backfilled with subsoil horizons, the topsoil would be placed on top of the ROW and the grade would be returned to its previous topography. Excess excavated material would be removed from the construction area and used as fill material in a suitable upland area.

For power lines, monopoles would be installed, which would require minimal clearing and excavation for the installation of the 75-foot (23-meter) power line pole. Tall vegetation would be removed from the power line corridor.

<u>Construction of ROWs in wetlands</u> that are not inundated would be similar to construction in the uplands. For pipelines, the impact on the wetland community would be based on the length of the wetland crossing. For wetland crossings less than 100 feet (30 meters), wetland soils would be stockpiled in an adjacent upland area within the ROW, allowing the construction ROW width within the wetlands to be

reduced to 85 feet (26 meters) as opposed to 150 feet (46 meters). For wetland crossings more than 100 feet (30 meters), directional drilling would be used where practicable. If directional drilling was not practicable, the full construction ROW (150 feet [46 meters]) would be required for traditional trenching installation. A temporary timber road would be installed to allow passage of equipment with minimal disturbance of the surface and vegetation. The access road would be removed after construction was completed and the footprint would be regraded and revegetated with native species. Trees would be cut to grade, but stumps would be removed only within 15 feet (4.6 meters) of the pipeline trench, the centerline of a power line, or where safety concerns would dictate. Topsoil would be segregated, stockpiled, and used as the final backfill material. A vegetative buffer zone would be left between the wetland and the upland construction areas. Where wetlands are inundated, it may be impossible to segregate and stockpile the topsoil/sediment for reuse in the trench.

Impacts associated with power line construction in wetlands would include the alteration and clearing of some of the vegetation along the ROW. Where feasible, power line poles would not be placed in wetlands. The power line poles placed in wetlands would require access to the pole location, which typically would be from an adjacent pipeline corridor.

A **spud barge** is a flat-decked floating structure that has devices similar to legs, called spuds, which are lowered from underneath the barge and pushed into the waterway floor to anchor the structure in place.

<u>The construction of ROWs in inundated wetlands</u> would involve a crane mounted on specially designed pontoons equipped with tracks, referred to locally as a “marsh buggy.” The marsh buggy would travel along the centerline of the pipeline and excavate the trench. Where possible, staging areas would be set up on **spud barges** temporarily anchored in navigable waterways. As described in chapter 2, pipe would be fabricated at the temporary staging area, then floats would be attached to the pipe to minimize dragging through the wetland system, and the pipe would be pushed into the pipe trench. Once the section of pipe has been floated into place, the floats would be cut free and the pipe would be allowed to sink to the bottom of the trench. The marsh buggy would then backfill the trench with the excavated dredge material and the disturbed area would be restored. This process would keep the construction ROW to the minimum width necessary for the pipe trench and the temporary dredge spoil pile. The construction of ROWs in submerged wetlands would affect coastal and estuarine emergent wetlands that are tidally influenced and mostly submerged. Impacts associated with pipelines would include the loss of the vegetative community along the ROW and decreased functions and values of the surrounding wetlands due to increased turbidity, erosion, and sedimentation. In addition to the impacts within the ROW, for remote pipeline routes primarily associated with Chacahoula, temporary staging areas would be established within or adjacent to navigable waters. Because of the submerged conditions, topsoil would not be segregated from the subsoil. Such measures would result in a temporary impact on the vegetative and wetland communities along and adjacent to the pipeline ROW as the emergent wetland vegetation typically would revegetate the area in two to three growing seasons.

<u>Open water construction</u> in a river, lake, or stream would cause temporary sedimentation and turbidity from any pipeline trenching. Trenching would be used in river and stream crossings less than 100 feet (30 meters) wide. Pipeline trenching effects would also include alteration of stream substrate, reduction in macroinvertebrate abundance and diversity, and a potential reduction in fish populations. In small streams, the increased suspended sediment concentration would dissipate relatively quickly depending on stream flow, keeping the impacts of trenching relatively localized. Water bodies less than 33 feet (10 meters) wide typically would be crossed using the open trench methodology in less than a day. Slightly larger streams, between 33 feet and 66 feet (10 and 20 meters) wide, typically would be crossed in 1 to 3 days (Reid and Anderson 2006). Monitoring results have demonstrated that the effects of open trench construction on water quality and macroinvertebrate communities are short term and are not severe (Tsui

and McCart 1980; Reid and Anderson 2006). Power line poles would not be placed in a river or stream, but would be placed at opposite banks and the power line elevated above the river.

The construction of pipelines in inland open water and navigation channels (rivers and streams) 100-feet (30-meters) wide or greater would involve horizontal directional drilling, as described in chapter 2. For such situations, any power lines would be co-located under the water body with the pipeline. The water body would not be affected because the pipeline and power line would be drilled and placed beneath the water body. Indirect impacts in the adjacent open water and navigation channels may result from stormwater runoff and erosion entering the water body from the work zone and staging area.

The construction of pipelines in open coastal waters associated with the brine pipelines and some oil pipelines may involve jet sleds, dredges, or shallow-draft spud barges, and would affect the vegetation and aquatic wildlife in the open water communities. Impacts would include the loss of benthic communities, increased sedimentation in the surrounding area, and increased turbidity in the water column. As described in chapter 2, the use of jet sleds, dredges, or spud barges would be based on site-specific conditions to minimize the area affected by construction operations. The impacts would be temporary and non-persistent impacts as the wildlife and vegetation would return to the area (postconstruction). The impacts created by the construction of a pipeline across a bay or estuary would be temporary, and with the river or stream bed returning to its pre-construction conditions over time. The time required for this to occur would depend on the method of construction and the water and biological conditions.

Temporary impacts, such as siltation from construction, are expected to be relatively small because the construction would be temporary and would use appropriate best management practices in accordance with an Erosion and Sediment Control Plan, Stormwater Pollution Prevention Plan, and an NPDES stormwater permit for construction activities. As presented in chapter 2, DOE would adhere to all relevant and applicable state and federal best management standards to minimize erosion and sedimentation. Standard construction operating procedures—including dust suppression, use of silt fencing, sediment detention basins, reseeding, stabilization of denuded areas, slope protection, and use of silt curtains in open water—would be employed to reduce impacts.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (regrade to preconstruction contours and greater than 100 feet [30 meters]) or in areas containing sensitive habitat. DOE would regrade to preconstruction contours and reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.

##### *3.7.2.1.3 Wetland Mitigation Common to Multiple Sites*

DOE's primary mitigation measure for wetland impacts would be avoidance and minimization. As described in chapter 2 and in the preceding text, DOE would locate temporary access roads and staging areas in upland areas or would use temporary floating staging areas, as appropriate. Larger wetlands (about 100 feet [30 meters] or wider) would be directionally drilled wherever practicable. DOE would continue to refine the concept plans for the site storage areas and terminals to avoid placing aboveground structures and fill in wetlands as much as practicable. Where the security buffers around the storage areas or permanent ROW easements extended into wetlands, DOE would preserve emergent wetlands and allow herbaceous species to re-establish themselves within the forested wetlands that were cut. Within the temporary construction easements of the ROWs, DOE would promote the restoration and re-establishment of the existing plant community by stockpiling and reusing the hydric soils (and their diverse seed bank) from the disturbed wetlands. In this way, some wetland functions and values would be preserved. In addition, wetlands would be restored more quickly if there was a temporary impact to wetlands or a permanent conversion from forested to emergent wetlands. For wetland impacts that cannot be avoided, DOE would implement one or more of the following mitigation measures:

- As described in chapter 2, DOE would install trench plugs (using low-permeability clay placed around the pipe) at intervals to prevent the unintentional draining of water from the wetlands or mixing of fresh-water and marine wetland systems.

- Excess dredged material would be disposed of in consultation and in accordance with permits issued by USACE and the state. Dredge spoils would be used for wetland creation or restoration activities wherever possible.

- Where possible, power line poles would not be placed in wetlands.

- If the wetlands are forested, tree stumps and root mass from all plants would be left intact, except where this would interfere with excavation of the pipeline trench.

- For wetlands that are not inundated or that have shallow standing water, equipment would be supported on timber mats or on prefabricated equipment mats. Spoil from the trench would be stored within the ROW on the nonworking side of the pipeline ROW. Topsoil would be stored separately, where appropriate. Stockpiling of soil would be interrupted at appropriate intervals to prevent change of surface water flow (sheet flow). If the bottom of the pipeline trench would be at a lower elevation than the wetlands, a permanent trench plug of impervious clay would be placed into the trench at the wetland boundaries. If a fresh-water marsh (palustrine emergent wetlands) would likely be exposed to brackish or marine water by connection with these water sources via the pipeline trench, then temporary trench plugs would be used during construction and permanent trench plugs would be installed after the pipe is lowered into the trench. The trench plugs would be installed between the fresh-water marsh (palustrine – emergent wetlands) and any adjacent body of water with a higher salinity.

- Excavated wetlands would be backfilled with either the same hydric topsoil that was removed or a comparable material capable of supporting similar wetland vegetation. Original wetland elevations would be restored and adequate material would be used so that following settling and compaction of the material, the proper preconstruction elevation would be attained. After backfilling, DOE would implement erosion protection measures to stabilize and revegetate the site and prevent further wetland degradation.

- DOE would remove all construction-related materials, such as timber mats, rip rap, silt fence, prefabricated equipment mats, and geotextile fabric, upon completing construction. Where the pipeline trench may drain wetlands, DOE would construct trench breakers and/or seal the trench bottom as necessary to maintain the original wetland hydrology. For each wetland area crossed, DOE would install a permanent slope breaker and a trench breaker at the base of the slopes near the boundary between the wetlands and the adjacent upland areas. The trench breaker would be located immediately upslope of the slope breaker. DOE would not use fertilizer, lime, or mulch along the ROW within wetlands, nor immediately upslope from wetlands. Reseeding activities would would use a seed mix of native wetland species. For ongoing ROW maintenance, DOE would limit vegetation to a narrow corridor over the pipeline and to either side to facilitate periodic pipeline corrosion and leak surveys. DOE would not use herbicides or pesticides in or within 100 feet

(30 meters) of wetlands. DOE would conduct a postconstruction monitoring program of the disturbed wetlands within the ROWs to ensure that the hydrology and wetland plant community is re-establishing successfully. The monitoring would follow approved procedures contained in the USACE Section 404 permit. If the monitoring showed that wetland plants and hydrology were not successfully re-established, DOE would implement corrective action.

- **Other potential mitigation measures or best management practices (to be considered during permit application and design):**
  - Other than the construction ROW, only use pre-existing roads within wetlands. Do not construct new access roads through wetlands.
  - Assemble a pipeline in an upland area and use the push technique to place the pipe in the trench where water and other site conditions allow.
  - Minimize the duration of construction-related disturbance within wetlands.
  - Schedule the construction-related disturbance during the dry season.
  - Limit construction equipment operating in wetland areas to equipment needed to clear the ROW, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the ROW.
  - Cut vegetation off at ground level, leaving existing root systems in place, except within the path of the pipe trench.
  - Do not pile woody vegetation within wetlands.
  - Do not store hazardous materials, chemicals, fuels, or lubrication oils, or perform concrete coating activities in wetlands or within 30 yards (9.1 meters) of any wetland boundary.
  - Attempt to refuel all construction equipment in an upland area at least 30 yards (9.1 meters) outside a wetland boundary. If construction equipment must be refueled within wetlands, follow fueling procedures outlined in project-specific spill prevention or contingency plans.
  - Do not use rock, soil imported from outside the wetlands, tree stumps, or brush rip rap to stabilize the ROW.
  - If standing water or saturated soils are present, use low-ground-weight construction equipment or operate normal equipment on timber mats or prefabricated equipment mats.
  - Do not cut trees outside the construction ROW to obtain timber for equipment mats.
  - Do not discharge hydrostatic test water into wetlands.

Where jurisdictional wetland impacts cannot be avoided, DOE would conduct the required wetlands delineations, secure jurisdictional determinations, and then complete and submit the appropriate permit application to USACE and the state agency. Unavoidable wetland impacts would be compensated by creating, restoring, and/or preserving wetlands, paying an in-lieu of fee, or buying credits from an approved mitigation bank. DOE would develop and submit the compensation plan as part of the Section 404/401 permit process. Wetland creation would typically involve alteration of an upland (generally though excavation) to create the proper hydrology for wetlands and planting of wetland species at the site. Restoration typically involves the modification of a previously disturbed wetland that may no longer function as a wetland because it has been ditched or drained. The wetland hydrology is restored and wetland species are planted at the site. Wetland preservation typically involves the purchase and preservation in perpetuity of existing wetlands.

Compensation credits and a compensation ratio would be established based on the functions and values of the affected wetland, the acreage of wetland impacts, and the type of compensation offered. Because the compensation ratio is based on the functions and values of the wetlands and the type of mitigation proposed, one compensation credit does not necessarily equate to one acre of wetlands. The type of mitigation is important in determining how many acres need to be preserved, created, or restored to equal one compensation credit. For example, the compensation required for preservation of wetlands would be much higher than that for wetland restoration to reach one compensation credit.

The type of wetland affected and its rarity are important in determining the compensation ratio. The filling of **palustrine** forested wetlands would cause a complete loss of functions and values of a relatively rare and ecologically important resource. This type of impact would require the highest compensation ratio, such as 5:1 or 7:1. On the other hand, impacts to emergent wetlands within the permanent easement for pipeline corridors would only cause a temporary loss of the wetland functions and values and would probably require compensation at the lowest ratio, such as 3:1 or 2:1.

Representative mitigation ratios for unavoidable impacts to jurisdictional wetlands are presented in Table 3.7.2-1 Wetland Mitigation Ratios. If required by the USACE, the compensation ratios would be determined through a formal assessment of wetland functions and values, which would be completed during the permit application stage. The Vicksburg, Mobile, and New Orleans Districts indicated that they would probably require DOE to use the USACE Charleston District methodology for determining wetland compensation credits (USACE Charleston District 2002).

**Table 3.7.2-1: Approximate Wetland Mitigation Ratios**

| State | Approximate Compensation Requirements | | |
|---|---|---|---|
| | High Wetland Functions and Values | Moderate Wetland Functions and Values | Low Wetland Functions and Values |
| Louisiana | 5:1 | 3:1 | 2 to 1:1 |
| Mississippi | 5:1 | 3:1 | 2 to 1:1 |
| Texas | 7:1 | 5:1 | 3 to 1:1 |

Notes:

These are estimates of the compensation ratios that may be required by regulatory agencies. The actual requirements would depend on several factors, including existing wetland conditions and their functions and values. If required for the selected alternative, a formal assessment of affected wetland functions and values would be completed to determine appropriate compensation ratios.

Source: U.S. Army Corps of Engineers, New Orleans, Vicksburg, Galveston, and Mobile Districts

#### *3.7.2.1.4 Brine Disposal Systems*

New brine disposal systems that discharge into the Gulf of Mexico would be constructed for the proposed new sites at Chacahoula, Richton, and Stratton Ridge. Existing brine disposal systems that discharge into the Gulf of Mexico would be used at Clovelly, Clovelly-Bruinsburg, Big Hill, and West Hackberry. The Bayou Choctaw and West Hackberry expansion sites would use underground injection wells for brine disposal. Brine disposal pipeline and diffuser construction would be similar for each site. The components of the brine disposal system are discussed further in section 2.3.3. Construction impacts would be limited to areas immediately surrounding the pipeline trench and staging area. These impacts would include increased turbidity due to sediment disturbance and noise.

Some loss of common sedentary macroinvertebrates would be expected during the excavation, laying, staging, and hydraulic jetting of the pipeline. Sensitive mobile species, including finfish and marine mammals, would move out of the area during the duration of construction. Impacts associated with pipeline construction would be temporary and organisms would be able to recolonize the area postconstruction. Because a portion of the diffuser and pipeline would be located in jurisdictional waters, DOE would conduct the required delineations, secure jurisdictional determinations, and complete and submit the appropriate Section 404/401 permit application. The permit/water quality certification would require that impacts to jurisidictional waters be minimized and that appropriate best management practices are implemented to protect aquatic resources.

Brine disposal in the Gulf of Mexico would be associated with new cavern development at proposed new storage sites at Clovelly, Clovelly-Bruinsburg, Chacahoula, Richton, and Stratton Ridge, and at the Big Hill expansion site. The process of brine creation and details on brine disposal are discussed in section 2.3.3, and details on the potential impacts from the brine plume are discussed in section 3.6 and appendices C and E. DOE would secure an NPDES discharge permit from the appropriate state agency for the brine diffusers. The permit would establish effluent discharge standards, a permitted flow rate, and regular monitoring and reporting requirements that protect water quality and aquatic resources.

Several studies have examined the effects of brine discharge on the composition of bottom-dwelling organisms at brine diffuser sites (DOT 1976 V.2; Barry A. Vittor & Associates 2002). In a 2001 to 2002 study on the impacts of the LOOP and associated facilities, no measurable impact on benthic assemblages was found at the brine diffuser site (Barry A. Vittor & Associates 2002). A study conducted by Texas A&M University in 1991 examined the impact of brine discharge from the West Hackberry and Bryan Mound diffuser sites on water quality and associated biota. This study determined through extensive postdisposal analyses of bioassays and sediment samples that impacts associated with brine disposal at these sites have not been significant. No significant biological impacts were observed at either diffuser site and levels of metals, ions, and other contaminants were similar to those detected at control stations. The researchers found that a decrease in the abundance of benthic species occurred mainly within 31 to 2,000 acres (12.5 to 809 hectares) of the diffusers at Bryan Mound and West Hackberry (DOE 1992a). Fish that feed on bottom-dwelling organisms would move from the diffuser area to feed in unaffected areas.

The population of commercially important white shrimp and brown shrimp could vary based upon the salinity changes associated with brine discharge. Subadult brown shrimp prefer high-salinity areas while white shrimp are typically found in areas of lower salinity. White shrimp are thought to have a wider variation of salinity tolerance, but might still move to other areas to avoid higher salinity in the area around the diffuser (DOT 1976 V.2).

##### *3.7.2.1.5 Essential Fish Habitat*

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act established a new mandate for the NOAA Fisheries, regional fishery management councils, and other federal agencies to identify and protect important marine and **anadromous** fish habitat. The EFH provisions of the Act support one of the Nation's overall marine resource management goals in maintaining sustainable fisheries. Essential to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. The fishery management councils, with assistance from NOAA Fisheries, have delineated EFH for federally managed species.

The composition of the federally managed species with designated EFH in the Gulf of Mexico depends on the distance offshore; however, they are largely the same at each of the potential brine disposal sites associated with Big Hill, West Hackberry, Chacahoula, Clovelly, Clovelly-Bruinsburg, Richton, and Stratton Ridge. For the nearshore portions of the brine pipelines located in estuarine environments, the federally managed species with designated EFH are brown shrimp, cobia, gray snapper, greater amberjack, king mackerel, lane snapper, pink shrimp, red drum, red grouper, red snapper, Spanish mackerel, stone crab, and white shrimp (GMFMC 2006). All of these species are also located at the potential offshore brine diffusion sites, along with spiny lobster and yellowtail snapper. Appendix E includes a detailed discussion of the impacts to EFH and managed fisheries.

DOE evaluated the impacts on EFH recognizing that the managed species found throughout the Gulf of Mexico region are sufficiently mobile to avoid areas of disturbance. Any impacts associated with construction, including increased sedimentation and possible disruption of species movement would be temporary. The potentially affected environment would quickly revert to pre-disturbed conditions once construction had been completed. The only potentially lasting effect of construction could be alteration of sediment type. The increased concentration of suspended and bedded sediments associated with construction may change the composition of the sediment, temporarily altering the diversity of organisms that live in the soft sea bottom. Complete recovery of soft-bottomed benthic communities may take up to 2 years from the time of construction, or longer for shell substrate. Although the recovery period is long, the project area is small relative to the amount of substrate habitat that exists throughout the Gulf of Mexico.

Depending on the site, the brine diffusion systems would operate for 4 to 5 years during cavern solution mining and could alter the physiochemical makeup of the water column. The brine would leave the diffusers at a rate of 30 feet (9.1 meters) per second at or near ambient temperature, and at a concentration of about 260 parts per thousand (ppt). The area immediately adjacent to the brine port nozzles would have an average estimated salinity increase of 4.7 parts per thousand. From the initial diffusion point, the brine would spread outward in plumes of decreasing salinity. The total potentially affected area has been modeled for each site and is presented in appendix B.

The plumes would range in extent, but would generally be similar with respect to shape and maximum salinity increase. The brine discharge for the Chacahoula site would have a slightly higher increase in salinity because of the unusual bathymetry around the brine diffusers (see appendix C). The size of the diffusion plumes would be up to 7.2 square nautical miles (25 square kilometers) for the +1 part-per-thousand contour, 4.0 square nautical miles (14 square kilometers) for the +2 part-per-thousand contour, 2.0 square nautical miles (7.0 square kilometers) for the +3 part-per-thousand contour, and 1.2 square nautical miles (4 square kilometers) for the +4 part-per-thousand contour. However, because of the freshwater influx from the Mississippi River, Gulf of Mexico species are generally more capable of tolerating salinity changes than are those species located near the proposed brine diffuser site. Furthermore, the majority of the federally managed species are mobile and would be able to quickly leave any affected areas. The benthic community near the diffuser could be altered by increased salinity. In addition, the species composition would change slightly to those more tolerant of increased salinity. The area of potential benthic community changes would be relatively small compared to the range of the species found throughout the Gulf of Mexico.

#### 3.7.2.2 Operations and maintenance Impacts

The following subsections discuss the operations and maintenance impacts associated with new and expansion sites and tank farms, RWI structures, pipeline and power line ROWs, and brine diffusion systems.

##### *3.7.2.2.1 New and Expansion Storage Sites and Terminals*

The operations and maintenance activities at a new or expansion storage site or terminals would include lawn maintenance, security lighting, equipment maintenance, testing, increased noise from equipment and workers, and vehicular traffic in and around the facility. Such activities would preclude non-tolerant wildlife species from using the site and immediately surrounding habitats. An 8-foot (2.4-meter) higher security fence would be constructed around a new SPR storage facility. The security fence would prevent most animals from returning to the site; however, some animals such as songbirds, raptors, waterfowl, armadillos, otters, egrets, herons, and alligators have been reported to visit or inhabit the existing SPR storage sites.

The structures and lighting associated with a new or expansion site or terminal may increase the number of injuries or mortality of resident and migratory birds. The proposed sites and terminals are located within two important and slightly overlapping North American migratory flyways—the Central and the Mississippi. The artificial lighting on tall structures can disorient birds migrating at night and cause collisions with the lighted structures or become fatigued from hovering around such light sources (Jones and Francis 2003).

> Mitigation: DOE would use down-shielded, low-mast lights on new buildings and storage tanks. Existing SPR facilities mitigate impacts on migratory birds that frequent the facilities during the year (DOE 2004f). During normal operations, environmental safety and health managers survey the property for migratory birds. Nests, when discovered, are flagged for the duration of nesting season and use of certain equipment, such as landscaping equipment or other non-mission critical equipment, is limited or prohibited to minimize the impact on migratory birds. These activities are conducted with the cooperation of the USFWS.

##### *3.7.2.2.2 Raw Water Intake Structure*

The operation of the RWI withdrawal during cavern creation, fill, and drawdown would affect aquatic communities by reducing the quantity of water in the water body and potentially altering currents. The intakes for new sites would withdraw up to 1.0 to 1.2 MMBD (42 to 50 million gallons per day) for solution mining during the 4- to 5-year construction of the caverns. The intake also could affect aquatic organisms by entraining organisms small enough to pass through the mesh screens or entrapment of larger aquatic organisms on the screen. Because the RWI structures would have a traveling screen that moves across the intake flow, most organisms would not become impinged for extended periods of time. The screen would travel across the intake current, picking up most aquatic organisms and carrying them back to the stream. Small aquatic organisms, such as juveniles, larval stages, small adults, and dispersed eggs, that are entrained would not be returned to the stream. Larger fish, mammals, and other large animals would be protected from the intake structure by the combination of trashbars, a relatively low intake velocity of about 0.5 feet per second (0.15 meters per second), and the size of the mesh in the screens (about 0.5 inches [1.3 centimeters]). Studies have shown that large volume water intake structures can impinge and entrain thousands of fish during the course of a year, but effective traveling screens and bypass systems can ensure a survival rate of 80 to 90 percent of the impinged fish (Henderson and Seaby 2000). The severity of the impact from impingement and entrainment due to large volume intakes depends on the site-specific conditions at the intake site, the composition and life history of aquatic species, and whether those species disperse eggs in the water column or lay eggs in a nest.

The operation of the water withdrawal pumps at locations along the ICW (for Stratton Ridge, Big Hill, and Chacahoula) would not reduce the quantity of water in the canal because the ICW waterway is tidal; however, the operation of the pumps would have minor localized effects on the currents in the ICW and could affect the salinity gradient by allowing higher salinity water to migrate further upstream. The RWI for the Clovelly site would be located on a tidally-influenced canal and the RWI for the Bruinsburg site would be located on the Mississippi River. The operation of water withdrawal pumps on the Leaf River for the Richton site could significantly reduce the streamflow needed to create habitats for aquatic organisms, including special status species and their designated critical habitats. Further, water withdrawals during low streamflow periods could increase the rate of fish entrainment and impingement in the RWI. This is discussed in detail in section 3.7.7. The operation of the RWI would also generate noise that could disturb nearby wildlife and aquatic organisms, especially those that are sensitive to disturbance or that may be nesting, breeding, or caring for young. The RWI would also require security lighting and a 300-foot (91-meter) security buffer. Artificial lighting can disorient birds migrating at night and cause them to collide with lighted structures.

The construction and operation of the RWI would require DOE to complete and submit the Section 404/401 permit application to the USACE and appropriate state agency. The permit application would require that DOE demonstrate avoidance and minimization of impacts to aquatic resources. Other resource agencies such as the USFWS, NOAA Fisheries, and the state agency responsible for water resources/fisheries would be involved in the review of the permit application. DOE would coordinate with these agencies during the permit process and incorporate their recommendations into the design of the facility where possible.

> Mitigation: Should the RWI be located near a noise sensitive area—for example, a national wildlife refuge, nesting area for a special status species, or bird rookery—noise attenuation (such as concrete enclosures and/or use of low noise pumps) would be incorporated into the structure.

> Mitigation: If the selected alternative involves a new RWI and water source with vulnerable special status species, DOE would modify the design and use appropriate screen size, intake velocity, withdrawal limits, and screen orientation to minimize the impact to that species. The design and construction method for the RWI would be reviewed by the USACE, USFWS, NOAA Fisheries, and appropriate state agency as part of the Section 404/401 permit process.

> Mitigation: DOE would use down-shielded, low-mast lighting at the RWI to minimize the impacts to migratory birds.

#### *3.7.2.2.3 Rights-of-Way*

DOE would actively maintain a portion of the pipeline and power line ROWs to prevent trees and dense scrub-shrub communities from revegetating in the corridor. The maintenance would involve periodic mechanical clearing of shrubs and trees using a mower, bush-hog, or marsh buggy or periodic pesticide application to suppress woody vegetation. The linear corridors created by new and expanded ROWs can contribute to habitat loss and fragmentation and allow the spread of exotic organisms (invasive species). The impacts of an ROW depend highly on the sensitivity of biota and are greatest when the managed vegetative composition of the ROW sharply contrasts with the surrounding habitat (Graham 2002). Some sensitive species, such as neotropical migrant songbirds, that are in decline along the Gulf Coast, have experienced diminished population levels along pipeline corridors 50- to 75-feet (15- to 23-meters) wide due to habitat loss and fragmentation (Rich et al. 1994). ROWs comprised of grasses and shrubs act as barriers to the crossing of other forest sensitive species, limiting overall habitat availability for some organisms and dividing breeding populations. Invasive species and other generalist organisms tolerant of modified and fragmented habitat conditions within the pipeline corridors can out-compete native vegetation that is sensitive to disturbance. Invasive species can reduce local biodiversity by out-competing native species and can reduce local wildlife habitat and food availability. Maintained corridors can lead to the spread of exotic organisms for several years after their creation (Zink et al. 1995). Examples of exotic species prevalent in southern forests and observed during site visits to the proposed storage sites include the Chinese tallowtree and kudzu (Graham 2002). Other invasive species that are likely to be present in uplands, wetlands, or water bodies along the proposed ROWs and/or the storage and terminal sites include hydrilla, giant salvinia, cogon grass, fire ant, zebra mussel, and nutria.

Several of the candidate sites and proposed ROWs have already experienced significant invasion by the Chinese tallowtree, an introduced species. As required by Executive Order 13112 (Invasive Species), DOE would implement appropriate measures to control invasive species on the selected site. Some native plants and wildlife may actually benefit from the creation of herbaceous dominated corridors, especially if the surrounding region is dominated by forest. In such a case, the establishment of a different type of plant habitat can enhance the local plant and animal biodiversity.

The operations and maintenance impacts associated with the power line ROWs would be the same as those described above. Low-growing vegetation would remain intact under the power lines, while tall vegetation would occasionally need to be trimmed to maintain an adequate distance between the tops of trees and the conductors so as to not interfere with safe operation of the power line. Additional impacts would include the potential for mortality of birds and bats resulting from collisions with the lines or poles. Local movements of birds are difficult to predict since they vary seasonally and annually and are often linked to climatic conditions. For this reason, the number of potential collisions with poles and/or power lines cannot be quantified or predicted with any specificity. Habitat adjacent to specific portions of each of the corridors determines bird abundance and the species present within that portion of the corridor.

Some mortality resulting from bird collisions with manmade structures within the power line corridor is considered unavoidable. Anticipated mortality levels are not expected to result in long-term loss of population viability in any individual species for any of the proposed corridors because mortality levels are anticipated to be low throughout the life of the power line. Electrocution is not expected to be a substantial hazard because the lines would be spaced wider than the largest local raptor's (eagles and vultures) wingspan. Furthermore, DOE would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996). None of the towers is anticipated to require lights for aircraft avoidance, which has been associated with nighttime collisions (Kerlinger 2000). Additional impacts to birds listed under the Migratory Bird Treaty Act would include a loss of some vegetation, an important habitat component.

The type and nature of the impact plant communities and wetlands would depend on whether the affected area is located within the permanently maintained easement (about 50 feet [13 meters] wide per pipeline) or within the temporary construction easement. Additional detail on the width and purpose of the permanently maintained easement and temporary construction easement is included in section 2.3.9.

The permanently maintained easement would be actively managed and therefore forested wetlands and upland forests would be converted to herbaceous plant communities. Upland herbaceous and emergent wetlands that were disturbed by construction would re-establish. The upland forest and forested and scrub-shrub wetlands within the temporary construction easement would re-establish within 5-25 years following construction, depending on the type of community affected. DOE would regrade to pre-construction contours, seed with native plant species, and re-apply the original topsoil, which would promote the re-establishment of the impacted community. About 33 to 40 percent of the acreage affected by the ROW would be located within the permanently maintained easement. Appendix B provides the approximate acreage of impacts to wetlands within both the temporary construction and permanently maintained easement.

> <u>Mitigation</u>: DOE management practices would reduce the actively managed area through forested areas to within 15 to 25 feet (5 to 8 meters) on either side of the pipeline, which would reduce the effects of habitat fragmentation. Where appropriate and in accordance with Federal Aviation Administration regulations, lighting would not be placed on the power line power poles. For the proposed power lines, DOE would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996). DOE would also conduct postconstruction monitoring of the

ROWs to ensure that the construction easements and wetlands hydrology are restored, original contours re-established, and appropriate species have re-established at the site. If the monitoring shows that restoration of the disturbed wetlands has not been successful, DOE would implement a plan to correct the problem.

Mitigation: DOE would actively manage pipeline ROWs to control invasive species and limit their spread along the corridor. DOE would manage the permanently maintained ROWs in accordance with DOE's 2003 standard procedures for *Offsite Pipeline Maintenance and Repair Instruction* (Publication AS16400.20) (DOE 2003c). DOE would employ the following:

- use seed mixes that are free of noxious or invasive species when reseeding disturbed areas;
- develop a management plan on sites where the Chinese tallowtree or another invasive species has already established;
- monitor the ROW corridors and sites postconstruction to determine if invasive species have colonized the area (DOE would monitor the corridors in accordance with monitoring guidelines established by state and federal resource agencies; DOE would also take corrective action such as pesticide application or mechanical clearing if invasive species become established within the corridor); and
- restore and reseed disturbed areas with native species immediately after final grades have been achieved.

#### *3.7.2.2.4 Brine Disposal Systems*

After storage cavern construction, brine would periodically be released into the Gulf of Mexico for cavern drawdown or maintenance. For example, at the existing Big Hill site, DOE released brine 220 times in 2001, 194 times during 2003, and 243 times during 2004 as part of maintenance or drawdown activities. The average brine discharge during those days was about 36,000 barrels/day with a minimum of 158 barrels/day and a maximum of 125,076 barrels/day. This frequency and volume of discharge is probably representative of the brine discharge that would occur at any of the new SPR sites once the caverns were operational. The impacts of brine disposal during operations and maintenance on aquatic organisms would be much smaller than those discussed for brine disposal during construction because the volume and duration of brine discharge during operations and maintenance generally would be less than that during cavern construction.

#### *3.7.2.2.5 Impacts of a Brine or Petroleum Release*

As discussed in section 3.7.2.1.4 and 3.7.2.2.1, there is a low risk of an accidental brine or oil discharge during operation of an SPR storage site, pipelines, and petroleum terminal. Although the likelihood of such an event is remote, the consequences of a release could be significant if the release was large and/or it migrated into a sensitive aquatic system or plant community. Sections 3.7.2.1.4 and 3.7.2.2.1 describe the probability of a release and the typical volume involved in past releases at SPR facilities. DOE would notify the appropriate state, local, and federal agencies and respond quickly to contain any release of brine or oil. Nevertheless, a large release of oil could result in mortality for plants and animals through chemical toxicity, physical smothering, respiratory interference, food and habitat loss, and inhalation or ingestion. Impacted communities can take decades to recover from a large release. A release of brine could cause significant and sometimes fatal physiological trauma to plants and animals, especially bird eggs, fish eggs, and fish larvae. If a release occurred, DOE would remediate, restore, and monitor the impacted area to help mitigate for the impact.  As discussed below, the potential impact and response action would be different depending on the type of community that was affected, including the following:

<u>If an upland community was affected by a release</u>, there would probably be plant mortality but most mobile animal species would likely be able to avoid the area.  Plants in areas covered by oil could die or be stressed due to chemical toxicity, reduced photosynthetic activity, and reduced growth and reproduction.  It is likely that some plants and non-mobile ground dwelling invertebrates and animals would die within the footprint of the area covered by the release.  However, a release into an upland would also create a better opportunity to contain and remediate the release, thereby limiting its impact.

<u>If flowing water was affected</u>, the release would potentially be distributed across a larger area.  A brine release would be diluted relatively quickly but a release of oil would not.  The flowing water would potentially distribute the oil over a wide area and thereby reduce the severity of the impact.  However, oil degrades relatively slowly in water and can persist for years.  A brine release would have a less severe impact if the receiving water body was a tidally influenced system.  A brine release into a fresh-water system would cause more significant impacts, but would not persist.  Some sensitive aquatic organisms such as waterfowl, fur-bearing mammals, **phytoplankton** and zooplankton, invertebrates, and some fish larvae would probably die within the immediate area of the brine or oil release.  In the case of an oil release, the affected area could remain biologically unproductive for a long period of time unless full restoration was successful.

<u>If a stationary water body was affected</u>, the brine or oil would not be transported as far or diluted as quickly.  Therefore, the impact would probably cause a higher incidence of plant and animal mortality.  The incidence of mortality from a brine release would be reduced in a marine or estuarine environment because the species are adapted to saline conditions.

<u>If wetlands were affected</u>, the brine or oil would probably not be transported as far or diluted as quickly unless the wetlands were inundated.  Therefore, the potential impact would probably be more severe.  Emergent wetland plants, invertebrates, and waterfowl within the immediate footprint of the impacted area could die or become severely stressed.  If the wetlands were inundated, some fish (especially fish eggs and juvenile fish) and aquatic invertebrates would be affected.  If the wetlands were an **estuarine system** with plants and animals adapted to saline environments, the severity of a brine release would be reduced.  The productivity of the wetlands could be greatly reduced for a long period unless full restoration was successful.

> <u>Mitigation</u>:  DOE would notify the appropriate agencies immediately upon a release and attempt to contain it as quickly as possible.  DOE would prepare a Spill Prevention, Control, and Countermeasure plan, conduct spill training, and have spill containment equipment onsite so that DOE personnel could respond immediately to contain a release. DOE would establish an agreement with an emergency response contractor to handle large releases, which may require specialized equipment for containment and remediation.  If a release occurred, DOE would work with the appropriate resource agencies to assess the extent of impacts to the biological resources and restore the impacted community to the extent practicable.

### 3.7.3 Bruinsburg Storage Site

This section addresses the following areas:

- The proposed Bruinsburg 160 MMB storage site, associated facilities, and site access road;

- The proposed pipeline, and power line ROWs;
- The proposed RWI structure;
- The proposed terminal in Peetsville;
- The proposed terminal in Anchorage, LA; and
- The proposed 60 brine disposal wells.

At the terminal in Anchorage, LA, DOE would use existing docks at the Placid refinery. Regardless of whether DOE selects the proposed Bruinsburg site, the refinery is upgrading the docks to receive oil tankers. The upgrade would accommodate DOE's dock needs for the marine terminal.

### 3.7.3.1 Affected Environment

#### *3.7.3.1.1 Bruinsburg Storage Site*

***Plants, Wetlands, and Wildlife***

The proposed Bruinsburg storage site would occupy about 364 acres (150 hectares) located 10 miles (16 kilometers) west of Port Gibson, MS. This area includes the 266-acre (108-hectare) storage site with a 99-acre (40-hectare) security buffer surrounding the facility. The site is in the Bluff Hills ecoregion of Mississippi in the alluvial plain of the Mississippi River (Chapman et al. 2004). The Bluff Hills ecoregion contains a mosaic of habitats including sloping hills, ravines, and small cypress swamps. Approximately two-thirds of the proposed Bruinsburg site is located in a relatively flat landscape, currently occupied by cultivated cotton fields, cypress swamp, and deciduous forest. The remaining one-third of the proposed site, where the administrative buildings, pumps, and brine pond would be located, would encompass an upland area outside the floodplain of the Mississippi River.

The cypress swamp (palustrine forested wetlands) is characterized by large cypress trees situated in 3 to 4 feet (1 to 1.3 meters) of standing water with Spanish moss on the branches. The cypress swamp is surrounded by fresh water emergent wetlands dominated by sedges and grasses. Water oak and hickory dominate the intermittent or semipermanently flooded forested wetlands on the site. Other trees common throughout the forested wetlands include sweet gum, basswood, water oak, tupelo, and box elder. The understory includes holly, bamboo, and arrowwood, while groundcover consists of various grasses and sedges, horsetail, clearweed, and smartweed. Portions of the forested wetlands that were not inundated during the site visit display signs of periodic inundation such as water marks on trees and tree buttressing. Forested wetlands are characterized by water oaks, box elder, and tupelo. The upland forested areas are dominated by oak and hickory, with some sweet gum.

The natural hydrology of the site has been altered by a levee extending across the center of the site separating a bayou from the cotton fields to the north. Beaver dams have further altered the surface water flow by creating temporary ponds along the intermittent streams crossing the central portion of the site. Two intermittent streams converge onsite to form a bayou, which is the only permanent stream within the proposed boundaries. Areas adjacent to the bayou are permanently flooded; the remaining areas show signs of intermittent or semipermanent flooding.

The administrative buildings would be located on the eastern side of the site. This area is characterized by steep rolling hills and ravines covered with mixed hardwood and pine forests. The area appeared previously disturbed due to the presence of bamboo mixed in the interior of the upland forest. The forest is dominated by oaks and hickories intermingled with pine. The **understory** is comprised of herbaceous cover, shrubs, and seedlings.

The wildlife observed in the vicinity of the Bruinsburg site during the site visit includes white-tailed deer, armadillo, beaver, slider turtle, American woodcock, owl, and woodpecker.

The proposed Bruinsburg site is located along the Mississippi River flyway (Birdnature.com 2005). The Mississippi alluvial valley is an important wintering habitat for waterfowl, particularly mallards, wood ducks, and numerous other bird species that are regulated by the Migratory Bird Treaty Act.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the county where the proposed Bruinsburg storage site is located: the interior least tern, the bayou darter, the pallid sturgeon, and the Louisiana black bear. However, a review of the conditions at the proposed Bruinsburg storage site and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the proposed storage site would not affect any federally listed threatened, endangered, or candidate species (see Appendix G Evaluation and Federally Listed Species in Mississippi).

Species that are listed as threatened or endangered by the states of Mississippi or Louisiana, but that are not federally listed, are summarized in appendix I for the counties or parishes containing parts of the proposed Bruinsburg development.

***Special Status Areas***

There are no special status areas in or adjacent to the proposed storage site.

#### *3.7.3.1.2 Bruinsburg Rights-of-Way*

Four pipelines and five power line ROWs would be required for the Bruinsburg storage site (see figure 2.4.1-1 in chapter 2). An access road to the brine injection wells would follow the brine disposal pipeline ROW.

***Pipeline ROWs***

- A proposed 109-mile (176-kilometer) crude oil pipeline from the Bruinsburg site to the Anchorage terminal. The pipeline would share an ROW with the brine disposal pipeline and RWI pipeline for 3.5 miles (5.6 kilometers) and then continues in a shared ROW with the brine disposal pipeline for another 10 miles (17 kilometers). Approximately 34 miles (55 kilometers) of the ROW would be along existing ROWs.

- A proposed 39-mile (62-kilometer) crude oil pipeline to the Peetsville terminal. This pipeline would start at the Bruinsburg storage site and end at the Peetsville terminal.

- A 4-mile (6.4-kilometer) RWI pipeline from the Bruinsburg site to the RWI structure on the Mississippi River. The pipeline would share an ROW with the brine disposal pipeline and the crude oil pipeline to Anchorage for 3.5 miles (5.6 kilometers).

- A 14-mile (22 kilometer) brine disposal pipeline and access road from the Bruinsburg site to the brine injections wells. The pipeline and access road would share an ROW with the crude oil pipeline to Anchorage and RWI pipeline for 3.5 miles (5.6 kilometers).

***Power Line ROWs***

- A proposed 5.4-mile (8.7-kilometer) ROW for a 138-kilovolt power line from the Bruinsburg site to the Grand Gulf substation.
- A proposed 7.2-mile (12-kilometer) ROW for a 138-kilovolt power line from the Bruinsburg site to the Port Gibson substation.  This ROW would follow the crude oil pipeline ROW to the Peetsville terminal.
- A proposed 4.1-mile (6.6-kilometer) ROW for dual 34.5-kilovolt power lines from the Bruinsburg site to the RWI structure.  This ROW would follow the RWI pipeline.
- A proposed 11.1-mile (17.9-kilometer) ROW for dual power lines to the brine disposal wells from the RWI structure.  This ROW would follow the pipeline ROW of the RWI and brine disposal pipeline.

***Plants, Wetlands, and Wildlife***

About 60 percent of the shared 3.5-mile (5.6-kilometer) ROW for the crude oil, brine disposal, and RWI pipelines would cross hardwood forested habitat.  This ROW would include the power line ROW for the RWI structure.  According to the National Wetlands Inventory data, most of this forest is palustrine forested wetlands, which is typical of the Mississippi River floodplain. Approximately 16 percent of the area crossed by the proposed pipelines is agricultural land.

The RWI ROW would continue for 0.5 mile (0.8 kilometer) west from the shared existing ROW. Approximately 44 percent of the ROW would cross palustrine forested wetlands.  The remaining habitat is a mixture of **riverine wetlands** and hardwood forest.

From the shared ROW, the proposed crude oil and brine disposal pipeline ROW would continue south for 10.3 miles (16.6 kilometers).  This ROW would include the power line and access road among the brine disposal wells.  Approximately 38 percent of the area that would be crossed by the shared crude oil and brine disposal pipeline ROW is hardwood forest and 15 percent of is transverse palustrine forested wetlands.  The remainder is a mixture of grassland and disturbed or management habitat.

The crude oil pipeline would continue from the last brine injection well for 95.5 miles (153.4 kilometers) to the Anchorage terminal.  Hardwood forested habitat is the dominant land classification crossed by this ROW.  The pipeline ROW would flank the Mississippi River in the alluvial plain, which is characterized by oxbow lakes that are remnants of the former channel of the Mississippi River.  Almost 30 percent of the proposed ROW area contains wetlands, most of which are palustrine forested or **scrub-shrub** associated with the floodplain.  This proposed ROW follows an existing pipeline ROW for 34.0 miles (54.7 kilometers) that spans from Mississippi into Louisiana, which represents approximately 32 percent of the ROW.

About 60 percent of the land crossed by the proposed crude oil pipeline to the Peetsville terminal and the power line ROW to Port Gibson is forested.  Most of the forests consist of deciduous hardwoods with 20 percent of the land classified as evergreen (pine) forest.  Most of the evergreen forest land crossed by the proposed pipeline ROW is managed pine plantations.  The remaining landscape contains scrub-shrub habitat, which likely includes areas formerly harvested for pine or used in agriculture.

The only power line not following a pipeline corridor would depart from the proposed Bruinsburg site and head northeast for 5.5 miles (8.6 kilometers) to the Grand Gulf Entergy substation.  The power line ROW would continue within the alluvial plain of the Mississippi River, avoiding the steep topography located to the east. More than 70 percent of the proposed ROW contains hardwood forested habitat, most of which is palustrine forested wetlands.

Based on the various land classification types and the wetlands present along the proposed ROWs, several common mammals, birds, amphibians, and reptiles may use the existing habitats in the proposed ROWs. The species would be similar to those described under the proposed Bruinsburg storage site.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the counties where the proposed ROWs would cross: bald eagle, interior least tern, red-cockaded woodpecker, bayou darter, gulf sturgeon, pallid sturgeon, Alabama heelspitter mussel, fat pocketbook mussel, Louisiana black bear, West Indian manatee, and ringed map turtle. However, a review of the conditions along the proposed ROWs and consultations with the USFWS and the Mississippi Natural Heritage Program revealed proposed pipeline ROWs associated with the proposed Bruinsburg site may affect the fat pocketbook mussel. Although some potential habitat for other federally listed species may exist along the ROWs, DOE has determined there would be no effect to these species (see appendix G).

A population of the federally endangered fat pocketbook mussel was recently discovered in the Mississippi River and associated tributaries in Jefferson County, MS (Aycock 2005; NatureServe 2005). The proposed construction of the pipeline ROW from Bruinsburg to Anchorage passes through Jefferson County and crosses Coles Creek and Fairchilds Creek, which are believed to support the fat pocketbook mussel.

Species that are listed as threatened or endangered by the states of Mississippi or Louisiana, but that are not federally listed, are summarized in Appendix I State Listed Species Screening Evaluation for the counties or parishes containing parts of the Bruinsburg development. The Mississippi Natural Heritage Program did not identify any populations of state-listed species within 2 miles (3 kilometers) of the proposed ROWs. Based on this information, DOE does not expect the proposed ROWs to affect state-listed species.

***Special Status Areas***

The proposed crude-oil pipeline ROW to the Peetsville terminal would cross through the Natchez Trace Parkway and the proclamation area of the Homochitto National Forest. The Natchez Trace Parkway is a 440-mile (710-kilometer) highway, managed by the National Park Service, created to commemorate an ancient trail that connected portions of the Mississippi River to salt licks located in central Tennessee. The crude oil pipeline would connect with an existing power line corridor before entering the proclamation area, and then it would follow that corridor through the parkway.

The Homochitto National Forest is in southwestern Mississippi. It contains close to 189,000 acres (765,000 hectares) of pine trees and deciduous hardwoods. The proposed crude oil pipeline to the Peetsville terminal from the Bruinsburg site would travel through private property in the proclamation boundary of the Homochitto National Forest for 6.8 miles (11 kilometers). The proclamation area includes land that the Forest Service could acquire in the future to expand the official boundaries of the National Forest. Approximately 5.6 miles (9 kilometers) of the pipeline would run parallel to Highway 550. The remainder of the ROW would follow an existing power line corridor.

#### *3.7.3.1.3 Raw Water Intake Structure*

The proposed RWI structure would be located on the Mississippi River approximately 3 miles (5 kilometers) southwest of the proposed storage site. Access to the facility would be available from an existing road; therefore, an additional access road would not be required.

***Plants, Wetlands, and Wildlife***

The RWI would occupy approximately 1.07 acres (0.43 hectares) along the Mississippi River. The RWI would be located on or adjacent to an existing elevated road. The area along the road is forested, containing similar vegetation as the site of the proposed storage facility. Along the road, some areas have been cleared to attract deer during the hunting season. The site is deciduous hardwood forest, classified as palustrine forested wetlands according to National Wetlands Inventory data. The area is susceptible to periodic flooding by the Mississippi River.

The lower Mississippi River basin fish habitat is characterized by swift current, shifting substrates, high suspended sediment concentrations, and low primary productivity (Wiener et al. 2005). More than 150 species inhabit the lower Mississippi River basin, which includes representatives of the following families: cipenseridae, Catostomidae, Clupeidae, Cottidae, Cyprinidae, Esocidae, Gasterosteidae, Ictaluridae, Lepisosteidae, Poeciliidae, and Polyodontidae (Page and Burr 1991; Froese and Pauly 2006; Hoese and Moore 1998). Most fish reside near the banks of the river and along the channel bottom where the current is slower.

The Mississippi River is an important visual landmark for migratory birds. Numerous North American bird species use the corridor to reach wintering habitat available in the swamps and bottomland hardwood forests of Louisiana, southern Mississippi, and other areas along the Gulf of Mexico. Many of these species are regulated by the Migratory Bird Treaty Act.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the county where the proposed RWI would be located: he interior least tern, the bayou darter, the pallid sturgeon, and the Louisiana black bear. Consultations with the USFWS and Mississippi Natural Heritage Program determined that the proposed RWI structure may affect the pallid sturgeon. Potentially suitable habitat exists near the RWI structure for the interior least tern, but there are no recorded occurrences of this species within 2 miles (3 kilometers) of the proposed RWI site. DOE determined that the proposed RWI would not affect the interior least tern. Detailed discussion of these species and the habitat found at the site is provided in appendix G.

The pallid sturgeon is a federally listed endangered species known to inhabit the Missouri/Mississippi River drainage. The sturgeon is listed in five counties in Mississippi, including Clairborne County where the proposed RWI structure would be located. This segment of the Mississippi River is not designated as critical habitat for the pallid sturgeon. Adults are seasonal visitors to the area, but larvae and juveniles could be found in this segment of the river year-round. If this alternative is selected, DOE would conduct a survey along this segment to determine if pallid sturgeon is present near the proposed RWI. DOE would initiate formal Section 7 Consultation with the USFWS and NOAA Fisheries if any portion of the project would adversely affect the pallid sturgeon.

Species that are listed as threatened or endangered by Mississippi or Louisiana, but are not federally listed, are summarized in appendix I for the counties or parishes containing parts of the proposed Bruinsburg storage site and related infrastructure. The Mississippi Natural Heritage Program did not identify any populations of state-listed species within 2 miles (3 kilometers) of the ROWs. Based on this information, DOE does not expect the proposed RWI to affect state-listed species.

***Special Status Areas***

No special status areas occur in or near the boundaries of the proposed RWI structure.

***Essential Fish Habitat***

No EFH occurs in or near the boundaries of the proposed RWI structure.

##### 3.7.3.1.4 Peetsville Terminal

***Plants, Wetlands, and Wildlife***

The proposed 71-acre (29-hectare) Peetsville terminal would be located adjacent to a pump station for the existing Capline pipeline. Managed pine plantations and rural housing surround the site for the proposed terminal, which is recovering from a relatively recent pine harvest. Approximately 53 percent of the site contains scrub-shrub habitat with approximately 27 percent of the total area occupied by hardwood deciduous forest. The remaining area is occupied by evergreen pine forest and disturbed or managed land.

The wildlife in the project area includes common, mobile species such as the nine-banded armadillo and white-tailed deer, which are adapted to living in somewhat disturbed habitat.

***Special Status Species***

A review of the conditions at the proposed Peetsville terminal and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the proposed terminal would not affect any federally listed threatened, endangered, or candidate species (see appendix G).

The proposed Peetsville terminal does not provide suitable habitat for any state-listed threatened or endangered species (see appendix I) and none were found within 2 miles (3 kilometers) of the proposed Peetsville terminal (MNHP 2006).

***Special Status Areas***

The Homochitto National Forest is located approximately 2 miles (3 kilometers) west of the proposed Peetsville terminal location.

##### 3.7.3.1.5 Anchorage Terminal

***Plants, Wetlands, and Wildlife***

The proposed 75-acre (31-hectare) Anchorage terminal would be located south of the Exxon/Mobil and Placid refineries. These facilities flank the Mississippi River levee. The existing land use for the area where the proposed facility would be located is row-crop agriculture. Most of the land surrounding the proposed site is also disturbed and is used for industrial, agricultural, and some residential purposes. According to the National Wetlands Inventory data, there are no wetlands or natural habitat on the proposed site. Because the area is disturbed and actively farmed, it would support only a limited amount of wildlife.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the county where the proposed Anchorage terminal would be located: bald eagle, pallid sturgeon, and the Louisiana black bear. However, a review of the conditions at the proposed Anchorage terminal and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the proposed terminal would not affect any federally listed threatened, endangered, or candidate species (see appendix G).

The proposed Anchorage terminal site also does not provide suitable habitat for any state-listed threatened or endangered species (see appendix I) and none was found within 2 miles (3 kilometers) of the proposed terminal (MNHP 2006).

***Special Status Areas***

No special status areas are located in or near the boundaries of the proposed terminal.

***Essential Fish Habitat***

No EFH is located in or near the boundaries of the proposed terminal.

#### *3.7.3.1.6 Brine Injection Wells*

Sixty brine disposal injection wells, each occupying an area of about 1.2 acres (0.5 hectares), would be located at 1,000-foot (300-meter) intervals along 11.2 miles (18.0 kilometers) of the proposed pipeline ROW from the Bruinsburg site toward Anchorage.

***Plants, Wetlands, and Wildlife***

The area proposed for the brine injection wells is located east of the Mississippi River in the Holocene floodplain of the Mississippi alluvial plain. The area is characterized by oxbow lakes, natural levees, and abandoned channels separated by upland hardwood forests and agricultural land. The land that would be affected by the proposed wells is roughly half hardwood deciduous forests and half agricultural land. According the National Wetlands Inventory data, 20 percent of the affected area is classified as palustrine forested or scrub-shrub wetlands.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the county where the proposed brine injection wells would be located: the interior least tern, the bayou darter, the pallid sturgeon, and the Louisiana black bear. However, a review of the conditions at the proposed brine injection wells and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the proposed injection wells would not affect any federally listed threatened, endangered, or candidate species (see appendix G).

The brine injection wells do not provide suitable habitat for any state-listed threatened or endangered species (see appendix I), and none was found within 2 miles (3 kilometers) of the proposed wells (MNHP 2006).

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***Special Status Areas***

No special status areas are located in or near the boundaries of the proposed brine injection wells.

### 3.7.3.2 Impacts

#### *3.7.3.2.1 Bruinsburg Storage Site*

***Plants, Wetlands, and Wildlife***

The clearing and grading associated with the Bruinsburg storage site would affect about 364 acres (147 hectares). This area would include the 266-acre (108-hectare) storage site with a 300-foot (91-meter) cleared security buffer surrounding the site and the 0.6-mile (0.9-kilometer) long site access road. Trees would be removed within the security buffer; however, emergent wetlands vegetation and herbaceous upland species would be allowed to revegetate following construction. Preparation of the site for the administrative buildings and brine disposal pond would require clearing, filling, and grading of steep, forested ravines. The proposed construction of the site and the access road would affect the following areas:

- 28 acres (12 hectares) of evergreen (pine) forest,
- 115 acres (47 hectares) of hardwood forest,
- 103 acres (42 hectares) of palustrine forested wetlands (cypress swamp),
- 30 acres (12 hectares) of grassland and scrub-shrub,
- 87 acres (35 hectares) of disturbed or managed land, and
- 38 acres (16 hectares) of water or emergent wetlands.

Clearing and grading the palustrine forested wetlands would permanently fill 103 acres (42 hectares), the impacts of which are described in section 3.7.2. Although the forested wetlands are adjacent to actively managed cotton fields, the forested wetlands contain large cypress trees, which indicate that the wetlands have been relatively undisturbed for several decades. Clearing and grading of the forested wetlands would result in the loss of a relatively stable and ecologically valuable ecosystem capable of supporting a variety of wildlife species. DOE modified this facility footprint and shifted the administrative buildings to the east to avoid wetlands. The small size and configuration of the salt dome makes it impractical to further reduce or avoid wetlands impacts. If this site is developed, this ecologically important wetlands may be adversely affected, which would be mitigated somewhat by compensating for the impacts to jurisdictional wetlands.

If this alternative is selected, DOE would complete a wetlands delineation and secure a jurisdictional determination from the USACE. In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands and preserve onsite emergent wetlands to the maximum extent practicable. DOE would submit a Joint Permit Application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in the Common Impacts section (section 3.7.2) and in accordance with the 404 permit and 401 Water Quality Certificate from the USACE and the Mississippi Department of Environmental Quality. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetlands impacts.

As discussed in section 3.7.2, Common Impacts, some wildlife would be killed or displaced to surrounding areas during construction. The forested wetlands habitat continues 1 mile (2 kilometers) to Bayou Pierre. It would provide sufficient habitat for displaced wildlife. Common animals such as white-tailed deer and nine-banded armadillo could find sufficient habitat in the surrounding area, including locally abundant upland forested areas. After the security fencing is constructed, wildlife use of the site would be limited; however, some mobile species and birds would still visit the site.

The operations and maintenance activities described in section 3.7.2 would preclude wildlife sensitive to human disturbance from entering the area. These animals either would adapt to the disturbance or would move to new habitat. Similar forested habitat is available adjacent to the proposed site. Most common species (e.g., deer and armadillos) could tolerate noise and activities at the new SPR facility. The construction, operations, and maintenance impacts might disrupt individual animals, but would not alter the state or regional population or viability of these wildlife species.

The proposed construction of the Bruinsburg site and related infrastructure would affect aquatic and terrestrial species such as beavers, amphibians, small reptiles, and fish that use the cypress swamp. The downgradient wetlands offsite would experience some sedimentation and temporary water impacts as the site vegetation is removed, the surrounding wetlands filled, and local streams diverted. Aquatic organisms would need to find suitable aquatic habitat in the adjacent wetlands or other nearby streams.

The clearing, filling, and grading of the steep, forested ravines in site preparation for the administrative buildings and brine pond would cause construction-related erosion. As presented in chapter 2, erosion would be minimized with the use of best management practices. An erosion and sediment control plan and NPDES stormwater permit issued by the Mississippi Department of Environmental Quality for construction activities would be secured, which would require the use of best management practices to minimize the impact to water bodies. After site preparation is completed, DOE would grade and contour the adjacent hillside at a slope that allows revegetation of herbaceous plants, which plants would help control runoff, minimize erosion, and stabilize the surrounding ravines.

The potential for operational and maintenance impacts on migratory birds is described in section 3.7.2.

> Mitigation: DOE would use low-mast, down-shielded lights to minimize the impacts to migratory birds. DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. If this candidate alternative is selected, DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with the requirements of the Migratory Bird Treaty Act.

***Special Status Species***

The proposed Bruinsburg storage site would not affect any federally listed threatened or endangered species, candidate species, or designated critical habitat (see appendix G).

DOE would conduct a habitat assessment to determine if any areas of the ROWs meet the habitat requirements of state-listed species presented in appendix I and to determine if surveys are necessary.

***Special Status Areas***

No special status areas are located in or near the boundaries of the proposed site.

***Essential Fish Habitat***

No EFH exists in or near the boundaries of the proposed site.

#### *3.7.3.2.2 Bruinsburg Rights-of-Way*

***Plants, Wetlands, and Wildlife***

Construction in the pipeline and power line ROWs would result in clearing all the vegetation within the ROW. The ROW clearing would affect the following land types as determined by Gap Analysis Program data (USGS 2003):

- 243 acres (98 hectares) of evergreen (pine) forest,
- 926 acres (375 hectares) of deciduous forest,
- 463 acres (187 hectares) of grassland and scrub and shrub habitat,
- 453 acres (183 hectares) of disturbed or managed areas,
- 106 acres (43 hectares) of water and emergent wetlands, and
- 5 acres (2 hectares) of other land categories that could not be determined with available data.

Some of the evergreen and deciduous forested habitat has already been disturbed and fragmented from existing pipeline corridors, agricultural lands, and pine plantations.

GAP Analysis Program data do not accurately classify wetlands areas, particularly forested wetlands. DOE used National Wetlands Inventory data and the proposed construction easements to determine that the ROWs would affect the following wetlands:

- 216 acres (87 hectares) of palustrine forested wetlands (cypress swamp),
- 44 acres (18 hectares) of palustrine scrub-shrub wetlands,
- 5 acres (2 hectares) of palustrine unconsolidated bottom, and
- 69 acres (28 hectares) of riverine wetlands.

The proposed pipeline and power line corridors would permanently affect about 33 to 40 percent of the acreage described above because only a 50-foot-wide (15-meter-wide) easement per pipeline would be maintained permanently. The vegetation in the construction easement would be cleared, but DOE would regrade to preconstruction contours and reseed with native species in this area to re-establish native habitat. The area within the permanent easement would be permanently maintained, but some wetlands functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands and the nature and amount of wetland impact from the permanent and construction easements. In addition, many of these wetlands would be avoided by the use of directional drilling under the wetlands from the adjacent uplands. Moreover, about 34 percent of the pipeline ROWs would be within or parallel to an existing ROW. Use of existing ROW corridors to the maximum extent practicable would minimize the impact to undisturbed communities and wildlife.

In accordance with the Section 404/401 permit conditions, DOE would compensate for the jurisdictional wetland impacts.

As stated in the section 3.7.2, construction in the proposed ROWs would displace or kill some aquatic and terrestrial wildlife. Noise and human activity may temporarily preclude some animals from using the nearby habitat. The duration of construction through these areas would be short (6 to 10 weeks at any one location) and ample habitat would be available nearby for most species. The elevated portion of the power lines could represent a strike hazard for resident and migratory birds; however, the maximum tower height is expected to be 75 feet (23 meters), which would greatly reduce the hazard. These impacts may disrupt individual animals, but they would not alter the regional population or species viability.

The impacts associated with the operations and maintenance of the proposed ROWs is described in section 3.7.2).

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct any problems that are identified.
>
> DOE would use low power line poles (less than 75 feet [23 meters]) and would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996).

***Special Status Species***

The federally endangered fat pocketbook mussel is believed to be present in Coles Creek and Fairchilds Creek, both of which would be crossed by the ROW to Anchorage. Coles Creek would also be crossed by the access road to the brine injection wells. Because these tributaries are small, conventional construction methods (e.g., open-ditch excavation) would normally be used to bury the pipeline below the streambeds. During construction of the stream crossings at Coles and Fairchilds Creeks, excavation may directly affect fat pocketbooks, if they are present. In addition, construction would temporarily disrupt sand, silt, or clay streambed habitat favored by the species. If construction were to occur during the reproductive stage (July to October) of the species, construction may drive away hosts of the mussel's larval stage, such as red drum or other fish.

If the Bruinsburg site is selected for development, a qualified biologist would survey Coles Creek or Fairchilds Creek in the area of the proposed crossings to determine if the fat pocketbook mussel is present. If the mussels are identified in those areas, DOE would initiate formal Section 7 Consultation with the USFWS and complete a Biological Assessment if required. DOE would use directional drilling to avoid disturbance to the stream, if practicable or the mussels would be relocated to suitable habitat outside the area of disturbance. Relocation of fresh-water mussels has been documented as a successful strategy to avoid impacts during instream construction disturbances (Reutter et al. 2001). After construction, the streambeds would be restored to their original condition. Operations and maintenance of the pipelines would not affect the mussels because such activities would be minor and infrequent.

A small bridge or box culvert would be built for the brine access road to cross Coles Creek. Construction of the box culvert may have a temporary effect on the mussels (if they are present) because some in-stream disturbance would occur even with best management practices to control siltation. The streambed would be restored after construction. Operations and maintenance of the road would occur infrequently and would not affect the mussels.

***Special Status Areas***

The proposed crude oil pipeline to the Peetsville terminal would cross the Natchez Trace Parkway in an existing utility ROW and would follow an existing highway through private land within the proclamation boundary of the Homochitto National Forest. Construction through the Natchez Trace Parkway would require an expansion of the existing ROW and the clearing of additional vegetation; however, the existing corridor has already fragmented the forest. Construction of the pipeline through the proclamation boundary of the national forest would also require clearing of additional vegetation along the highway easement. Trees would not be allowed to regrow within the 50-foot (15-meter) maintained easement; though the remaining area affected by construction would be allowed to regenerate to natural habitat. Use of existing ROW and road corridors to the maximum extent practicable would minimize the impact to undisturbed communities and wildlife.

> Mitigation: If the Bruinsburg site is selected, DOE would coordinate with the National Park Service to obtain the proper ROW easements through the Natchez Trace Parkway and ensure that important natural resources are avoided to the maximum extent practicable.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat such as wetlands or habitat for special status species. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.

***Essential Fish Habitat***

No EFH exists in or near the pipeline and power line ROWs.

#### *3.7.3.2.3 Raw Water Intake*

***Plants, Wetlands, and Wildlife***

Section 3.7.2 describes construction impacts associated with the RWI structure. The clearing and grading associated with construction of the RWI structure would affect 1.7 acres (0.7 hectares) of forested and wetlands habitat.

If a Bruinsburg alternative is selected, DOE would complete a wetlands delineation, secure a jurisdictional determination from the USACE, and refine the conceptual site plan to avoid filling in jurisdictional wetlands to the maximum extent practicable. DOE would submit a Joint Permit Application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetlands impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in section 3.7.2 and in accordance with the Section 404 permit and Section 401 Water Quality Certificate from the USACE and the Mississippi Department of Environmental Quality. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetlands impacts.

As presented in chapter 2, erosion would be minimized with the use of best management practices. An erosion and sediment control plan and NPDES stormwater permit issued by the Mississippi Department of Environmental Quality for construction activities would be secured, which would require the use of best management practices to minimize the impact to water bodies.

As discussed in section 3.7.2, some wildlife species would be displaced to similar vegetative and wetlands communities surrounding the RWI structure. Dredging required for construction of the RWI structure would affect some aquatic organisms and temporarily increase suspended sediment in the water column. Mobile species could move away from the construction area. The Mississippi River, in the area of the RWI structure, is a heavily traveled corridor for large barges and other vessels. Most aquatic species would be tolerant of noise and human activity.

Operations and maintenance of the RWI structure would produce noise during cavern solution mining (4 to 5 years) and after construction and during maintenance and drawdown. Noise may preclude sensitive terrestrial and aquatic wildlife from using habitat in the immediate vicinity of the RWI structure. During water withdrawal activities and operation of the RWI structure, some aquatic organisms would become entrained or impinged by the intake, especially larval forms, juveniles, and dispersed fish eggs.

The planned 1.2 MMBD (50 million gallon per day water withdrawal would be a small fraction of the total flow, and the potential for entrainment and impingement would be minimized by equipping the RWI with appropriate screen diameter, intake velocities, and traveling screens to collect and return aquatic life to the Mississippi River.

Section 3.7.2 provides a description of other operations and maintenance impacts including artificial lighting and increased human activity that could affect migratory birds and other wildlife.

> Mitigation: As described in section 3.7.2, DOE would use down-shielding and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. As described in chapter 2, DOE would use noise attenuation measures such as use of a concrete enclosure for the pump station to minimize noise impacts.

***Special Status Species***

Construction of the RWI on the Mississippi River would not be likely to cause an adverse affect on the federally endangered pallid sturgeon and would not affect designated critical habitat. Construction activities would temporarily disturb a small area of the Mississippi River bottom and resuspend sediments; however, impacts on water quality would be negligible because of the large size and flow rate of the Mississippi in this area. Similarly, impacts on habitat characteristics would be inconsequential because of the small size of the area affected. Any potential construction impacts would be minimized with the use of onshore erosion barriers, instream silt curtains or cofferdams, postconstruction restoration, and other measures.

Operation of the RWI would have the potential to entrain and impinge juvenile and larval sturgeon and their prey. If an alternative with the Bruinsburg site is selected, DOE would initiate formal Section 7 Consultation with the USFWS and NOAA Fisheries. DOE would prepare a Biological Assessment, if required, and implement any conditions of a Biological Opinion. In addition, DOE would work with USFWS and NOAA Fisheries to design the RWI with appropriate mesh size, intake velocity, and other technologies to avoid adverse impacts. Because the planned 1.2 MMBD (50 million gallons per day) raw water withdrawal would be a small fraction of the daily flow of the Mississippi, there would be no significant changes in the water conditions or flow regime due to operation of the RWI.

***Essential Fish Habitat***

No EFH is in or near the proposed RWI structure.

***Special Status Areas***

No special status areas are in or near the proposed RWI site.

##### *3.7.3.2.4 Peetsville Terminal*

***Plants, Wetlands, and Wildlife***

The clearing, grading, and construction of the tank farm associated with the Peetsville terminal would affect about 71 acres (28 hectares) as follows:

- 10 acres (4 hectares) of evergreen (pine) forest,
- 18 acres (7 hectares) of hardwood forest,
- 35 acres (14 hectares) of grassland scrub-shrub habitat,
- 3 acres (1 hectare) of disturbed or managed land, and
- 5 acres (2 hectares) of other land.

If this alternative is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible, although the entire footprint would be cleared of trees for security reasons. The placement of fill in the wetlands would cause a permanent loss of wetland functions and values. DOE would secure permits from the USACE and Mississippi Department of Environmental Quality for the impact to jurisdictional wetlands and provide compensation for the unavoidable wetland impacts. Section 3.7.2 describes the effects of clearing and filling wetlands in detail. DOE would implement best management practices and comply with permits for erosion and stormwater control during construction and operation of the facility to reduce impacts to aquatic species.

After the security fencing is constructed, wildlife use of the site would be limited; however, some mobile species and birds would probably still visit the site.

The operations and maintenance activities, described in section 3.7.2, may preclude wildlife sensitive to human disturbance from entering the area. These activities at the terminal would be infrequent and similar to activities occurring at the oil pump station adjacent to the proposed terminal. This area has already been disturbed by past construction and habitat fragmentation.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts and impacts to forests.

***Special Status Species***

No federally or state-listed threatened or endangered species would be affected by the construction of the Peetsville terminal (see appendix I).

***Special Status Areas***

The Peetsville terminal would not affect the Homochitto National Forest, which is located 2 miles (3 kilometers) to the west.

***Essential Fish Habitat***

No EFH exists in or near the boundaries of the proposed Peetsville terminal.

#### *3.7.3.2.5 Anchorage Terminal*

***Plants, Wetlands, and Wildlife***

The clearing and grading associated with the Anchorage marine terminal would affect about 71 acres (28 hectares). As described in section 3.7.3.1.5, the proposed facility would be located entirely within actively managed agricultural land; therefore, no natural habitat or wildlife would be affected. No wetlands would be disturbed by clearing and grading activities. Rodents and common organisms living in the fields could find available habitat in other fields near the proposed facility. After the security fencing is constructed, wildlife use of the site would be limited. Some mobile species and birds would probably still visit the site, however.

The operations and maintenance activities described in section 3.7.2 would preclude wildlife sensitive to human disturbance from entering the area. The efforts to operate and maintain the terminal would be similar to activities occurring at other industrial facilities located near the proposed site. Although these construction, operations, and maintenance activities may affect individual organisms, they would not alter the regional population or species viability.

***Special Status Species***

No federally or state-listed threatened, endangered, or candidate species would be affected by the proposed terminal (see appendices G and I).

***Special Status Areas***

No special status areas exist in or near the boundaries of the proposed facility.

***Essential Fish Habitat***

EFH is not present at the proposed Anchorage terminal site.

#### *3.7.3.2.6 Brine Injection Wells*

***Plants, Wetlands, and Wildlife***

Construction of the brine injection wells would result in clearing all vegetation at those sites. The following habitats would be affected according to Mississippi GAP Analysis Program data (USGS 2003):

- 2 acres (1 hectares) of evergreen (pine) forest,
- 31 acres (21 hectares) of deciduous forest,
- 8 acres (3 hectares) of grassland and scrub-shrub habitat,
- 21 acres (8 hectares) of disturbed or managed habitat,
- 11 acres (5 hectares) of open water and emergent wetlands, and
- < 1 acre (< 0.04 hectare) of other land categories that could not be determined with available data.

GAP Analysis Program data do not accurately classify wetlands areas, particularly forested wetlands. DOE used National Wetlands Inventory data to determine that the brine injection wells would affect the following wetlands:

- 17 acres (7 hectares) of palustrine forested wetlands, and
- 9 acres (4 hectares) of palustrine scrub-shrub wetlands.

Clearing and grading the palustrine forested wetlands would permanently fill about 9 acres (4 hectares). The impacts associated with clearing and filling wetlands are described in section 3.7.2. If this alternative is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible, although the entire footprint would be cleared of trees for security reasons. DOE would secure permits from USACE and Mississippi Department of Environmental Quality for the impact to jurisdictional wetlands and provide compensation for unavoidable wetland impacts. After security fencing is constructed, wildlife use of the site would be limited, though some mobile species and birds would probably still visit the area enclosed near the brine injection wells.

Operation of the brine injection wells would produce some continuous noise during the 3 year period of cavern construction and may thus preclude wildlife sensitive to human disturbance from entering the area. These organisms would either adapt to the disturbance or move to new habitat. Most common species (e.g., deer and armadillo) could tolerate noise and activities associated with the brine injection wells.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts and impacts to forests.

***Special Status Species***

The proposed Bruinsburg brine injection wells would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices G and I).

***Special Status Areas***

No special status areas exist in or near the proposed brine injection wells.

***Essential Fish Habitat***

No EFH exists in or near the proposed brine disposal injection wells.

### 3.7.4 Chacahoula Storage Site

This section addresses the following areas:

- The proposed Chacahoula storage site, associated facilities, and access road;

- Four pipelines and four power lines:
  - a crude oil distribution pipeline to St. James,
  - a crude oil distribution pipeline to Clovelly,
  - a brine disposal pipeline to the Gulf,
  - an RWI pipeline to the ICW,
  - a power line from Thibodaux substation to the site,
  - a power line from Terrebonne substation to the site, and
  - two power lines from existing power lines north of Highway 90 to the RWI;

- The RWI structure and access road; and

- The offshore pipeline and the brine diffusion system.

### 3.7.4.1 Affected Environment

#### *3.7.4.1.1 Chacahoula Storage Site and Access Road*

***Plants, Wetlands, and Wildlife***

The proposed Chacahoula storage site is located to the west of Route 309 in southwestern Lafourche Parish, LA, in the Sub-tropical Division, Outer Coastal Plain Mixed Forest Province (Bailey 1995). The proposed site would encompass 230 acres (92 hectares) with a 1.5-mile (2.4-kilometer) access road. The habitat consists of cypress-tupelo swamp, classified by National Wetlands Inventory data as palustrine-forested wetlands. This swamp is associated historically with Bayou Lafourche and locally with the Bubbling Bayou and other canal-like bayous. The site is located within a large continuous patch of a cypress-tupelo swamp, which has limited areas of oil and gas development, but remains largely undisturbed.

The entire site is typically flooded, and it has interspersed hammocks of dry or seasonally flooded land formed by sediment deposits. The National Wetlands Inventory data classify the entire site as palustrine, semi-permanently flooded, broadleaf deciduous or needle-leaf deciduous wetlands. The swamp is dominated by bald cypress and water tupelo. Other tree species include ash, maple, black willow, and water oak. Understory vegetation includes greenbriar, palmetto, blackberry, trumpet vine, Virginia creeper, holly, and grape. Deep water areas are devoid of living trees and are covered by a vegetated mat.

The cypress-tupelo swamp is an important fresh-water ecosystem that was once common throughout the southeastern United States. Logging and development pressures have destroyed much of this ecosystem. In Lafourche and Terrebonne Parishes, many of the swamps have been drained and converted to agricultural, residential, or industrial use. The remaining swamps are a critical part of the natural landscape. Generally, their functions include nutrient transformation, flood storage, wildlife habitat, and timber production. Locally, forested wetlands can mitigate the negative impacts of nonpoint source pollution, protect adjacent land from flood waters, and provide economic benefit to local communities through recreational and commercial uses. The forested wetlands of Louisiana are a stopover for millions of migrating birds. The wetlands provide important resources to dozens of species of wading birds. They also serve as a carbon sink, which is a natural environment that absorbs and stores more carbon dioxide from the atmosphere than it releases offsetting greenhouse gas emission (Coastal Wetlands Forest Conservation and Use Science Working Group 2006).

The area supports numerous bird species that are regulated by the Migratory Bird Treaty Act. The site provides habitat for a large number of terrestrial and aquatic wildlife species including rabbit, squirrel, raccoon, nutria, mink, deer, woodcock, wood duck, crayfish, and various species of fish. The area also provides important resources for wide-ranging predators such as bobcats and coyotes.

Many of the fish species found at or near the site are common throughout the Gulf Coast region. Typical species include fresh-water eels, suckers, minnows, sunfishes and basses, mullet, perch and darters, and fresh-water catfish. Invertebrate species found in the bayous and sloughs are typical of any fresh-water system along the Louisiana swampland. Reptiles such as turtle, American alligator, water moccasin, and western diamondback rattlesnake are often observed in the swamps around the Chacahoula site.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the parish where the proposed storage site would be located: bald eagle, brown pelican, peregrine falcon, piping plover, and the gulf sturgeon. However, a review of the conditions at the proposed site and consultations with USFWS and the Louisiana Department of Wildlife and Fisheries revealed that there may be suitable habitat for the bald eagle at the proposed storage site. As discussed in appendix F, USFWS and Louisiana Department of Wildlife and Fisheries confirm a recorded bald eagle nesting site within 1 mile (2 kilometers) of the proposed storage site (Lester 2006). The bald eagle is a federally listed threatened species. Much of the habitat surrounding the site and associated infrastructure is cypress-tupelo swamp that could serve as potential habitat for bald eagles, which are known to nest in bald cypress trees near fresh to brackish marshes (estuarine emergent wetlands) or open water in the southeastern parishes (Carloss 2005). The USFWS has proposed removing the bald eagle from the ESA list.

***Essential Fish Habitat***

No EFH is located in or near the boundaries of the proposed site.

***Special Status Areas***

There are no special status areas in or near the proposed Chacahoula storage site.

##### *3.7.4.1.2 Chacahoula Rights-of-Way*

Four pipelines and three power line ROWs would be required for the Chacahoula storage site. To reduce the impacts from this infrastructure DOE would co-locate many pipelines and power lines and place them adjacent to existing utility corridors where feasible.

***Pipeline ROWs***

- The proposed crude oil pipeline to St. James would share an ROW for 1 mile (1.6 kilometers) with the crude oil pipeline to Clovelly. Then, it would follow existing ROWs to the north/northeast for 20 miles (32 kilometers) to the existing terminal at St. James.

- The proposed crude oil pipeline to Clovelly would share an ROW for 1 mile (1.6 kilometers) with the crude oil pipeline to St. James. It would then continue east on a new ROW for 23 miles (37 kilometers), joining an existing ROW southeast for 30 miles (48 kilometers) to the LOOP underground storage facility at Clovelly.

- The proposed RWI pipeline would share a new ROW for 0.4 miles (0.7 kilometers) with the brine disposal pipeline. It would be co-located with the brine disposal pipeline on an existing ROW for another 6.7 miles (11 kilometers), heading south before turning to the RWI located 5.3 miles (8.6 kilometers) to the southwest.

- The proposed brine disposal pipeline would share a new ROW for 0.4 miles (0.7 kilometers) with the RWI pipeline and share an existing ROW with the RWI pipeline for another 6.9 miles (11.0 kilometers) heading south. It would then continue on a new ROW for 4.3 miles (6.8 kilometers) before joining an existing ROW for 26.8 miles (43 kilometers). The final 2.3 miles (3.7 kilometers) of the route to the beach would be through a new ROW before heading offshore 17 miles (28 kilometers) to the diffuser.

***Power Lines ROWs***

- A proposed 7.1-mile (11-kilometer) power line from Thibodaux substation would join a 15-mile (24-kilometer) power line from Terrebonne station, and then follow the proposed pipeline ROW to the site for 2.5 miles (4.1 kilometers).
- A proposed power line would extend 4.5 miles (7.3 kilometers) south to the RWI.

***Plants, Wetlands, and Wildlife***

About 50 percent of the proposed corridor for pipelines, power lines, and access roads would follow existing utility corridors; therefore, the habitat is already disturbed and fragmented.  The dominant vegetation community crossed by the proposed Chacahoula ROWs is wetlands, comprising 73 percent of the affected vegetation communities.  These wetlands include palustrine forested (37 percent), palustrine emergent (14 percent), and estuarine wetlands (16 percent).  The wetlands transition from forested to emergent to estuarine as the pipelines transition from the storage site toward the ocean.  More than 58 percent of the ROW corridor for the brine discharge pipeline follows existing canals or pipeline corridors, which are maintained and offer reduced habitat value.  The wetlands in the proposed ROW protect upland areas from storm and flood surges, convert and store important ecological nutrients and nonpoint pollutants, and serve as habitat for important commercial and recreational species such as fur bears, crayfish, marine fish, and shellfish.  Upland areas along the ROWs are disturbed or managed lands such as agriculture and low-density residential.  Three-quarters of the upland areas are crossed by the crude oil distribution pipelines to Clovelly and St. James.

Mammals found in and around the fresh-water wetlands include otter, mink, raccoon, muskrat, and nutria.  Major avian groups include waterfowl, herons, egrets, ibises, and shorebirds.  Amphibians and reptiles include the American alligator, snapping turtles, red-eared turtles, water snakes, southern leopard frogs, and bullfrogs.

The estuarine emergent wetlands are a highly diverse community supporting both saltwater and fresh-water vegetation.  They are tidally influenced, with most of the water receding from the vegetated area during low tides.  These areas are important nurseries for juvenile species of fish, crustaceans, and other invertebrates.  The vegetation provides protection and shelter from larger predators and provides food production for wildlife and aquatic organisms.  Many of these species, such as shrimp, crab, oysters, trout, flounder, and redfish, are commercially important.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the parishes where the proposed ROWs cross:  bald eagle, brown pelican, peregrine falcon, piping plover, gulf sturgeon, pallid sturgeon, red wolf, and several marine mammals and sea turtles.  As discussed in appendix F, the proposed pipeline ROWs would cross within 1 mile (2 kilometers) of a recorded bald eagle nest (Lester 2006).  The proposed ROWs to Clovelly, St. James, and the RWI pass within 1,500 feet (460 meters) of a bald eagle nesting site.

According to USFWS, brown pelicans may roost in coastal areas crossed by the proposed Chacahoula pipeline ROWs.  The brine disposal pipeline ROW and the crude oil pipeline ROW to Clovelly would pass through or near coastal areas including barrier islands, sandbars, and wetlands that provide potentially suitable habitat for the brown pelican.

***Essential Fish Habitat***

No EFH is located in or near the proposed Chacahoula ROWs.

***Special Status Areas***

There are no special status areas in or near the proposed Chacahoula ROWs.

##### *3.7.4.1.3 Raw Water Intake and Access Road*

The proposed RWI would be located on the ICW south of the project site. A 2.5-mile (3.9-kilometer) access road would be built to access the RWI from Highway 90.

***Plants, Wetlands, and Wildlife***

The ICW is a heavily traveled corridor that is frequently maintained for navigational depth. The RWI access road would pass through 5.6 acres (2.3 hectares) of palustrine forested wetlands and 3.3 acres (1.3 hectares) of palustrine emergent wetlands. The proposed RWI location is characterized by the same type of palustrine forested wetland community as described at the proposed storage site, although the water would be more saline. Terrestrial species would be similar to those found at the storage site. More than 130 species of fish may inhabit the ICW, including representatives from 40 families (Page and Burr 1991; Froese and Pauly 2006; Hoese and Moore 1998). These organisms are common throughout the Gulf Coast region.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the parish where the proposed RWI and associated infrastructure would be located: bald eagle, brown pelican, peregrine falcon, piping plover, gulf sturgeon, red wolf, and several marine mammals and sea turtles. The area around the proposed RWI has been identified by the USFWS as an area with a large number of bald eagle nests (Watson 2005). Two nests are located within 1,500 feet (460 meters) of the proposed RWI site.

***Essential Fish Habitat***

No EFH is located in or near the boundaries of the proposed RWI and access road.

***Special Status Areas***

There are no special status areas in or near the proposed Chacahoula RWI site.

##### *3.7.4.1.4 Offshore Brine Disposal*

***Plants, Wetlands, and Wildlife***

The offshore brine disposal pipeline would extend 17 miles (28 kilometers) from the shore directly south through the Gulf of Mexico. Unlike the other brine diffusion sites, which are located on relatively flat seabed, Chacahoula's brine diffusers are located next to Ship Shoal. Ship Shoal is a large, natural sand bank that is an important habitat for fish and other marine organisms.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the parishes where the proposed offshore brine disposal pipeline and diffuser would be located:  bald eagle, brown pelican, peregrine falcon, piping plover, gulf sturgeon, red wolf, and several marine mammals and sea turtles.  As discussed in appendix F, DOE determined that no threatened, endangered, or candidate species would be affected by the proposed brine disposal pipeline or brine discharge.

***Essential Fish Habitat***

The offshore area for the proposed brine disposal pipelines would include areas that are designated EFH. The composition of managed species and type of EFH differ based on distance offshore.  For nearshore, estuarine environments, the managed species include cobia, greater amberjack, king mackerel, red drum, Spanish mackerel, red grouper, gray snapper, lane snapper, red snapper, stone crab, brown shrimp, pink shrimp, and white shrimp.  All of the above species are also located at the proposed offshore brine diffusion site, along with two additional species—yellowtail snapper and spiny lobster.

***Special Status Areas***

No special status areas are located near the proposed offshore and brine diffuser system.

#### 3.7.4.2 Impacts

##### *3.7.4.2.1 Chacahoula Storage Site and Access Road*

***Plants, Wetlands, and Wildlife***

Development of the site would require clearing about 230 acres (93 hectares) of vegetation within the cypress-tupelo swamp.  To support the construction of buildings, roads, well heads, and the security perimeter, about 120 acres (49 hectares) of wetlands would be filled.  Construction of the access road would fill about 5.9 acres (2.4 hectares) leading to the site.  Another 120 acres (49 hectares) surrounding the site would be cleared of trees and dense vegetation to establish the 300-foot (91-meter) security buffer.  Areas not filled in the site boundary probably would re-establish with the dense floating vegetation found in naturally occurring openings in the cypress-tupelo swamp.  DOE would place culverts in the security perimeter road to retain the hydrological regime of the wetlands.

The placement of fill in the wetlands would cause a permanent loss of wetland functions and values; however, the clearing of forested wetlands in the security buffer would represent a wetland conversion and some wetland functions would be preserved.  The removal of trees and other vegetation would create a large open area in the otherwise continuous forested wetlands.  Although the impact to this relatively rare and important type of forested wetland may be an adverse affect, it would be mitigated somewhat by the compensation plan for jurisdictional wetland impacts.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from the USACE.  DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetland impacts to jurisdictional wetlands.  DOE would implement the mitigation measures described in section 3.7.2 and in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality.  Specifically, DOE would preserve, restore, or create forested wetlands or contribute to a mitigation bank in the region to compensate for impacts to jurisdictional wetlands.

The development of the Chacahoula storage site would change wetland species composition and have long-term impacts on surrounding plant and animal communities by introducing edge habitat within a relatively large continuous flooded forested area. Generally, any displaced organisms could find sufficient habitat in the surrounding area. After the security fencing is constructed, wildlife use of the site would be limited, though some mobile species and birds would still visit the site. The operational and maintenance activities described in section 3.7.2 could affect migration of birds due to night lighting, noise, and human activity.

The fill of inundated wetland areas would temporarily increase erosion and could affect aquatic species such as fish, amphibians, and invertebrates as described in section 3.7.2. As described in chapter 2, DOE would minimize erosion by complying with permit requirements. DOE would develop an erosion-and sediment-control plan and secure a Louisiana Pollutant Discharge Elimination System stormwater permit issued by the Louisiana Department of Environmental Quality for construction activities, which would require the use of best management practices to minimize the impact to water bodies.

> <u>Mitigation</u>: DOE would continue to refine the concept plan to avoid and minimize impacts to wetlands and comply with state and federal regulations on wetlands.

> <u>Mitigation</u>: DOE would use low-mast, down-shielded lights to minimize the impact on migratory birds. DOE would mitigate impacts to migratory birds and sensitive species in coordination with the USFWS. If this candidate alternative is selected, DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with the requirements of the Migratory Bird Treaty Act.

***Special Status Species***

Construction of the Chacahoula storage site would remove all trees in the 320-acre (130-hectare) site and security buffer. This would be a large area of potential nesting, roosting, and foraging habitat within 1 mile (1.6 kilometers) of a recorded bald eagle nesting area. Because of the complexity of this site and duration of construction (8 to 10 years), DOE could not avoid all construction activities during bald eagle nesting periods. DOE has determined this may affect the bald eagle. Therefore, if this site is selected, DOE would initiate formal Section 7 Consultation with USFWS and work with the Louisiana Department of Wildlife and Fisheries to avoid, minimize, or mitigate the effects to bald eagles. DOE would prepare a Biological Assessment if it was determined that the project may adversely affect the bald eagle and implement any conditions of a Biological Opinion.

Operations and maintenance activities at the site may affect the bald eagle because noise, human activities, and lights near nesting and perching sites can disturb normal behavior or render sites unsuitable for continued use by this species. DOE would use low-mast and down-shielded lights to minimize the impacts of photopollution.

***Essential Fish Habitat***

No EFH is located in or near the boundaries of the proposed Chacahoula site.

***Special Status Areas***

No special status areas would be affected by the proposed Chacahoula site.

#### 3.7.4.2.2 Chacahoula Pipeline Rights-of-Way

***Plants, Wetlands, and Wildlife***

Construction in the pipeline and power line ROW would result in clearing all the vegetation in the ROW. The ROWs would affect the following upland habitats:

- 4 acres (0.6 hectare) of deciduous forest,
- 490 acres (198 hectares) of disturbed or managed habitat, and
- 2 acres (0.8 hectare) of other habitat.

Using the USFWS National Wetlands Inventory maps and proposed construction easements, construction would affect the following wetland types:

- 978 acres (396 hectares) of palustrine forested wetlands,
- 371 acres (150 hectares) of palustrine emergent wetlands,
- 410 acres (166 hectares) of estuarine wetlands,
- 46 acres (19 hectares) of palustrine scrub-shrub wetlands,
- 59 acres (24 hectares) of lacustrine wetlands,
- 15 acres (6 hectares) of riverine wetlands ,
- 6 acres (2 hectares) of palustrine aquatic bed wetlands,
- 13 acres (5 hectares) of palustrine unconsolidated bottom wetlands, and
- 3 acres (1 hectare) of marine wetlands.

About 50 percent of the proposed ROW would follow existing corridors, which means habitat has already been fragmented and disturbed for a large percentage of the proposed ROW.

As discussed in section 3.7.2.1, approximately 33 to 40 percent of this footprint would be a permanent impact because it is located within the permanently maintained easement. The vegetation in the construction easement would be cleared, but DOE would regrade to preconstruction contours and reseed with native species in this area to re-establish native habitat. The area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be returned to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands and the nature and amount of wetland impact from the permanent and construction easements.

If this alternative is selected, DOE would complete wetland delineations and secure a jurisdictional determination from USACE. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetland impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in section 3.7.2 and in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetland impacts.

The operations and maintenance impacts within the ROWS in wetlands are described in section 3.7.2, Common Impacts.

As stated in section 3.7.2, construction in the ROWs would displace or kill some aquatic and terrestrial wildlife. Noise and human activity may temporarily preclude some organisms from using nearby habitat. The duration of construction in these areas would be short (6 to 10 weeks at any one location) and ample habitat would be available nearby for most species. The aboveground portion of the power lines to the site and RWI represents a potential strike hazard that could affect resident and migratory birds as described in section 3.7.2.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat such as wetlands or habitat for special status species. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.
>
> DOE would use low power line poles (less than 75 feet [23 meters]) and would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996).

***Special Status Species***

All proposed ROWs have at least one documented bald eagle nesting site within 1 mile (1.6 kilometers). The USFWS and the Louisiana Department of Wildlife and Fisheries recommend against construction activities that would occur during nesting periods (i.e., October to mid-May) within 1 mile (1.6 kilometers) of nest sites. The agencies also recommend that large trees be saved for potential roost and perch trees (Carloss 2005). During preconstruction surveys, DOE would map all bald eagle nests located within 1 mile (1.6 kilometers) of a proposed ROW. DOE would coordinate with the USFWS and Louisiana Department of Wildlife and Fisheries to avoid adverse impacts by shifting the alignment, adjusting the construction schedule, and implementing a large tree preservation plan (where practicable). Most trees within the ROW easement would be cleared, but DOE would reseed with native species in this area to re-establish native habitat.

Along the pipeline ROWs, maintenance activity would be restricted during the nesting season; therefore, operations and maintenance activities would have no effect on the bald eagle. Most of the pipelines would be built along existing ROWs and operations and maintenance of the proposed widening of the ROW would be similar to existing conditions; and therefore, they should have no effect on the bald eagle.

If nesting brown pelicans are located near the crude oil pipeline ROW to the storage facility at Clovelly, they may be affected by the construction of these ROWs. The crude oil pipeline, however, would be built along an existing ROW, which would minimize the potential for an adverse effect. Brown pelicans can be disturbed by human noise and activity nearby, especially if activity is closer than 2,300 feet (700 meters) to nests (NatureServe 2005). If brown pelican roosts or nests are identified in or near a pipeline ROW, construction would be scheduled to occur during periods when nesting is not active, if possible. Bird nests and roosts would be left undisturbed, and all activity would be restricted near them.

If any portion of the project may adversely affect the bald eagle or brown pelican, DOE would initiate formal Section 7 Consultation with the USFWS and coordinate with the Louisiana Department of Wildlife and Fisheries to develop a plan to avoid adverse impacts. A Biological Assessment would be completed by the DOE if required. DOE would implement any conditions included in the Biological Opinion.

***Essential Fish Habitat***

No EFH is located in or near the boundaries of the proposed Chacahoula ROWs.

***Special Status Areas***

There are no special status areas in or near the proposed Chacahoula pipeline ROWs.

##### *3.7.4.2.3 Raw Water Intake*

***Plants, Wetlands, and Wildlife***

Construction of the proposed RWI would require clearing of about 1 acre (0.4 hectares) of palustrine forested wetlands at the intake site and 6 acres (2 hectares) of palustrine forested wetlands and 3 acres (1.2 hectares) of palustrine emergent wetlands for the access road. Fill would be required for the facility footprint and some construction staging areas. The footprint of the structure would occupy approximately half of the area needed for site construction. The access road would be built on pilings. DOE would restore cleared areas to preconstruction conditions and monitor them after construction. The 9 acres (3.6 hectares) of land affected by the access road would not be filled, but would lose some wetland functions because the species composition would be indirectly affected from shading of the roadway, which would be on pilings.

If this alternative is selected, DOE would secure a jurisdictional determination from USACE. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetland impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in section 3.7.2 and in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. Specifically, DOE would preserve, restore, or create forested and emergent wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for wetland impacts.

This area of the ICW is frequently disturbed by traffic and dredging. Although species that forage or nest in the immediate area would be tolerant of frequent human activity and noise, construction and operation of the RWI would add to this disturbance and may displace sensitive species.

The RWI would withdraw about 1.2 MMB (50 million gallons per day) from the ICW for a period of 4 to 5 years during cavern solution mining and periodically afterwards for drawdown or cavern maintenance. The ICW has a relatively stable and abundant flow of water due to the tidal influence from the Gulf of Mexico. The proposed water withdrawal would not affect the stream flow in the ICW nor diminish the minimum instream flow necessary to sustain aquatic organisms. The withdrawal could change the salinity gradient in the ICW by causing an upstream migration of more saline brackish water.

Operations and maintenance of the RWI would produce noise during cavern solution mining, for a period of 4 to 5 years, and postconstruction during periods of oil fill and drawdown. Noise may preclude sensitive terrestrial and aquatic wildlife from using habitat in the immediate vicinity of the RWI. During water withdrawal, some aquatic organisms would become entrained or impinged by the intake, especially juveniles, larval stages, and dispersed fish eggs. The RWI would be equipped with screens, an intake velocity, a traveling screen, and fish bypass that would minimize entrainment and impingement.

Section 3.7.2 provides a description of other operations and maintenance impacts including artificial lighting and increased human activity that could affect migratory birds and other wildlife.

Mitigation: As described in section 3.7.2, DOE would use down-shielded and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. As described in chapter 2, DOE would use noise attenuation measures such as a concrete enclosure for the pump station to minimize noise impacts.

***Special Status Species***

Data provided by the Louisiana Department of Wildlife and Fisheries indicates that bald eagle nests exist within 1,500 feet (460 meters) of the proposed RWI. The USFWS and the Louisiana Department of Wildlife and Fisheries recommend against any activity taking place within this 1,500 foot (460 meter) buffer area of an active nesting site (Carloss 2005; Watson 2005b). DOE would have a biologist survey the area to identify the exact locations of nests near the proposed RWI. Where feasible, DOE would adjust proposed locations to avoid disturbance within 1,500 feet (460 meters) of a nest tree. If nests and the recommended buffer zone cannot be avoided, DOE would initiate formal Section 7 Consultation with the USFWS, coordinate with the Louisiana Department of Wildlife and Fisheries, and prepare a Biological Assessment if required. DOE would follow all recommendations provided in the Biological Opinion from the USFWS.

DOE would enclose the raw water pump station to minimize noise impacts on wildlife including the bald eagle. Normal operations and maintenance activities at the RWI would be completed outside nesting seasons to the extent possible. Operation activities associated with a drawdown of oil and water withdrawal may happen at any time of the year, but the noise from that activity would not likely adversely affect bald eagles near the RWI.

***Essential Fish Habitat***

No EFH is located in or near the boundaries of the proposed Chacahoula RWI.

***Special Status Areas***

There are no special status areas in or near the proposed Chacahoula RWI.

#### *3.7.4.2.4 Offshore Brine Disposal*

***Plants, Wetlands, and Wildlife***

Section 3.7.2 describes impacts to common species found in the Gulf of Mexico from offshore pipeline construction and brine disposal.

***Special Status Species***

Several species of sea turtles as well as the manatee may travel through the area of the offshore pipeline and brine diffuser; however, none of these species would be adversely affected by the proposed action because they are highly mobile and relatively tolerant of salinity changes, and the brine discharge would affect only a very small portion of their habitat.

***Essential Fish Habitat***

Because the bottom currents are parallel to Ship Shoal, it is possible that the Chacahoula discharge plume would be constrained by the decrease in depth of 14 to 18 feet (4.3 to 5.5 meters) near the shoal.  The plume is also confined due to the shallower water depth to the west.  Therefore, the plume is expected to elongate and move to the north and east.  Under certain oceanic conditions, the plume could move to the southeast along the Ship Shoal boundary.  However, under most ocean conditions, the higher salinity concentrations would be located off the Ship Shoal area.  The location of the diffusers and proximity to the shallow Ship Shoal may limit the dilution and mixing capacity of the brine discharge.  The presence of the shoal could create a more concentrated brine plume that could potentially have a greater impact on species that are less tolerant of higher salinity.  DOE would secure a Louisiana Pollutant Discharge Elimination System permit for the discharge from the Louisiana Department of Environmental Quality, which would establish discharge limits that protect water quality and aquatic resources.  Given the relatively limited size of the salinity plumes and the salinity tolerances of most organisms, the overall impacts to mobile, commercially valuable species are expected to be relatively small.

> Mitigation:  DOE would evaluate the mixing capacity of the brine discharge during the application process for a Louisiana Pollutant Discharge Elimination System permit. During the LPDES permit process, DOE would model the discharge using EPA's CORMIX discharge model to better refine the design and location of the diffusers.  The design and orientation of the diffusers could be modified to ensure that mixing and dilution are maximized.  DOE has already modified the original orientation of the brine diffusers so that they form and east-west line.  This modification was designed to enhance the mixing of the discharge and minimize the potential for impacting the ship shoal fisheries.  DOE would coordinate with the Louisiana Department of Environmental Quality, NOAA Fisheries, USACE, and U.S. Coast Guard to ensure that navigation, recreational fisheries, managed fisheries, and marine organisms are not impacted adversely by the brine disposal pipeline and discharge.

***Special Status Areas***

There are no special status areas located in or near the offshore brine diffusion system.

### 3.7.5 Clovelly Storage Site

This discussion addresses the following areas:

- The Clovelly storage site, including administrative buildings, piperacks, and security fencing; and
- New onsite RWI system and access road.

The proposed storage site at Clovelly would not require construction for the brine disposal or oil distribution systems.  DOE would use LOOP's current facilities for the brine disposal and oil distribution. Brine disposal during cavern development and draw down would use the existing brine reservoir and offshore disposal system within currently permitted limits.  Because of the similarity among the proposed SPR facilities in offshore environment and operations and maintenance of the brine diffuser, the discussion of the brine diffusion system for all proposed storage facilities is covered in section 3.7.2 and appendix E.  Also due to the similarities among the proposed storage sites, the discussion of EFH is contained in section 3.7.2 and appendix E.

#### 3.7.5.1 Affected Environment

##### *3.7.5.1.1 Clovelly Storage Site*

***Plants, Wetlands, and Wildlife***

The proposed Clovelly storage site would be developed at the existing LOOP Clovelly dome storage terminal in southeastern Louisiana within the Outer Coastal Plain Forest Province (Bailey 1995). The proposed storage site encompasses portions of the Barataria Bay estuary between the Mississippi River and Bayou Lafourche. The principal habitats include bayous, fresh to saline marshes (estuarine emergent wetlands), and **cheniers**, which are water-deposited and wind-driven depositional features associated with high-water marks. Although this area was west of the Hurricane Katrina path, it was flooded during the event. The immediate area at the Clovelly site did not experience adverse impacts to biological resources.

The site consists of maintained open-water canals for access to LOOP storage caverns among vegetated dredge spoil piles. The canals are devoid of submerged aquatic vegetation because the water is too deep, too turbid, and maintained. The former dredge spoil piles are in various stages of revegetation and include the following species: spikerush, arrowhead, cordgrass, wiregrass, roseau cane, deer pea, and water hyssop. Upland portions of the spoil piles support tree species such as red maple and Chinese tallowtree, which would otherwise not be expected to grow in the low-lying and saline wetland environment. The aquatic environment is influenced by a daily tidal influence. Depending on the season, waterfowl, wading birds, marsh hawks, alligators, and fur-bearing mammals are commonly found at the proposed storage site.

The area is predominately an estuarine community. The estuarine finfish species expected to inhabit the site include saltwater catfishes, drums, croakers, killifish, and jacks. Fresh-water species that may be present include fresh-water catfishes, sunfishes, and mullets. Invertebrate species common in these estuarine systems include stone crab, blue crab, oysters, and shrimp.

The administration buildings would be constructed about 4 miles (6 kilometers) to the west of the storage caverns across the road from LOOP administrative facilities. The land is disturbed from frequent activity along the road and nearby agriculture.

***Special Status Species***

A literature review identified that the following federally listed species may be present within the parish where the proposed Clovelly storage site would be located: bald eagle, brown pelican, peregrine falcon, piping plover, the gulf sturgeon, and several marine mammals and sea turtles. However, after consultations with USFWS and the Louisiana Department of Wildlife and Fisheries, DOE determined that the proposed Clovelly storage site would not affect federal or state-listed threatened, endangered, or candidate species.

***Essential Fish Habitat***

No EFH is located in or near the proposed Clovelly storage site.

***Special Status Areas***

The Gulf ICW to Clovelly Hydrologic Restoration project area (Coastal Wetlands Planning, Protection and Restoration Act, Project Number BA 2) is located immediately to the north of the LOOP facility. It is a wetland protection, restoration, and enhancement project involving about 60,000 acres (24,000 hectares) of fresh and brackish wetlands. The project was completed in 2002, but continues to be monitored.

##### *3.7.5.1.2 Raw Water Intake*

***Plants, Wetlands, and Wildlife***

The proposed RWI site would be located at the existing LOOP facility on a platform adjacent to an open-water canal. The RWI would be located a few hundred meters southwest of the storage caverns. Emergent wetland is the dominant vegetation classification in the area of the proposed RWI. The plants, wetlands, and wildlife are described in detail in the Clovelly storage site description.

***Special Status Species***

The RWI would be located in the same general location as the storage caverns. DOE has determined this area would not affect federal or state-listed threatened, endangered, or candidate species.

***Essential Fish Habitat***

No EFH is located in or near the proposed Clovelly storage site.

***Special Status Areas***

The special status area that may be affected by the proposed RWI is described above in the discussion of the affected environment for the proposed Clovelly storage site.

#### 3.7.5.2 Impacts

##### *3.7.5.2.1 Clovelly Storage Site*

***Plants, Wetlands, and Wildlife***

The proposed facility would have a small footprint and cause minimal disturbance to plant communities, open-water canals, estuarine wetlands, and dredge spoil sites. To construct the proposed caverns, about 8 acres (3 hectares) of estuarine wetlands would be dredged to allow access for drill barges. About 1 acres (0.4 hectares) of estuarine wetlands and canal would be filled. All of this land is conmprised of dredge spoil piles from previous LOOP construction activities. Although used by some bird species for nesting and foraging, the spoil areas are poor quality habitat due to previous disturbance and the presence of invasive species such as Chinese tallowtree. The spoil piles are elevated above the water level and support trees and upland species that otherwise would not grow in the estuarine open-water habitat. The dredged material would be temporarily placed on an upland area at the south side of the LOOP facility. Removal of the vegetation from the dredge spoil areas would displace some birds and other animals to adjacent habitat. This impact may disrupt individuals, but it would not alter the overall population or species viability. The Coastal Wetlands Planning, Protection, and Restoration Act project to the north provides about 60,000 acres (24,000 hectares) of high quality habitat near the site; therefore, there should be adequate and suitable habitat located nearby for displaced species.

DOE would conduct most of the cavern solution mining from drill barges. At the seven caverns where dredging is not needed, drilling would disturb plant communities in previously disturbed areas. Fish and other mobile species could move to adjacent undisturbed areas during construction. Drilling activities would increase suspended sediments in a localized area around the cavern sites. The erosion and sediment control plans and a Louisiana Pollutant Discharge Elimination System stormwater permit for construction activities would require best management practices to minimize siltation and sedimentation.

The piperacks to the cavern areas would be erected on pilings above the estuarine emergent wetlands and open water. Wetlands located underneath would be indirectly affected due to shading. Some vegetation directly under these areas would die, while vegetation near the edges may receive sufficient light to survive. The platforms are typically made of open mesh metal elevated several feet above the water. Some sunlight would penetrate through the platform to the wetlands and open water below. These affected areas are revegetated spoil piles that provide marginal habitat to bird and other species.

DOE's administration buildings would be located in an upland area about 4 miles (6 kilometers) from the caverns along East 103 Street and on the north side of the existing LOOP buildings. Construction of these buildings would impact about 0.1 acres (0.04 hectares) of upland forest and 0.2 acres (0.08 hectares) of maintained grass. No wetlands would be affected. This area has been previously disturbed and is frequently disturbed by mowing and other human activities along the access road.

The LOOP facility currently operates as an oil storage facility. The construction and operation of an additional 16 caverns and related facilities for the proposed SPR site would not alter day-to-day operations in the long-term. Areas dredged for access during construction would be maintained at depths to allow for navigation by service boats. This activity would temporarily disturb some aquatic species in the area.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from the USACE. In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands and preserve onsite emergent wetlands to the maximum extent practicable. The footprint of fill into open-water canals and wetlands would be small because the infrastructure would be placed on an elevated platform that is supported by pilings. DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid and minimize and compensate for impacts to jurisdictional wetlands. In addition, a Section 10 permit from the U.S. Coast Guard may be needed for the proposed filling of the mouth of a canal if it is determined to be navigable waters. DOE would implement the mitigation measures described in section 3.7.2 and in accordance with the 404 permit and 401 Water Quality Certificate from the USACE and the Louisiana Department of Environmental Quality. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with permit conditions.

> Mitigation: The spoil would be disposed of in an upland area, used to create or restore estuarine wetlands within the LOOP facility, or donated to nearby marsh (emergent wetland) restoration areas.
>
> Mitigation: DOE would implement a plan to control Chinese tallowtree invasion on the site. DOE would control invasive species by using seed mixes devoid of exotic and invasive species and through postconstruction monitoring of the disturbed areas. If the monitoring detected problems with invasive species, DOE would implement corrective action.
>
> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetlands impacts and impacts to forests.

***Special Status Species***

DOE has determined that no federal or state-listed threatened, endangered, or candidate species would be affected at the Clovelly storage site.

***Essential Fish Habitat***

No EFH exists in or near the boundaries of the proposed site.

***Special Status Areas***

The proposed action at Clovelly is contained entirely within the current LOOP boundaries, and operation would be consistent with current activity. DOE does not expect any effect on the Gulf ICW to the Clovelly Hydrologic Restoration project area.

##### 3.7.5.2.2 Raw Water Intake

***Plants, Wetlands, and Wildlife***

Section 3.7.2 describes general information about construction impacts associated with the proposed RWI structure. The proposed RWI would have a small footprint and cause minimal disturbance to plant communities, open-water canals, estuarine wetlands, and dredge spoil sites. To construct the proposed RWI and access road extension, about 1 acre (0.4 hectares) of wetlands, according to National Wetlands Inventory data, would be affected by dredging and construction of the platform. The existing access road would be extended about 300 feet (91 meters) to the proposed intake structure.

As discussed in section 3.7.2, some wildlife species would be displaced to similar vegetative and wetland communities surrounding the RWI. Dredging required for construction of the RWI structure may affect some aquatic organisms and temporarily increase suspended sediment in the water column. Mobile species could move away from the construction area. The canals in this area are dredged and maintained regularly. Therefore, most aquatic species would be tolerant of noise and human activity.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from the USACE. In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands and waters to the maximum extent practicable. DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetland impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in Common Impacts (see section 3.7.2) and in accordance with the 404 permit and 401 Water Quality Certificate from the USACE and the Louisiana Department of Environmental Quality. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts. As presented in chapter 2, erosion would be minimized with the use of best management practices. An erosion and sediment control plan and NPDES stormwater permit issued by the Louisiana Department of Environmental Quality for construction activities would be secured, which would require the use of best management practices to minimize the impact to water bodies.

Operations and maintenance of the RWI structure would produce noise during cavern solution mining (4 to 5 years) and periods of fill and drawdown. Noise may preclude sensitive terrestrial and aquatic wildlife from using habitat in the immediate vicinity of the RWI structure. Section 3.7.2 describes other operations and maintenance impacts, including artificial lighting and increased human activity, that could affect migratory birds and other wildlife.

The operation of the RWI would require up to 1.1 MMBD (46 million gallons per day) of water for a period of 4 to 5 years for cavern solution mining, which would be drawn from a tidally influenced canal. Periodically afterwards, water would be drawdown or cavern maintenance. Because LOOP uses a large brine pond for day-to-day operations, drawdown of 4 MMBD (170 million gallons per day) or less would use the existing brine reservoir. The entire region around the site is interspersed with a complex system of interconnected canals that extend to the Gulf of Mexico. Because of the tidal influence and extensive system of interconnected canals, the withdrawal would not impact water levels or the hydrology of the surrounding wetlands. During water withdrawal activities and operation of the RWI, some small aquatic organisms could become entrained or entrapped on the intake—especially larval stages, juveniles, and dispersed fish eggs as described in section 3.7.2. The potential for entrainment and impingement would be minimized by equipping the RWI with appropriate screen diameter, intake velocities, and traveling screens equipped with a fish bypass to collect and return aquatic life to the canals.

> Mitigation: As described in section 3.7.2, DOE would use down-shielded and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. As described in chapter 2, DOE would use noise attenuation measures such as a concrete enclosure for the pump station to minimize noise impacts.

***Special Status Species***

DOE has determined the construction, operations and/or maintenance of the RWI would not affect special status species (see appendices F and I).

***Essential Fish Habitat***

No EFH exists within or near the boundaries of the proposed RWI and no impact to EFH would occur.

***Special Status Areas***

DOE does not expect any effect on the Gulf ICW to Clovelly Hydrologic Restoration project area.

### 3.7.6 Clovelly and Bruinsburg Storage Sites

This section addresses the following areas:

- The proposed Clovelly 80 MMB and Bruinsburg 80 MMB alternative (160 MMB total), the proposed Clovelly 90 MMB and Bruinsburg 80 MMB alternative (170 MMB total) and their associated facilities;
- The proposed pipeline and power line ROW segments;
- The proposed RWI structures at Clovelly and Bruinsburg including site access roads;
- The proposed petroleum storage terminal in Jackson; and
- The 30 offsite brine injection wells.

Section 2.4.4 describes the proposed action for the joint development of the Clovelly and Bruinsburg storage sites. Most components of the proposed action and the potentially affected areas for the development of the Clovelly and Bruinsburg storage alternative would be similar to the analysis provided in sections 3.7.3 and 3.7.5. This section on the Clovelly-Bruinsburg alternative focuses on the elements of the proposed action and their associated biological impacts that would be different from the development of the alternatives as individual storage sites. These differences include smaller site footprints for the proposed infrastructure and changes in crude oil pipeline distribution routes.

The Clovelly 90 MMB and Bruinsburg 80 MMB alternative (see chapter 2) was addressed as well. The only difference from the Clovelly 90 MMB and Bruinsburg 80 MMB alternative is that the RWI withdrawal and the brine discharge would occur over a slightly longer time frame during cavern construction. Because the footprint for the Clovelly 80 MMB or Clovelly 90 MMB layout would not be different and the impacts would not be substantially different, DOE did not specifically describe the impacts of the Clovelly 90 MMB-Bruinsburg 80 MMB alternative. Thus, all the discussion below is related to the Clovelly 80 MMB and Bruinsburg 80 MMB alternative but also applies to the Clovelly 90 MMB and Bruinsburg 80 MMB alternative.

### 3.7.6.1 Affected Environment

#### *3.7.6.1.1 Clovelly and Bruinsburg Storage Sites*

***Plants, Wetlands, and Wildlife***

The proposed Clovelly 80 MMB storage site would be developed at the existing LOOP Clovelly Dome storage terminal in southeastern Louisiana within the Outer Coastal Plain Forest Province (Bailey 1995). The affected environment for the proposed Clovelly storage site is described in detail in section 3.7.5. The Clovelly 80 MMB storage site would be slightly smaller than the 120 MMB proposed site with 4 less caverns. Consequently, with the smaller footprint, the 80 MMB storage configuration would require less dredging and connecting pipeline.

The proposed Bruinsburg 80 MMB storage site would occupy about 254 acres (103 hectares) at a site located about 10 miles west of Port Gibson, MS (see figure 2.4.4-2). This area includes about a 172-acre (69-hectare) storage site with a 300-foot (91-meter) security buffer around the facility. The facility would also have an access road that would occupy about 2.3 acres (0.8 hectares). The affected environment for the proposed Bruinsburg storage site is described in detail in section 3.7.3.

***Special Status Species***

Special status species for the proposed Clovelly and Bruinsburg storage sites are described in sections 3.7.3 and 3.7.5, respectively.

***Essential Fish Habitat***

EFH for the proposed Clovelly and Bruinsburg storage sites are described in sections 3.7.3 and 3.7.5, respectively.

***Special Status Areas***

Special status areas for the proposed Clovelly and Bruinsburg storage sites are described in sections 3.7.3 and 3.7.5, respectively.

#### *3.7.6.1.2 Clovelly and Bruinsburg Rights-of-Way*

Four pipeline and five power line ROWs would be required for the proposed Bruinsburg storage site (see figure 2.4.1-1).  This affected environment section discusses the pipeline and power line ROWs that are different from the proposed Bruinsburg 160 MMB storage site (section 3.7.3).  The impacts discussion in section 3.7.6.2.2 considers the impact of all pipeline and power line ROWs associated with the proposed Clovelly-Bruinsburg alternative.

The proposed RWI pipeline ROW, RWI power line ROW, and site power line ROW would be the same under the 80 MMB and 160 MMB Bruinsburg storage site alternatives.  The 8-mile (13-kilometer) brine-disposal ROW, including the pipeline, power line, and access road, would be half the length of the brine disposal ROW proposed under the 160 MMB option.  The brine disposal pipeline would only need to support 30 brine injection wells rather than 60 wells.  The proposed crude oil distribution pipelines would differ from the 160 MMB site alternative in that they would go north and northwest and end at different petroleum storage terminals located near the Cities of Jackson and Vicksburg, MS.

No offsite pipelines or power lines would be necessary for the proposed Clovelly storage site.

***Pipeline ROWs***

- A proposed 54.4-mile (87.5-kilometer) crude oil pipeline would be constructed from the Bruinsburg site to the Jackson terminal.  The pipeline would share an ROW with the crude oil pipeline to the Vicksburg terminal for 19.0 miles (30.6 kilometers).  A 138-kilovolt power line would exit the site and share an ROW with the crude oil pipelines for 5.7 miles (8.8 kilometers).  Approximately 30 miles (50 kilometers) of the pipeline ROW would follow existing power line corridors.

- A proposed 31.8-mile (52.1-kilometer) crude oil pipeline would be constructed from the Bruinsburg site to the Vicksburg terminal.  The proposed pipeline would share an ROW with the crude oil pipeline to the Jackson terminal for 19.0 miles (30.6 kilometers).  A 138-kilovolt power line would exit the site and share an ROW with the crude oil pipelines for 5.7 miles (8.8 kilometers).  Approximately 20 miles (30 kilometers) of the pipeline ROW would follow existing power line corridors.

***Plants, Wetlands, and Wildlife***

Nearly 60 percent of the 19.0 miles (30.6 kilometers) of the shared crude oil pipeline ROW from the proposed Bruinsburg storage site contains deciduous forest.  Approximately 70 percent of the deciduous forest contains palustrine forested wetlands.  The remainder of the ROW consists of evergreen forest, grassland and scrub-shrub habitat, and disturbed or managed lands.

The crude oil pipeline to the Jackson terminal continues for 35.3 miles (56.8 kilometers) to the Vicksburg terminal after splitting from the shared ROW with the crude oil distribution pipeline.  Approximately 39 percent of the ROW traverses grassland and scrub-shrub habitat.  A large portion of this habitat is likely successional growth from abandoned agricultural fields or pine plantations.  The remaining habitat within the ROW is comprised of deciduous forest and disturbed or managed lands.  Approximately 26 percent of the total ROW area is identified as palustrine forested wetlands by the National Wetlands Inventory data.

The crude oil pipeline to the Vicksburg terminal would extend for 12.8 miles (20.6 kilometers) after splitting from the shared ROW with the crude oil distribution pipeline to the Jackson terminal.  Approximately 44 percent of the ROW is comprised of grassland and scrub-shrub habitat and disturbed or managed lands. The remainder of the habitat is classified as a mixture of hardwood forest and wetlands habitat. The USFWS National Wetlands Inventory data classify 12 percent of the total ROW area as palustrine forested wetlands. An additional 7 percent of the total ROW area is identified as emergent and lacustrine wetlands.

Based on the various land classification types and the wetlands present along the ROWs, several common mammals, birds, amphibians, and reptiles may use the existing habitats within the ROWs. Such species would be similar to those described under the proposed Bruinsburg storage site.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the counties where the proposed Bruinsburg ROWs would be located: bald eagle, interior least tern, bayou darter, gulf sturgeon, pallid sturgeon, Louisiana black bear, and ringed map turtle. However, a review of the conditions along the ROWs and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that there are no federally listed threatened, endangered, or candidate species within 2 miles (3 kilometers) of the proposed crude oil pipeline ROWs to Vicksburg and Jackson.

Appendix I identifies species listed as threatened or endangered by Mississippi (but are not on the federal list) in the counties in the proposed Bruinsburg site and related infrastructure. Data provided by the Mississippi Natural Heritage Program indicated that 4 species are located within 2 miles (3 kilometers) of the proposed ROWs: bayou darter, crystal darter in Bayou Pierre, pyramid pigtoe, and rabbitsfoot in Big Black River.

***Special Status Areas***

The crude oil pipeline ROW to the Jackson terminal would cross through the Natchez Trace Parkway, a 440-mile (710-kilometer) highway managed by the Park Service, created to commemorate an ancient trail that connected portions of the Mississippi River to salt licks located in central Tennessee. The crude oil pipeline would connect with an existing power line corridor before entering the park boundaries and would follow that corridor through the park.

#### 3.7.6.1.3 Clovelly and Bruinsburg Raw Water Intake Structures

The proposed Bruinsburg RWI for the 80 MMB facility would be located on the Mississippi River at the same site, but would have a smaller site footprint than the 160-MMB alternative. Access to the facility would be available from an existing road; therefore, an additional access road would not be required. The affected environment for the structure is described in section 3.7.3.1.3.

The proposed Clovelly RWI for the 80 MMB and 90 MMB facility would be located on the existing LOOP Clovelly Dome Storage on an open-water canal. The proposed RWI would have a similar site footprint as the Clovelly 120 MMB alternative. The affected environment for the proposed structure is described in section 3.7.5.1.2.

***Plants, Wetlands, and Wildlife***

A description of the plants, wetlands, and wildlife for the proposed Clovelly and Bruinsburg RWI is provided in sections 3.7.3 and 3.7.5, respectively.

***Special Status Species***

Special status species for the proposed Clovelly and Bruinsburg RWIs are described in sections 3.7.3 and 3.7.5, respectively.

***Special Status Areas***

Special status areas for the proposed Clovelly and Bruinsburg RWIs are described in sections 3.7.3 and 3.7.5, respectively.

***Essential Fish Habitat***

No EFH occurs in or near the boundaries of the RWI structure.

#### *3.7.6.1.4 Jackson Terminal*

***Plants, Wetlands, and Wildlife***

The proposed 71-acre (29-hectare) terminal would be located northwest of Raymond, MS, adjacent to the existing Jackson pump station for the Capline pipeline. More than 50 percent of the proposed site consists of grassland and open field habitat. Drainage ditches are present, suggesting that the grassland areas are likely converted farm fields with the ditches likely dug to drain the site. Deciduous and evergreen pine forest and agricultural fields comprise the remainder of the proposed facility. The National Wetlands Inventory data identified 9.7 acres (3.9 hectares) of palustrine forested wetlands on the site.

The surrounding area is a similar mosaic of forested and open field habitat. Wildlife using the forests and fields would be common species that are tolerant of human activities. The site provides low to moderate habitat.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Jackson terminal would be located: bayou darter, gulf sturgeon, Louisiana black bear, and ringed map turtle. However, a review of conditions at the proposed Jackson terminal and consultations with the USFWS and Mississippi Natural Heritage Program revealed that the terminal would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices G and I).

***Special Status Areas***

No special status areas are located in or near the boundaries of the proposed terminal.

***Essential Fish Habitat***

No EFH exists in or near the boundaries of the proposed Jackson terminal.

#### *3.7.6.1.5 Brine Injection Wells*

Thirty brine injection wells, each occupying an area of about 1.2 acres (0.5 hectares), would be located adjacent to the pipeline and power line ROW.

***Plants, Wetlands, and Wildlife***

The plants, wetlands, and wildlife potentially affected by the proposed brine injection wells for the Clovelly and Bruinsburg alternative are similar to what is described in section 3.7.3.2.6. The entire footprint of the brine injection wells would comprise half the size of the Bruinsburg 160 MMB alternative.

***Special Status Species***

A review of the conditions at the brine injection wells and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the area does not provide suitable habitat for any federally or state-listed threatened or endangered species (see appendices G and I).

***Special Status Areas***

No special status areas are located in or near the boundaries of the proposed brine injection wells.

#### 3.7.6.2 Impacts

##### *3.7.6.2.1 Clovelly and Bruinsburg Storage Sites*

The impacts due to construction and operations and maintenance for the proposed Clovelly storage site are described in detail in section 3.7.5.

***Plants, Wetlands, and Wildlife***

The proposed Clovelly 80 MMB facility would have a smaller footprint than the proposed Clovelly 120 MMB facility and would cause only minimal disturbance to plant communities, open-water canals, estuarine wetlands, and dredge spoil sites. To construct the proposed caverns, about 3 acres (1 hectare) of estuarine wetlands would be dredged to allow access for drill barges. These wetlands are associated with dredge spoil piles from previous activities at the existing LOOP Clovelly storage facility. DOE would dredge 5 acres (2 hectares) less wetlands habitat than the proposed 120 MMB alternative described in section 3.7.1.2. No wetlands or portions of the canal would require filling under either the 80 MMB or 90 MMB facility at Clovelly. Construction, operations, and maintenance impacts related to wildlife and plant communities are described further in section 3.7.5.

The clearing and grading associated with the Bruinsburg 80 MMB storage site would affect about 254 acres (103 hectares) and include the 83-acre (33-hectare) storage site with a 300-foot (91-meter) cleared security buffer zone. An additional 2.3 acres (0.8 hectares) would be cleared to construct an access road to the Bruinsburg storage site.

The construction would affect the following habitats:

- 119 acres (48 hectares) of hardwood forest,
- 60 acres (24 hectares) of disturbed or managed land,
- 38 acres (15 hectares) of grassland and scrub-shrub habitat, and
- 36 acres (15 hectares) of palustrine-forested wetlands.

Clearing and grading the palustrine-forested wetlands would permanently fill 20 acres (8 hectares) onsite and convert 16 acres (6 hectares) within the security buffer to emergent wetlands or open water.

The construction, operations, and maintenance impacts associated with the Bruinsburg 80 MMB alternative are similar to the impacts described for the proposed 160 MMB alternative (section 3.7.3.2.1).

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts and would comply with relevant state and federal regulations on wetlands.
>
> Mitigation: As described in section 3.7.2 DOE would use down-shielded lights and use low-mast lighting to minimize the impacts of artificial lighting on migratory birds and other wildlife. If this alternative is selected, DOE would conduct a survey for raptor nests in accordance with USFWS requirements under the Migratory Bird Treaty Act.
>
> Mitigation: DOE would implement a plan to control Chinese tallowtree invasion on the site. DOE would control invasive species by using seed mixes devoid of exotic and invasive species and through postconstruction monitoring of the disturbed areas. If the monitoring detected problems with invasive species, DOE would implement corrective action.

***Special Status Species***

Special status species for the proposed Clovelly and Bruinsburg storage sites are described in sections 3.7.3 and 3.7.5 respectively.

***Special Status Areas***

No special status areas are in or near the boundaries of the proposed site.

***Essential Fish Habitat***

No EFH exists in or near the boundaries of the proposed site.

#### 3.7.6.2.2 Bruinsburg Rights-of-Way

The proposed Clovelly storage site would not require offsite pipelines or power lines. Thus, this section evaluates the impacts of all pipelines and power line ROWs associated with the proposed Bruinsburg 80 MMB storage site.

***Plants, Wetlands, and Wildlife***

Construction in the pipeline and power line ROWs would result in clearing all the vegetation within the ROW. Clearing the ROWs would affect the following habitats:

- 80 acres (32 hectares) of evergreen (pine) forest,
- 546 acres (221 hectares) of hardwood forest,
- 261 acres (106 hectares) of grassland and scrub-shrub habitat,
- 176 acres (71 hectares) of disturbed or managed areas, and
- 114 acres (46 hectares) of water and emergent wetlands.

GAP Analysis Program data do not accurately classify wetland areas, particularly forested wetlands (USGS 2003). DOE used National Wetlands Inventory data to determine that the proposed ROWs would affect the following wetland types:

- 408 acres (165 hectares) of palustrine forested wetlands,
- 12 acres (5 hectares) of lacustrine,
- 5 acres (2 hectares) of palustrine emergent,
- 8 acres (3 hectares) of riverine wetlands,
- 20 acres (8 hectares) of other wetlands categories,
- 1 acre (0.4 hectare) of palustrine-aquatic bed,
- 4 acres (2 hectares) of palustrine scrub-shrub,
- 3 acres (1 hectare) of palustrine open water, and
- 6 acres (2 hectares) of palustrine unconsolidated bottom.

Approximately 87 percent of the proposed Bruinsburg ROW would follow existing pipeline and utility corridors, which already have fragmented and disturbed plant communities.

The proposed pipeline and power line corridors would permanently affect about 33 to 40 percent of the described impact areas because only a 50-foot (15-meter) wide easement per pipeline would be permanently maintained. The vegetation in the construction easement would be cleared, but DOE would regrade to preconstruction contours and reseed with native species in this area to re-establish native habitat. The remaining area in the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be regraded and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands and the nature and amount of wetland impact from the permanent and construction easements. In addition, many of these wetlands would be avoided by directional drilling from the adjacent uplands. Moreover, about 25 percent of the pipeline ROWs is within or parallel to an existing ROW. Use of existing ROW corridors to the maximum extent practicable would minimize the impact to undisturbed communities and wildlife.

DOE would preserve, restore, or create wetlands in accordance with the Section 404/401 permit conditions, which would mitigate for the wetland habitat lost due to construction and operation of the site.

As stated in the section 3.7.2, construction in the ROWs would displace or kill aquatic and terrestrial wildlife. Noise and human activity may temporarily preclude some organisms from using nearby habitat. The duration of construction through these areas would be short (6 to 10 weeks at any one location) and ample habitat would be available nearby for most species. The elevated portion of the power lines could represent a potential strike hazard to resident and migratory birds. However, the maximum pole height is expected to be 75 feet (23 meters), which would greatly reduce the hazard. These impacts may affect individual organisms, but would not alter the regional population or species viability.

Common impacts associated with the operations and maintenance of the ROWs are described in section 3.7.2.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with

erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.

DOE would use low power line poles (less than 75 feet [23 meters]) and follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996).

***Special Status Species***

The proposed ROWs would not affect any federally listed threatened, endangered, or candidate species (see appendix G). Because the brine disposal ROW and access road would not cross Coles Creek as it does in the Bruinsburg 160 MMB option there would be no impact to the federally listed endangered fat pocketbook mussel.

Bayou Pierre and Big Black River would be directionally drilled to avoid impacts to the state-listed species associated with these rivers.

***Special Status Areas***

The crude oil pipeline to the Jackson terminal would cross the Natchez Trace Parkway in an existing utility ROW. Construction through this area would require an expansion of the existing ROW and the clearing of additional vegetation. Trees would not be allowed to regrow within the 50-foot (15-meter) maintained easement of the pipeline; however, the remaining area affected by construction would be allowed to revegetate to natural habitat. Use of existing ROW corridors to the maximum extent practicable would minimize the impact to undisturbed communities and wildlife.

Mitigation: If the Bruinsburg site is selected, DOE would coordinate with the National Park Service to obtain the proper ROW easements through Natchez Trace Parkway. DOE would follow the existing power line easement to minimize impacts to the Parkway. DOE would work with the National Park Service to ensure that wildlife and natural resources are disturbed to the smallest degree practicable.

***Essential Fish Habitat***

No EFH exists in or near the pipeline and power line ROWs.

#### *3.7.6.2.3 Raw Water Intake*

Section 3.7.5.2.2 describes the construction, operations, and maintenance impacts of the proposed Clovelly RWI structure. The sections below describe the construction, operations, and maintenance impacts of the Bruinsburg RWI structure because they would be slightly different from the Bruinsburg 160 MMB storage site.

***Plants, Wetlands, and Wildlife***

Section 3.7.2 describes construction impacts associated with the proposed RWI structure and access roads. The clearing and grading associated with construction of the Bruinsburg RWI would affect 0.2 acres (0.1 hectare) of forested and wetland habitat. The permanent site structure would occupy only about 0.3 acres (0.1 hectare). DOE would secure permits from the USACE and the Mississippi Department of Environmental Quality for the impact to jurisdictional wetlands and would provide compensation for the unavoidable impacts.

The impacts associated with the Bruinsburg RWI are discussed in further detail in section 3.7.1.2.3.

> Mitigation: As described in section 3.7.2, DOE would use down-shielded and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. As described in chapter 2, DOE would use noise attenuation measures such as a concrete enclosure for the pump station to minimize noise impacts.

***Special Status Species***

Special status species for the proposed Clovelly and Bruinsburg storage sites are described in sections 3.7.3 and 3.7.5, respectively.

***Essential Fish Habitat***

No EFH is located in or near the proposed RWI boundaries.

***Special Status Areas***

No special status areas are located in or near the proposed RWI boundaries.

#### *3.7.6.2.4 Jackson Terminal*

***Plants, Wildlife, and Wetlands***

The clearing, grading, and construction of the proposed tank farm associated with the Jackson terminal would affect about 71 acres (28 hectares) of the following areas:

- 4 acres (2 hectares) of evergreen (pine) forest,
- 20 acres (8 hectares) of deciduous forest,
- 38 acres (16 hectares) of grassland scrub-shrub habitat, and
- 8 acres (3 hectares) of disturbed or managed land.

Approximately 10 acres (4 hectares) of palustrine forested and 1 acre (0.4 hectares) of palustrine unconsolidated bottom wetlands would be filled. The placement of fill in the wetlands would cause a permanent loss of wetlands functions and values. DOE would secure permits from the USACE and the Mississippi Department of Environmental Quality for the impact to jurisdictional wetlands and provide compensation for the unavoidable wetland impacts. Section 3.7.2 describes the effects of clearing and filling wetlands in detail.

After the security fencing is constructed, wildlife use of the site would be limited; though some mobile species and birds would probably still visit the site. The operations and maintenance activities, which are described in section 3.7.2, may preclude wildlife sensitive to human disturbance from entering the area. The operational and maintenance activities at the terminal would be infrequent and similar to activities occurring at the oil pump station adjacent to the proposed terminal. This area has already been disturbed by past construction and habitat fragmentation.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts and impacts to forests.

***Special Status Species***

A review of conditions at the proposed Jackson terminal and consultations with the USFWS and Mississippi Natural Heritage Program revealed that the terminal would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices G and I).

***Special Status Areas***

No special status areas are located near or within the boundaries of the proposed Jackson terminal.

***Essential Fish Habitat***

No EFH exists in or near the boundaries of the proposed Jackson terminal.

##### 3.7.6.2.5 Offsite Brine Injection Wells and Brine Disposal Pipeline and Power line ROW

***Plants, Wetlands, and Wildlife***

Construction of the brine injection wells would result in clearing all vegetation in the well sites. The following habitats would be affected according to Mississippi GAP Analysis Program data (USGS 2003):

- 23 acres (9 hectares) of deciduous forest,
- 2 acres (1 hectare) of grassland and scrub-shrub habitat,
- 6 acres (3 hectares) of disturbed or managed habitat, and
- 5 acres (2 hectares) of water and emergent wetlands.

Because GAP Analysis Program data does not accurately classify wetland areas, particularly forested wetlands, DOE used National Wetlands Inventory data and the proposed construction easements to determine that construction of the brine injection wells would affect 12 acres (5 hectares) of palustrine forested wetlands. The placement of fill in the wetlands would cause a permanent loss of wetland functions and values. DOE would secure permits from the USACE and the Mississippi Department of Environmental Quality for the impact on jurisdictional wetlands and provide compensation for the unavoidable wetland impacts. Section 3.7.2 describes the effects of clearing and filling wetlands in detail.

The impacts associated with the Bruinsburg brine injection wells are discussed in further detail in section 3.7.3.1.6.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize impacts to wetlands and forests.

***Special Status Species***

No federally listed threatened, endangered, or candidate species would be affected by the construction or operations and maintenance of the proposed brine injection wells for the Bruinsburg site (see appendix G).

No state-listed threatened or endangered species would be affected by the construction, operations, and maintenance of the proposed brine injection wells for the Bruinsburg site (see appendix I).

***Special Status Areas***

No special status areas exist in or near the brine disposal pipeline, power lines, and brine injection wells.

***Essential Fish Habitat***

No EFH exists in or near the brine disposal pipeline, power lines, and brine injection wells.

### 3.7.7 Richton Storage Site

This section addresses the following areas:

- Storage site and site access road;
- Five proposed ROW segments:  an ROW that contains all the pipelines and power lines leaving the proposed new site, a crude oil pipeline ROW to Liberty Station, a crude oil pipeline and a brine disposal pipeline ROW to Pascagoula, a raw water pipeline and power line to the RWI structure, and power line ROW from the RWI to existing lines south of the Leaf River;
- RWI structure and access road;
- Terminal in Pascagoula, MS; and
- Terminal in Liberty, MS.

Because of the similarity among the proposed SPR facilities in offshore environment, offshore pipeline construction methods, and operations and maintenance of the brine diffuser, the discussion of the offshore pipeline and brine diffusion system for the Richton proposed storage facilities is covered in section 3.7.2. In addition, due to these similarities among the proposed storage sites, the discussion of EFH is contained in section 3.7.2 and appendix E.

#### 3.7.7.1 Affected Environment

##### *3.7.7.1.1 Richton Storage Site and Access Road*

***Plants, Wetlands, and Wildlife***

The proposed Richton storage site is located in a transition area between the Outer Coastal Plain Forest Province and the Southeastern Mixed Forest Province (Bailey 1995).  The ecological characteristics of the site and surrounding area represent the general characteristics of the Southeastern Mixed Forest Province, which is comprised of mixed deciduous and evergreen forests.

The proposed site encompasses about 346 acres (140 hectares) and is located north of Highway 42.  This area includes the approximately 238-acre (96-hectare) storage site with a 109-acre, 300-foot (44-hectare, 91-meter) security buffer.  The site is an actively managed slash pine plantation stands from 10 to 20 years of age.  Some areas of the site have been harvested within the last 5 years and are at various stages of regrowth.  During DOE’s site visit in October 2005, trees were being harvested.  The most recently logged areas are devoid of vegetation and covered in dried and rotting woody material.  Older logged areas are revegetated with various herbaceous plants, grasses, bushes, and tree saplings such as blackberry, trumpet creeper, thistle, goldenrod, and Chinese tallowtree—an invasive tree species.  The plant communities at the site were not affected by the hurricanes of 2005.

The site has a small intermittent stream channel that drains its center and is bordered by forested and emergent palustrine wetlands. The wetlands and intermittent stream are the headwaters of Pine Branch, which flows south out of the site and through a culvert under Highway 42. A manmade pond occupies approximately 6.0 acres (2.4 hectares) at the western boundary of the proposed site and is surrounded by palustrine forested and emergent wetlands. The species in forested wetlands areas include red maple, sweet gum, tupelo, and Chinese tallowtree. A variety of sedges, rushes, bulrush, and pitcher plants comprise the dominant species in the emergent wetlands adjacent to the stream channel and manmade pond.

The terrestrial wildlife observed in the vicinity of the Richton site during the site visit include white-tailed deer, armadillo, raccoon, opossum, black vulture, and red-tailed hawk, which are common, fairly mobile species adapted to living in disturbed habitat areas.

The manmade pond located near the central western boundary of the Richton site probably supports a small fish population, including minnows, sunfish, bass, and catfish. Because of the lack of permanent water in Pine Branch Creek, it probably does not support a permanent fish population. The permanent surface water bodies outside the boundaries of the proposed Richton site are fresh water systems and have species that are typical of these communities in the southern United States.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Richton storage site would be located: red-cockaded woodpecker, gulf sturgeon, pearl darter, Camp Shelby burrowing crayfish, gray myotis, Louisiana quillwort, black pine snake, Eastern indigo snake, gopher tortoise, and the yellow-blotched map turtle. After a review of the conditions at the proposed Richton storage site and consultations with the USFWS and the Mississippi Natural Heritage Program, DOE determined that the federally listed black pine snake (candidate species) and gopher tortoise (federally threatened) may be affected. The Richton site does not have suitable habitat for any state-listed species and the Mississippi Natural Heritage Program confirmed no occurrences of state-listed species within 2 miles (3 kilometers) of the proposed site.

The black pine snake is a candidate species for federal listing under the ESA and has been documented within 2 miles (3 kilometers) of the Richton site in Perry County (Clark 2005; MNHP 2006). Its preferred habitat is sandy, well-drained soils with an **overstory** of longleaf pine, a fire-suppressed midstory, and a dense herbaceous ground cover (Duran 1998b). It is rarely found in riparian areas, hardwood forests, or closed **canopy** conditions (Duran 1998a).

The federally threatened gopher tortoise prefers locations with dry sandy soils, abundant ground cover, and a sparse canopy. Although seldom seen above ground, the presence of large conspicuous burrows is indicative of its presence.

***Special Status Areas***

No special status areas exist within or near the boundaries of the proposed Richton site.

#### *3.7.7.1.2 Richton Rights-of-Ways*

The proposed Richton storage site would require a 10-mile (17-kilometer) RWI pipeline, two 88-mile (142-kilometer) dual-purpose crude oil and brine pipelines to Pascagoula, a 116-mile (186-kilometer) crude oil pipeline to Liberty, and two 138-kilovolt power lines in the following ROWs:

- The proposed RWI pipeline would share the ROW with the rest of the pipelines for 5.8 miles (9.3 kilometers) and then continue south for 4.6 miles (7.3 kilometers) to the RWI structure on the Leaf River.

- The proposed crude oil pipeline to Liberty terminal would share an ROW for 5.8 miles (9.3 kilometers) with the power lines, RWI, brine disposal, and crude oil pipeline to Pascagoula. It then heads west 110 miles (177 kilometers) to the terminal at Liberty.

- The proposed crude oil pipeline to Pascagoula and brine disposal pipeline would share the 5.8 mile (9.3 kilometers) ROW with other pipelines. They join an existing pipeline ROW for 72 miles (116 kilometers) to Pascagoula City. The pipelines continue for 9.5 miles (15 kilometers) to the terminal on Singing River Island. The proposed brine disposal pipeline would then continue into the Gulf of Mexico to the brine diffuser located about 13 miles (20 kilometers) offshore.

- The proposed power lines follow the RWI pipeline and connect to existing power lines 1 mile (0.6 kilometers) south of the RWI structure.

***Plants, Wetlands, and Wildlife***

Approximately 30 percent of the ROWs for the proposed pipelines follow existing ROW corridors. These easements have been disturbed by previous construction and periodic maintenance activities. The crude oil pipeline, RWI pipeline, brine disposal pipeline, and power lines share an exit ROW for 5.8 miles (9.3 kilometers) south from the Richton storage site. This proposed ROW would cross 62 percent pine and hardwood forested habitat and approximately 27 percent grassland habitat. Seven percent of the proposed ROW would cross palustrine wetlands. The grassland category includes natural areas of low herbaceous cover, but also includes range or pasture areas. The classification of pine forests in the Gap Analysis Program data does not distinguish between natural evergreen forests and pine plantations. In Mississippi, roughly one-third of evergreen forests are pine plantations that are subject to frequent thinning and application of fertilizers and herbicides.

The main wetland type within the ROWs are palustrine forested wetlands or bottomland hardwood forests. This habitat type used to be common throughout the Southeast. Agriculture, flood control, and land development have drained, converted, or fragmented large areas of these forests; thus, Mississippi recognizes this habitat type as vulnerable (MMNS 2002).

The RWI ROW continues south from the end of the shared exit ROW to the RWI structure at the Leaf River. The majority of this ROW is forested with 57 percent pine forest and 15 percent hardwood. The remaining area consists of palustrine forested wetlands associated with the floodplain of the Leaf River. The power line ROW would cross similar habitat types and wetlands as the ROW for the RWI.

The proposed crude oil pipeline to Liberty continues from the end of the exit ROW west for 110 miles (177 kilometers) to Liberty Station. Ninety-seven percent of this proposed ROW contains upland habitats of pine forest, hardwood forest, grasslands, and disturbed areas. Palustrine forested wetlands are the dominant wetland category found in the proposed corridor. A proposed pump station for the crude oil pipeline would require approximately 1.7 acres (0.7 hectares) of land. The proposed site for the pump station includes mostly grassy or open areas with approximately 13 percent of the area comprised of mixed pine and hardwood forests.

The proposed crude oil pipeline ROW to Pascagoula would follow an existing 72-mile (116-kilometer) pipeline ROW to the City of Pascagoula. Nine miles (15 kilometers) of the proposed pipeline would cross through the City of Pascagoula in a new ROW to the terminal on Singing River Island. The dominant vegetation present along the corridor is pine forest. Approximately 13 percent of the proposed ROW contains wetlands, mostly palustrine forested wetlands in the interior sections of the ROW. As the ROW approaches the coast, it crosses estuarine wetlands.

Based on the various land classification types and the wetlands present along the ROWs, several common mammals, birds, amphibians, and reptiles may use the existing habitats within the ROWs. These species would be similar to those described under the Richton storage site description. The ROWs would cross fresh-water systems that include common species of fish such as fresh-water eels, minnows, mullet, catfish, suckers, sunfish, bass, perch, and darters—all of which are common throughout the Gulf Coast region, and adapt well to changes in the environment.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the counties where the proposed Richton ROWs would cross: bald eagle, brown pelican, Mississippi sandhill crane, piping plover, red-cockaded woodpecker, Gulf sturgeon, pearl darter, Camp Shelby burrowing crayfish, gray myotis, Louisiana black bear, Louisiana quillwort, Alabama red-belly turtle, black pine snake, Eastern indigo snake, gopher tortoise, Kemp's ridley sea turtle, loggerhead sea turtle, yellow-blotched map turtle, and several marine mammals. A review of the conditions at the Richton pipeline ROWs and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that areas included in the pipeline ROWs may provide suitable habitat for several of these federally listed threatened or endangered species.

The pearl darter (a federal candidate species) has been documented throughout the Leaf River to the lower Pascagoula drainage, but little is known about their specific habitat requirements or spawning behavior (Slack et al. 2005). Proposed ROWs that would cross this drainage system include the pipeline ROW from Richton to Pascagoula and the pipeline ROW from Richton to Liberty Station. The pipeline ROW from Richton to Liberty Station would cross the Leaf River in Forrest County. The proposed pipeline ROW from Richton to Liberty station would also cross Black Creek in Lamar County and Tallahala Creek in Perry County. Candidate species are not regulated under the ESA unless they are listed as threatened or endangered by the USFWS or NOAA Fisheries before the proposed action is undertaken.

The black pine snake and gopher tortoise are both found on well-drained sandy soils with sparse forest canopy. Data from Mississippi Natural Heritage Program confirms populations of gopher tortoises within 2 miles (3 kilometers) of all proposed ROWs and the black pine snake within 5 miles (8 kilometers).

Species that are listed as threatened or endangered by Mississippi but are not federally listed are summarized in appendix I for the counties containing parts of the Richton development. Table 3.7.7-1 lists the species that the Mississippi Natural Heritage Program has confirmed within 2 miles (3 kilometers) of the proposed ROWs.

There are no known occurrences of these species within the proposed ROWS; however, no comprehensive survey or habitat assessments have been conducted.

***Special Status Areas***

The proposed crude oil pipeline to the Pascagoula terminal would be located about 1 mile (1.6 kilometers) from the Grand Bay National Estuarine Research Reserve. Approximately 0.5 mile (0.7 kilometer) of the proposed ROW to Liberty would pass through Percy Quin State Park.

**Table 3.7.7-1: State-listed Species Within 2 miles of Richton ROWs**

| Common Name | State Status | Global Status[a] | Potentially Suitable Habitat at Site |
|---|---|---|---|
| Dark gopher frog | Endangered | Critically imperiled | Pine and upland hardwood forest mixed with wetlands forests |
| Crystal darter | Endangered | Vulnerable | Pearl River |
| Frecklebelly madtom | Endangered | Vulnerable | Pearl River |
| Rainbow snake | Endangered | Secure | Streams, marshes (emergent wetlands), and sandy fields |

Notes:

[a] Secure is defined by NatureServe and the Mississippi Natural Heritage Program as common, widespread, and abundant. Apparently secure is defined as uncommon, but not rare. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer). Critically imperiled is defined as a species at a very high risk of extinction due to very few populations or other factors.

#### *3.7.7.1.3 Raw Water Intake and Access Road*

***Plants, Wetlands, and Wildlife***

The proposed RWI structure would be located along the shoreline of the Leaf River. The area is characterized by mixed hardwood forest that is periodically flooded. When DOE visited the location in October 2005, the area was significantly affected by Hurricane Katrina. Only about 20 percent of the surrounding forest remained intact. In the next few years, this area will experience a successional transition that will probably increase species diversity and the density of understory vegetation. The terrestrial wildlife present at the proposed RWI structure includes mammals, birds, and reptiles that are common throughout the southeast. The likely change in the vegetation post-hurricane would attract more birds and wildlife as the increase of shrubby vegetation and other early successional species provides more food resources.

The proposed access road to the RWI structure would be 2.3 miles (3.7 kilometers) long. From the existing road, the access road would cross pine forest and then mixed hardwood forest, which includes the palustrine forested wetlands adjacent to the Leaf River.

The Leaf River is part of the Pascagoula drainage system and supports a wide variety of aquatic species. It has a sand and gravel bottom and does not support submerged aquatic vegetation. At the proposed location of the intake structure, the river has a steep bank on one side and a wide sandy beach on the other. A diverse fish assemblage is present in the Leaf River, including 17 families (e.g., Centrarchidae, Clupeidae, Cyprinidae, Ictaluridae, Percidae) and over 75 species of fish (Ross 2001; MMNS 2006). In addition, the American eel and gulf sturgeon are seasonally present in the Leaf River and may live in the river during early stages of their life cycle.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Richton RWI would be located: red-cockaded woodpecker, gulf sturgeon, pearl darter, Camp Shelby burrowing crayfish, gray myotis, Louisiana quillwort, black pine snake, Eastern indigo snake, gopher tortoise, and the yellow-blotched map turtle. A review of the conditions at the Richton RWI and consultations with the USFWS and the Mississippi Natural Heritage Program revealed that the area may affect several federally listed threatened or endangered species.

The black pine snake, which is a federal candidate species, reportedly occurs in the vicinity of the proposed RWI intake in Perry County. Some areas near the RWI contain potentially suitable habitat of sandy, well-drained soils with an overstory of longleaf pine, a fire-suppressed midstory, and a dense herbaceous ground cover (Duran 1998b).

The gopher tortoise has been recorded in the vicinity of the proposed location of the RWI structure (MNHP 2006). Habitat suitable for the gopher tortoise may be found at this location (i.e., locations with dry sandy soils, abundant ground cover, and a sparse canopy). Although seldom seen aboveground, the presence of gopher tortoises is indicated by large conspicuous burrows. No burrows were observed at the proposed RWI site; however, a comprehensive survey of the site has not been completed.

The range of the yellow-blotched map turtle includes the Leaf River in the general area where the proposed RWI structure would be sited. The yellow-blotched map turtle is a federally threatened species. This species prefers habitats with sand, clay, or rocky bottoms with limestone ledges along banks (McCoy and Vogt 1987). It also uses oxbow lakes, semipermanent ponds, or temporary flooded pools (Jones 1996). Nesting occurs on sandbars or in small clearings along the bank of a river such as on a clay bank with a steep slope (Horne et al. 2003).

The gulf sturgeon is found in the proposed location of the RWI for the Richton site on the Leaf River in Perry County. This segment of the Leaf River is designated as critical habitat for this federally threatened species. Although the entire potentially affected segment of this river is designated critical habitat, spawning generally occurs only in areas where the streambed is hard clay, rubble, gravel, or shell (68 CFR Part 13370). Adult sturgeons are anadromous fish that inhabit the fresh-water river for spawning. However, juvenile sturgeons may be found year-round because young sturgeons spend their first 2 years in the river in which they were spawned (68 CFR Part 13370).

The pearl darter, which is a federal candidate species, is believed to exist only in the Pascagoula River drainage system that includes the Leaf River (NatureServe 2005). The only area where pearl darter spawning has been documented in recent decades is in the Leaf River near Hattiesburg, MS, which is located upstream from the proposed RWI.

After a review of the conditions at the proposed RWI and consultations with the Mississippi Natural Heritage Program, DOE determined that the proposed RWI would not affect any state-listed special status species (see appendix I).

***Special Status Areas***

No special status areas exist at or near the proposed location of the RWI structure.

#### *3.7.7.1.4 Terminal in Pascagoula*

***Plants, Wetlands, and Wildlife***

The proposed marine terminal in Pascagoula would be a 63-acre (25-hectare) facility located on Singing River Island. Singing River Island is a 440-acre (180-hectare) manmade island composed of deposited dredged materials. The proposed terminal would be located adjacent to and partially overlap the site of the current Pascagoula Naval Station, which was selected for closure by the Commission on Base Realignment and Closure in 2005. The proposed site for the SPR terminal would occupy about 63 acres (26 hectares). A little more than half of the proposed site (35.6 acres [14.4 hectares]) is identified as estuarine wetlands by the National Wetlands Inventory map. About 75 percent of the proposed terminal is located within the low-lying diked area within the central part of the island. The remaining area is comprised of developed land and maintained grassy areas associated with the Naval Station. The grassy areas on the site and the undeveloped portions of the island offsite support shore birds, rabbits, alligator, snakes, and nutria. The Naval Station has problems with overpopulation and overgrazing by rabbits and nutria and released two spayed bobcats in 1995 to help control the rodent population.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Pascagoula terminal would be located: bald eagle, brown pelican, Mississippi sandhill crane, piping plover, red-cockaded woodpecker, gulf sturgeon, pearl darter, Louisiana black bear, several marine mammals, Louisiana quillwort, Eastern indigo snake, gopher tortoise, Kemp's ridley sea turtle, loggerhead sea turtle, and the yellow-blotched map turtle. However, after a review of the conditions at the proposed Pascagoula terminal and consultations with USFWS and the Mississippi Natural Heritage Program, DOE determined that the proposed terminal would not affect any federally or state-listed listed threatened, endangered, or candidate species (see appendices G and I).

***Special Status Areas***

The proposed terminal site is located more than 6 miles (9.7 kilometers) from the Grand Bay National Estuarine Research Reserve (NOAA 2005a, 2005b).

#### *3.7.7.1.5 Terminal at Liberty Station*

***Plants, Wetlands, and Wildlife***

The 66 acre (27 hectare) proposed terminal at Liberty Station would be located adjacent to another oil tank farm in an otherwise rural area east of Liberty, Mississippi. The entire site is disturbed upland habitat comprised mostly of pasture with fragmented pine and hardwood forests. According to the National Wetlands Inventory data, no wetlands exist on the site.

Wildlife that inhabits this area includes common, mobile species such as the nine-banded armadillo and white-tailed deer, which are adapted to living in somewhat disturbed habitat areas.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Liberty terminal would be located: red-cockaded woodpecker and the Louisiana black bear. However, after a review of the conditions at the proposed Liberty terminal and consultations with USFWS and the Mississippi Natural Heritage Program, DOE determined that the proposed terminal would not affect any federally or state-listed listed threatened, endangered, or candidate species (see appendices G and I).

***Special Status Areas***

There are no special status areas located within or near the proposed terminal at Liberty Station.

#### 3.7.7.2 Impacts

##### *3.7.7.2.1 Richton Storage Site*

***Plants, Wetlands, and Wildlife***

The development of the proposed Richton storage site would affect about 346 acres (140 hectares), which includes a 109-acre (44-hectare), 300-foot (91-meter) buffer cleared for security purposes. The proposed construction would affect the following:

- 3 acres (1 hectare) of palustrine emergent wetlands,
- 6 acres (2 hectares) of palustrine forested wetlands,
- 312 acres (133 hectares) of pine plantation, and
- 25 acres (10 hectares) of clear cut and field.

The proposed access road would be 990-feet (300 meters) long and extend from Highway 42 to the site. The area of the proposed road would affect about 0.5 acres (0.2 hectares) of pine forest. The pine forest and logged areas are actively managed and disturbed by timber harvesting. These areas are low quality habitat for plants and animals. The palustrine forested wetlands within the security buffer would be permanently converted to emergent wetlands as DOE would not allow trees to regrow in this area. The proposed construction footprint would avoid the manmade pond, which would reduce the hydrological modification of the site and preserve some fringe wetlands and their associated functions.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands and would preserve onsite to the maximum extent practicable. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid and minimize and compensate for wetland impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in section 3.7.2 in accordance with the 404 permit and 401 Water Quality Certificate from the USACE and the Mississippi Department of Environmental Quality. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetland impacts.

Because the habitats present at the Richton storage site are actively disturbed by logging and do not represent regionally unique habitats, there would be little affect to terrestrial wildlife. Some wildlife would be killed and some would be displaced by the construction activities. Fencing would exclude most wildlife from the site, though some mobile species and birds would probably still visit the site. As discussed in section 3.7.2, the wildlife species would be displaced to similar vegetative and wetlands communities surrounding the proposed site. Though these impacts may affect individual organisms, construction, operations, and maintenance of the facility would not alter the regional population or species viability.

Aquatic species in the manmade pond would not be affected by construction because DOE would not alter the pond. The intermittent streams located within the site would be affected as the natural flow would be altered and the runoff associated with the clearing and grading would temporarily degrade their water quality. As described in section 2.3, an erosion- and sediment-control plan and the Mississippi Pollutant Discharge Elimination System stormwater permit for construction activities would be secured, which would require the use of construction best management practices to minimize the impact to water bodies.

Potential operational and maintenance impacts on migratory birds, such as the affect of artificial lighting on migration, are described in section 3.7.2.

> Mitigation: DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. DOE would use down-shielded and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. If this candidate alternative is selected, DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with the requirements of the Migratory Bird Treaty Act.
>
> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize impacts to wetlands and forests.

***Special Status Species***

Because the black pine snake has been confirmed within 2 miles (3 kilometers) of the site, DOE would survey the site for evidence of black pine snakes or suitable habitat. DOE would consult with the USFWS if suitable habitat or individuals were found on the site.

DOE would have a biologist to survey moderately well-drained to excessively well-drained sandy soils for gopher tortoise burrows. If gopher tortoises or their burrows are found, DOE would contact the Mississippi Department of Wildlife, Fisheries, and Parks and the USFWS. DOE would initiate formal Section 7 Consultation if development of the storage site may adversely affect the gopher tortoise. If required, DOE would prepare a Biological Assessment and implement the conditions of a Biological Opinion. Gopher tortoises and/or black pine snakes would be relocated only with concurrence of the USFWS and the Mississippi Department of Wildlife, Fisheries, and Parks; according to strict protocols; and within seasonal windows specified by these agencies (MNHP 2006).

#### *3.7.7.2.2 Richton Pipeline Rights-of-Way*

***Plants, Wetlands, and Wildlife***

Construction in the pipeline and power line ROWs would result in clearing all the vegetative within the ROW. The ROW clearing would affect the following areas:

- 822 acres (333 hectares) of grasslands,
- 521 acres (211 hectares) of disturbed, managed, or urban land,
- 481 acres (195 hectares) of hardwood forest,
- 1024 acres (414 hectares) of pine forest, and
- 271 acres (110 hectares) of water and emergent wetlands.

As described under the affected environment, the majority of the pine forests that would be affected are pine plantations. Because DOE aggregated the Mississippi GAP Analysis Program to identify upland habitat, some of the acreage listed above under hardwood forest or grasslands may include wetlands. DOE used USFWS National Wetlands Inventory data to determine that the following wetlands would be affected by the proposed ROW:

- 786 acres (318 hectares) of palustrine forest,
- 183 acres (74 hectares) of palustrine scrub-shrub,
- 156 acres (63 hectares) of estuarine,
- 40 acres (16 hectares) of palustrine emergent,

- 19 acres (8 hectares) of lacustrine,
- 15 acres (6 hectares) of palustrine open water,
- 32 acres (13 hectares) of palustrine unconsolidated bottom,
- 12 acres (5 hectares) of riverine,
- 3 acres (1 hectare) of estuarine scrub-shrub, and
- 2 acres (1 hectare) of palustrine (aquatic bed).

Permanent impacts from the maintained ROW would be about 33 to 40 percent of the acreage reported above. The vegetation within the construction easement would be cleared, but DOE would regrade to preconstruction contours and reseed with native species within this area to re-establish native habitat. The area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands, and the nature and amount of wetland impact from the permanent and construction easements. Within the permanent ROW easement, the open water, emergent and riverine wetlands would be allowed to return to preconstruction conditions. Section 3.7.2 describes ROW operations and maintenance effects in more detail.

DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would use or directional drilling to avoid sensitive wetland areas or large water bodies greater than 100 feet (30 meters). DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid and minimize and compensate for wetland impacts to jurisdictional wetlands. To limit impacts to aquatic habitats, DOE would implement appropriate best management practices to minimize erosion and runoff as described in chapter 2. Moreover, about 20 percent of the pipeline ROWs would be located along an existing ROW. Use of existing ROW corridors to the maximum extent practicable would minimize the impact to undisturbed communities and wildlife. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in accordance with the Section 404/401 permit conditions, which would compensate for the jurisdictional wetland impacts.

As stated in section 3.7.2, construction in the ROWs would displace or kill some aquatic and terrestrial wildlife. The impacts would not alter the state population or the species viability. Noise and human activity may temporarily preclude some organisms from using nearby habitat. The duration of construction through these areas would be short (6 to 10 weeks at any one location) and ample habitat would be available nearby for most species. The elevated portion of the power lines could represent a strike hazard that could impact resident and migratory birds. However, the maximum tower height is expected to be 75 feet (23 meters), which would greatly reduce the hazard. Though these impacts may affect individual organisms, construction, operations, and maintenance of the pipeline and power line ROWs would not alter the regional populations of wildlife or species viability.

The impacts associated with the operations and maintenance of the ROWs are described in section 3.7.2.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat such as wetlands and habitat for special status species. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems identified. For the proposed power lines, DOE

would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Power lines: the State of the Art in 1996* (APLIC 1996).

***Special Status Species***

Construction of the proposed pipeline to Liberty Station would not affect the pearl darter because directional drilling would be used to place the pipeline beneath the Leaf River, Black Creek, and Tallahala Creek without instream activity. If directional drilling was not feasible, DOE would use conventional open-ditch excavation. Conventional construction methods may affect the pearl darter; thus, DOE would consult with the USFWS to develop a construction plan that would not adversely affect the species.

The proposed ROWs may affect the black pine snake if it inhabits the site. These snakes live in burrows underground. DOE would conduct habitat assessments of the proposed ROWs to determine if surveys for black pine snakes are necessary. If suitable habitat exists or black pine snakes inhabit the ROW, DOE would consult with the USFWS and Mississippi Natural Heritage Program to identify methods to avoid adverse effects. The black pine snake is a mobile species and would generally be expected to avoid construction activities. Individuals identified during construction would be relocated to nearby suitable habitat under guidance of USFWS. Operations and maintenance of pipeline ROWs would not affect the black pine snake. Mowing of the ROW would maintain the ROW as habitat preferred by the black pine snake.

DOE would conduct surveys for gopher tortoise burrows on moderately well-drained to excessively well-drained sandy soils of the ROWs. If burrows or gopher tortoises are identified within the ROW, DOE would initiate formal Section 7 Consultation with the USFWS. DOE would prepare a Biological Assessment if the proposed activity had the potential to adversely affect the gopher tortoise. All burrows identified during preconstruction field assessments would be marked and cogon grass—an invasive species that destroys tortoise habitat (Van Loan et al. 2002)—would be mapped and treated with chemicals approved for use around tortoises. Where possible, clearing and construction activities would be precluded within a 25-foot (8-meter) radius around each burrow. The crude oil pipeline to Liberty terminal, RWI pipeline, and power lines do not, for the most part, follow an existing ROW. Alignments may be adjusted to avoid relatively large clusters of burrows. When burrows cannot be avoided, tortoises would be relocated only with concurrence of the USFWS and the Mississippi Department of Wildlife, Fisheries, and Parks; according to strict protocols; and within seasonal windows specified by these agencies.

Because moderately to excessively well-drained sandy soils of the maintained pipeline and power line ROWs would provide potential habitat for the gopher tortoise, these areas may attract more tortoises than their preconstruction condition. DOE would monitor these areas for the presence of gopher tortoise mounds and control the invasion and spread of cogon grass using only herbicides approved for use around tortoises to avoid poisoning food resources (MNHP 2006). With proper monitoring and procedures, operations and maintenance activities may improve habitat quality for gopher tortoises.

The state-listed species confirmed to exist within 2 miles (3.2 kilometers) of the proposed Richton ROWs are the dark gopher frog, crystal darter, frecklebelly madtom, and rainbow snake. Based on the data available, DOE does not expect the proposed ROWs to affect these species. The crystal darter and frecklebelly madtom are known to inhabit the Pearl River. The crude oil pipeline to Liberty would be directionally drilled under the Pearl River so there would be no changes in the instream environment. The occurrence of the rainbow snake is recorded along Preists Creek, which would not be crossed by any ROW. The dark gopher frog population is located more than 1 mile (1.6 kilometers) from the proposed

ROW. At this distance, DOE would not expect construction, operation, or maintenance to affect the species.

***Special Status Areas***

The proposed Pascagoula crude oil pipeline would not affect the Grand Bay National Estuarine Research Reserve because it is located about 1 mile (1.6 kilometers) away. The proposed ROW to Liberty terminal would pass through Percy Quin State Park. The proposed alignment does not follow an existing ROW through the park. If the Richton site were selected, DOE would consult with the Park to identify a corridor that avoids sensitive resources in the park. DOE may be able to realign the pipeline ROW to follow one of the existing ROW corridors to minimize affects to natural resources.

#### *3.7.7.2.3 Raw Water Intake*

***Plants, Wetlands, and Wildlife***

About 5 acres (2 hectares) of palustrine forested wetlands would be cleared to construct the RWI structure. About one half of this area would be restored after construction is complete. The access road to the structure would permanently remove 3 acres (1 hectare) of palustrine forested wetlands and 7 acres (3 hectares) of pine forest. As discussed in section 3.7.2, construction activities would cause displacement of terrestrial and aquatic species to adjacent undisturbed areas of similar habitat.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from the USACE. In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands to the maximum extent practicable. DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for wetland impacts to jurisdictional wetlands. DOE would submit an application for a stream diversion permit from the Mississippi Department of Environmental Quality for the proposed water withdrawal. DOE would implement the mitigation measures described in section 3.7.2 in accordance with the 404 permit, 401 Water Quality Certificate from the USACE, and a stream diversion permit from the Mississippi Department of Environmental Quality. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetland impacts. As discussed in chapter 2, erosion would be minimized with the use of best management practices. An erosion- and sediment-control plan and NPDES stormwater permit issued by the Mississippi Department of Environmental Quality for construction activities would be secured, which would require the use of best management practices that minimize the impact to water bodies.

The operation of the RWI structure would affect some terrestrial species that would avoid the area due to human activity and noise from the pumps. The aquatic communities in the Leaf River at the site and downstream would potentially be impacted by the withdrawal of water, especially during low flow conditions. During cavern development, up to 1.2 MMBD (50 million gallons per day) would be withdrawn from the Leaf River for a period of 4 to 5 years and periodically afterwards for drawdown or cavern maintenance after construction is completed. During times of low-flow, the withdrawal could equal 11 percent or more of the total flow in the river. Such a withdrawal rate during low-flow conditions could significantly impact the downstream aquatic communities as the decrease in flow would lower the water depth, reduce the width of the stream channel, and change the currents. Such impacts would stress aquatic organisms by exposing once submerged nesting and feeding areas, altering vegetative communities, potentially changing the temperature regime, and impairing water quality.

Without mitigation, withdrawal during low-flow rates could affect riverine wetlands and aquatic organisms. It would also affect species that rely on aquatic prey species for food. The severity of these impacts would depend on the length and frequency of low-flow rates in the Leaf River during the 4 to 5 years of cavern solution mining. Operation of the RWI structure in these conditions would result in a significant impact on aquatic species, and a moderate impact on other species that depend on Leaf River water resources.

During water withdrawal activities and operation of the RWI, some small aquatic organisms would become entrained or entrapped on the intake—especially larval stages, juveniles, and dispersed fish eggs as described in section 3.7.2. The entrainment and impingement would be minimized by equipping the RWI with appropriate mesh size, intake velocities, and traveling screens to collect and return aquatic life to the Leaf River.

***Special Status Species***

Construction of the RWI structure may affect the black pine snake and gopher tortoise. DOE would survey well-drained sandy soils for gopher tortoise burrows and evidence of the black pine snake or suitable habitat. If the gopher tortoise or burrows were identified, DOE would initiate formal Section 7 Consultation with the USFWS and coordinate with the Texas Parks and Wildlife Department. If the project may adversely affect the gopher tortoise, DOE would prepare a Biological Assessment and implement any condition included in the Biological Opinion. Before construction, individuals living on the proposed site would be relocated, under strict guidance of USFWS. DOE would also consider moving the location of the RWI on the Leaf River to avoid the black pine snake and gopher tortoise if they were found to be present. Operations and maintenance activities at the RWI structure involve infrequent human disturbance and would not affect black pine snakes or gopher tortoises near the site.

Construction of the RWI on the Leaf River may affect the yellow-blotched map turtle. Any turtles in the work zone would be moved to an adjacent undisturbed area upstream each day prior to the start of work. Best management practices, such as the use of a cofferdam, would be employed to minimize water quality and sedimentation impacts. Upon completion of the RWI structure, the streambed would be restored to the extent possible to minimize long-term impacts of construction. Although there may be short-term effects, in the long-term, construction would not likely adversely affect the species viability or designated critical habitat.

Operation of the RWI during cavern development would withdraw up to 1.2 MMBD (50 million gallons per day) for 4 to 5 years during solution mining. This would alter flow in the Leaf River especially during low-flow periods in the late summer and early fall. Reduced flow would degrade water quality by reducing the capacity of the river to assimilate wastes from nonpoint pollution sources and permitted discharges. Impaired water quality has contributed to the decline of the yellow-blotched map turtle through adverse affects on its food resources. In addition, withdrawal of water may affect the species by entraining or impinging small turtles or their invertebrate prey. Impinged turtles would be returned to the water downstream of the intake by traveling screens. During normal to above average flows, the entrainment or impingement of yellow-blotched map turtle prey food resources would not affect the turtles. During extreme low-flow periods, entrainment or impingement of prey may stress the species, but such periods are expected to be temporary and not affect the long-term survival of the species.

The RWI structure would be located on the Leaf River in Perry County and the power lines for the RWI structure and site would cross the Leaf River. Construction of the RWI may affect the designated critical habitat for the Gulf sturgeon at this location and the area immediately downstream. For example, excavation would disturb the Leaf River streambed, remove vegetation, and temporarily raise turbidity while reducing dissolved oxygen levels. These potential effects would be mitigated with the use of erosion barriers, cofferdams, postconstruction restoration, and other measures. Construction would be scheduled to avoid spawning periods (mid-February to April) and limited to high-water periods. Construction of the power lines across the Leaf River is not expected to have any additional effect on the Gulf sturgeon because no instream work would occur.

Operations and maintenance of the RWI may have an adverse affect on the Gulf sturgeon, especially during low-flow periods. DOE has conducted informal consultation with the USFWS and Mississippi Natural Heritage Program on the proposed withdrawal. Both agencies expressed serious concerns about water flow and the Gulf sturgeon. The Mississippi Natural Heritage Program (2006) stated that "because of the importance of the Leaf River near Hattiesburg to spawning and juvenile sturgeon, it is recommended that water withdrawals be discontinued if discharge from the Leaf River reaches 30 percent of the mean daily discharge." DOE reviewed the daily average streamflow data for the Leaf River for a 21-year period from 1983 through 2004 and determined that the mean daily discharge was 3,770 cubic feet (107 cubic meters) per second and 30 percent of that flow was 1,131 cubic feet (32 cubic meters) per second. During the same 21-year period, the daily discharge was less than the 30 percent minimum instream flow recommended by the Mississippi Natural Heritage about 27 percent of the time.

Decreased flow would potentially alter the designated critical habitat by reducing water depth and width, increasing pollutant concentrations, and altering water temperatures. These changes may expose breeding areas, limit adult migration movements, and/or increase mortality of larval and juvenile sturgeon. Intake of water during low-flow periods would affect water flow downstream and lower water depth in pools at the confluence of the Leaf and Chickasawhay Rivers where adult sturgeon rest with nonspawning individuals until fall when they return to saltwater (Heise et al. 2004).

The intake of the RWI would be designed for a maximum intake velocity of 0.5 feet (0.15 meters) per second. The raw water withdrawal may cause impingement of young Gulf sturgeon. Although moving vertical screens deposit impinged fish or materials into a chute that releases them downstream of the intake, impingement of young Gulf sturgeon would cause bodily harm that may result in mortality.

The pearl darter has been documented throughout the Leaf River to the lower Pascagoula drainage, but little is known about their specific habitat requirements or spawning behavior (Slack et al. 2005). Construction of the RWI may temporarily increase water turbidity. Increased turbidity has the potential to adversely affect pearl darters and other fish species downstream by making the habitat less suitable for feeding and reproduction (USFWS 2001). These temporary impacts would be mitigated with erosion and sedimentation best management practices, use of a cofferdam for instream work, as well as habitat restoration. DOE has determined that the construction of the RWI may affect the pearl darter.

Operation of the RWI may have an adverse affect on the pearl darter. The water withdrawal would be expected to have negligible impacts on the river while it is flowing near or above its overall average flow rate of 4,100 cubic feet (116 cubic meters) per second. During periods of low-flow, however, the withdrawal may constitute up to 11 percent of the river's flow. The reduction in flow would alter water depth, channel width, water temperatures, and pollutant concentrations downstream. These types of alterations are identified as a major threat to pearl darter populations (USFWS 2001).

The water intake would also cause entrainment and impingement of pearl darters. The RWI would have a maximum intake velocity of 0.5 feet (0.15 meters) per second with traveling 0.5 inch (40 mm) mesh screen. Standard length of the adult pearl darter ranged from one inch (30 mm) to two inches (50 mm) in sampling of the Leaf River in 2004 (Slack et al. 2005). Due to their small size, impingement on the screens or entrainment through the screens would occur and would cause bodily harm that may lead to death of some individual fish.

If this site is selected, DOE would initiate formal Section 7 Consultation with the USFWS and NOAA Fisheries for a potential adverse affect to the Gulf sturgeon. DOE would prepare a Biological Assessment and implement any conditions of the Biological Opinion. DOE would consult with the USFWS and Mississippi Natural Heritage Program for potential adverse affects to the pearl darter.

After a review of the conditions at the proposed RWI and consultations with the Mississippi Natural Heritage Program, DOE determined that the proposed RWI would not affect any state-listed threatened, or endangered species (see appendix I).

#### *3.7.7.2.4 Terminal in Pascagoula*

***Plants, Wetlands, and Wildlife***

The proposed terminal in Pascagoula would involve redevelopment of a heavily disturbed portion of Singing River Island. The construction of the facility would remove approximately 34 acres (14 hectares) of estuarine wetland habitat and 1 acre (0.4 hectare) of estuarine scrub-shrub wetland habitat, as well as areas of maintained grass lawns and gardens. Because wildlife on the island is accustomed to frequent disturbance by human activity, operations and maintenance of the terminal would not add further disturbance to surrounding communities.

If this alternative is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible. The placement of fill in the wetlands would cause a permanent loss of wetland functions and values. DOE would secure permits from USACE and the Mississippi Department of Environmental Quality for the impact to jurisdictional wetlands and would provide compensation for the unavoidable wetland impacts. Section 3.7.2 describes the effects of clearing and filling wetlands in detail.

DOE would implement best management practices and comply with permits for erosion and stormwater control during construction and operation of the facility to reduce impacts to aquatic resources. These are described in chapter 2.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

***Special Status Species***

DOE determined that Pascagoula terminal would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices G and I).

***Special Status Areas***

The proposed construction and operation of the Pascagoula terminal would not affect the Grand Bay National Estuarine Research Reserve because it is located more than 6 miles (9.7 kilometers) away from the proposed site.

#### *3.7.7.2.5 Terminal at Liberty Station*

***Plants, Wetlands, and Wildlife***

The clearing and grading associated with the Liberty Station terminal would affect approximately 66 acres (27 hectares) of the following vegetation types:

- 31 acres (13 hectares) of grasslands,
- 15 acres (6 hectares) of hardwood forest,
- 12 acres (5 hectares) of pine forest, and
- 7 acres (3 hectares) of disturbed or managed land.

According to National Wetlands Inventory data, one small area of approximately 2 acres (1 hectare) of palustrine open-water wetlands are located within the proposed terminal boundary.  Small mammals living in the open areas could be displaced during construction, but would return to the area after construction is complete.  The forested areas are fragmented and not likely to support large mammals other than deer.  Once security fencing is constructed, larger mammals would be precluded from entering facility boundaries.  Birds that utilized the forested areas for nesting or foraging would be permanently displaced to similar forested patches that are common in the area.  Some mobile wildlife species and birds would use the site after construction is complete even though a security fence would surround the site.

If this alternative is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible.  The entire footprint would be cleared of trees for security reasons.  The placement of fill in the wetlands would cause a permanent loss of wetland functions and values.  DOE would secure permits from USACE and the Mississippi Department of Environmental Quality for the impact to jurisdictional wetlands and would provide compensation for the unavoidable wetland impacts.  Section 3.7.2 describes the effects of clearing and filling wetlands in detail.  DOE would implement best management practices and comply with permits for erosion and stormwater control during construction and operation of the facility to reduce impacts to aquatic species and resources.

The common operations and maintenance efforts, described in section 3.7.2, would preclude wildlife sensitive to human disturbance from entering the area.  These efforts to operate and maintain the terminal would be similar to activities occurring at other industrial facilities located near the proposed site.

> Mitigation:  DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

***Special Status Species***

DOE determined that the Liberty Station terminal would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices G and I).

***Special Status Areas***

There would be no impacts to special status areas by constructing or operating the terminal at Liberty Station.

### 3.7.8 Stratton Ridge Storage Site and Associated Infrastructure

This section addresses the proposed Stratton Ridge site and infrastructure areas, including the following:

- Storage site and site access road;
- Four proposed ROW segments:  RWI pipeline, brine disposal pipeline, and power line ROW from Stratton Ridge to the RWI on the ICW; the brine disposal pipeline ROW from the RWI to the Gulf of Mexico; the crude oil pipeline ROW from Stratton Ridge to Texas City; and the crude oil pipeline connecting the terminal to local refineries;
- RWI; and

- Terminal and dock refurbishment in Texas City.

Because of the similarity among the proposed SPR facilities in offshore environment, offshore pipeline construction methods, and operations and maintenance of the brine diffuser, the discussion of the offshore pipeline and brine diffusion system for all proposed storage facilities is covered in section 3.7.2 and appendix E. Also due to these similarities among the proposed storage sites, the discussion of EFH is contained in section 3.7.2 and appendix E.

#### 3.7.8.1 Affected Environment

##### *3.7.8.1.1 Stratton Ridge Storage Site*

***Plants, Wetlands, and Wildlife***

The proposed 370-acre (150-hectare) Stratton Ridge storage site, including a 102-acre (41-hectare), 300-foot (91 meter) buffer is in the Oak-Prairie Wildlife District within the Texas Gulf Coast Prairie Parkland Province (see appendix B) (TPWD 2005b; Bailey 1995). The Oak-Prairie Wildlife District includes some of the most ecologically diverse ecosystems in the state, historically characterized by savannas comprised of bluestem and browsed paspalum grasses intermixed with clusters of post-oak-dominated forests. As observed at the Stratton Ridge site, the Oak-Prairie Wildlife District vegetation also includes other tree species such as blackjack oak, live oak, water oak, winged elm, hackberry, and yaupon (TPWD 2005b). Although it remains forested, the Stratton Ridge site has been disturbed and fragmented by human activities and introduced animals and plants. Cattle and feral pigs roam throughout the site and their presence and activities, including grazing and burrowing, have long influenced the vegetative communities. Chinese tallowtrees are present throughout the site. Two large ROWs for large power lines and a multiple pipeline ROW flank the northeastern border of the site. Another pipeline ROW passes through the central portion of the site.

The site consists of palustrine forested wetlands with patches of deciduous forest and palustrine emergent wetlands. The site visit revealed that the proposed site includes about 260 acres (105 hectares) of palustrine forested wetlands that are not included in the National Wetlands Inventory data. DOE used the estimated wetland acreage from the site visit in the impact calculations because this approach provides a more accurate assessment than the NWI data. Live oak trees that characterize the forested wetlands are sometimes greater than 4 feet (1.2 meters) in diameter. Other canopy species include water oak and Chinese tallowtree, while greenbrier, trumpet creeper, pigweed, smart weed, and blackberry are present in the understory. Signs of periodic inundation, such as the prevalence of water-tolerant organisms and watermarks on trees, occur throughout the forest. Small pockets of upland islands are dispersed throughout the evergreen forest and occupy approximately 15 percent of land within the site. General species composition on the upland islands is similar to the composition on periodically inundated portions of the evergreen forest. Winged elm and Chinese tallowtree are the dominant species in the deciduous forest.

The forested wetlands on the Stratton Ridge site are categorized as a bottomland hardwood habitat, which is a diverse and greatly threatened ecosystem in the United States. These ecosystems provide habitat and play important roles in maintaining water quality and retaining flood waters. Bottomland hardwood forests are also important sources of organic material for aquatic ecosystems. Only 180,000 acres (72,000 hectares) of this type of ecosystem remain along the Texas Gulf Coast (TPL 2005). Despite its disturbed condition, the bottomland hardwood forest at the Stratton Ridge storage site is ecologically important because it represents one of the only contiguous patches of this habitat type within several miles. The land immediately surrounding Stratton Ridge is used for industrial facilities or pasture.

Four areas of permanent and semipermanent standing water with emergent vegetation are located on the proposed Stratton Ridge site. These emergent wetlands, which are located on the western edge of the proposed site boundary, span from 1 acre (0.4 hectares) to 7 acres (3 hectares) in size. They are characterized by sedges, rushes, legumes, and rattlebush. Chinese tallowtree is prevalent along the perimeter of the wetlands. No perennial streams are located within the site; however, ephemeral channels were observed in association with the site's wetlands.

Bottomland hardwood forests and emergent wetlands along the Texas Gulf Coast provide permanent or temporary habitat for hundreds of species of birds, including neotropical migratory songbirds. The proposed Stratton Ridge site is located in the center of the Central Flyway (Birdnature.com 2005). The Texas Gulf Coast is the primary wintering site for ducks and geese that use the Central Flyway. The area probably supports numerous bird species that are regulated by the Migratory Bird Treaty Act.

Oyster Creek and Stubblefield Lake are two fresh-water water bodies located less than 0.6 miles (1 kilometer) from the proposed Stratton Ridge storage site. These systems support common aquatic fish species such as bluegill, pugnose minnow, and gizzard shad. Neither Oyster Creek nor Stubblefield Lake have submerged aquatic vegetation. The vegetation is limited to the shoreline, emergent wetland, and other wetland areas.

The wildlife observed in the project area are common, mobile species such as the nine-banded armadillo and white tailed deer, which have adapted to living in somewhat disturbed habitat areas. Several bird species, such as spoonbills and great blue herons, were observed near the emergent wetlands. The water bodies associated with the wetlands onsite do not appear capable of supporting a fish community year-round because of periodic drying and low oxygen conditions. These systems likely support a variety of invertebrate organisms, reptiles, and amphibians.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Stratton Ridge storage site would be located: bald eagle, brown pelican, piping plover, whooping crane, and several marine mammals and sea turtles. A site visit to Stratton Ridge and consultations with USFWS and the Texas Parks and Wildlife Department revealed that the area may provide suitable habitat for the bald eagle, which is a federally listed threatened species, although USFWS has proposed delisting the bald eagle (see appendix H) (Aycock 2005; TPWD 2005a; Woodrow 2005). Brazoria County in eastern Texas has breeding and wintering bald eagles (TWPD 2005a; Woodrow 2005). No known bald eagle nests are located at the proposed Stratton Ridge site; however, the bottomland hardwood forest (palustrine forested wetlands) and emergent wetland habitat at the site is suitable for nesting or roosting bald eagles. A pair of bald eagles is known to nest near Ash Lake about 1.8 miles (2.7 kilometers) northwest of the proposed Stratton Ridge site. No other federally listed species is known to inhabit the site.

Appendix I identifies species listed as threatened or endangered by the State of Texas (but not listed federally) in counties in the proposed Stratton Ridge SPR development area. Table 3.7.8-1 shows a comparison of the habitat preferences of threatened or endangered species on the state list and habitat present in the proposed Stratton Ridge site.

None of these species is known to inhabit the site, but a survey or habitat assessment has not been conducted.

**Table 3.7.8-1: State-Listed Species With Potentially Suitable Habitat at Stratton Ridge Storage Site**

| Species Common Name | State Status | Global Status[a] | Potentially Suitable Habitat at Site |
|---|---|---|---|
| Swallow-tailed kite | Threatened | Secure (G5) | Tall, easily accessible trees; open areas for foraging |
| White-faced ibis | Threatened | Secure (G5) | Bayous and palustrine wetlands |
| Wood stork | Threatened | Apparently secure (G4) | Bayous and palustrine wetlands |
| Black bear | Threatened | Secure (G5) | Mixed deciduous-coniferous forest with thick understory |
| Smooth green snake | Threatened | Secure (G5) | Grasslands, forest, meadows, grassy marshes, moist grassy fields at forest edge, and abandoned farmland |

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity Database as common, widespread, and abundant. Apparently secure is defined as an uncommon species, but not rare. There is some cause for long-term concern.

Source : NatureServe 2005

***Essential Fish Habitat***

No EFH is located near or within the boundaries of the proposed storage facility.

***Special Status Areas***

There are no special status areas in or adjacent to the proposed Stratton Ridge storage site. The Brazoria National Wildlife Refuge is located 3.5 miles (5.6 kilometers) from the site; the Peach Point Wildlife Management Area is located 10 miles (16 kilometers) from the site; and the San Bernard National Wildlife Refuge is located 11 miles (17 kilometers) from the site. These protected areas provide coastal habitat to migratory birds, reptiles, and amphibians.

#### *3.7.8.1.2 Stratton Ridge Rights-of-Way*

Three pipeline and power line ROWs would be required for the Stratton Ridge storage site. The proposed ROWs would include the following:

- A proposed shared 6.2-mile (10-kilometer) ROW for an RWI pipeline, a brine disposal pipeline, and two (34.5-kilovolt) power lines. The shared ROW would leave the site and terminate at the RWI.
- A proposed 3.8-mile (6.1-kilometer) brine disposal pipeline would continue in an ROW from the RWI to the Gulf of Mexico, and then proceed to the offshore brine diffuser.
- A proposed 37-mile (60-kilometer) crude oil pipeline would parallel the existing Bryan Mound pipeline ROW to a terminal in Texas City, TX.
- A 2.7-mile (4.3-kilometer) crude oil pipeline that would connect the Texas City terminal to the British Petroleum and GAP Analysis Program facilities.

***Plants, Wetlands, and Wildlife***

Over 80 percent of the proposed 45 miles (72 kilometers) of ROWs for the pipelines and power line corridor follow existing utility easements. These easements have been disturbed by previous construction and periodic maintenance activities. Sand flats, which include estuarine emergent wetlands, is the dominant Texas GAP Analysis Program (plant community) classification crossed by the proposed shared 6.2-mile (10-kilometer) ROW to the RWI. Most of the estuarine wetlands crossed by the ROW are in the Brazoria National Wildlife Refuge. These wetlands are characterized by salt meadow cordgrass and mudflats.

The 0.8-mile (1.2-kilometer) brine pipeline ROW from the RWI to the Gulf of Mexico would cross estuarine emergent wetlands, sand flats, and beach habitat.

The 37-mile (60-kilometer) crude oil pipeline ROW would be located along an existing and maintained corridor, with approximately 75 percent of the ROW surrounded by hardwood forested habitat. The remaining habitat is a mixture of disturbed or managed areas, grassland, and beach or bare soil habitat. Wetlands are present in about 21 percent of the proposed ROW, with the majority being palustrine emergent wetlands.

The proposed 2.7-mile (4.3-kilometer) connecting pipeline from the Texas City terminal to the British Petroleum and GAP Analysis Program facilities would follow an existing road and drainage canal through disturbed habitat. Approximately 23 acres (9.2 hectares) have been identified by the National Wetlands Inventory data as palustrine unconsolidated bottom wetlands.

Based on the various land classification types and the wetlands present along the ROWs, several common mammals, birds, amphibians, and reptiles may use the habitats within the ROWs. Such species would be similar to those described under the Stratton Ridge storage site description. Organisms observed at the Brazoria National Wildlife Refuge include alligators, other reptiles, salamanders, other amphibians, coyotes, and bobcats (USFWS 2003). More than 200 species of birds have been observed at the refuge.

The typical species of fish found in southern fresh-water systems reside in streams and open water bodies crossed by the existing and new ROWs. Many of the fish species are common throughout the Gulf Coast region, adapt well to moderate environmental change, and include the following: fresh-water eels, suckers, minnows, sunfish and bass, mullet, perches and darters, and fresh-water catfish.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the counties where the proposed Stratton Ridge ROWs would be located: Attwater's greater prairie chicken, bald eagle, brown pelican, Eskimo curlew, piping plover, whooping crane, and several marine mammals and sea turtles. A review of the conditions along the ROWs and consultations with USFWS and the Texas Parks and Wildlife Department revealed that the proposed ROW from the Stratton Ridge site to the RWI may include suitable foraging habitat for the bald eagle, which is on the federal and state threatened species list (see appendix H). The bald eagle has been proposed for delisting from the federal ESA list by USFWS. No known bald eagle nests are located along the ROW, but emergent wetland habitat along the ROW may be suitable for foraging bald eagles that nest in the surrounding area. The closest known nest is located 2 miles (3.2 kilometers) from the crude oil pipeline to Texas City.

Appendix I identifies species listed as threatened or endangered by Texas, but not by the federal government, in the counties in the proposed Stratton Ridge area. Table 3.7.8-2 shows a comparison of the habitat preferences of threatened or endangered species on the state list and habitat present in the proposed Stratton Ridge ROWs.

**Table 3.7.8-2: State-Listed Species With Potentially Suitable Habitat Along Stratton Ridge ROWs**

| Common Name | State Status | Global Status[a] | Potentially Suitable Habitat at Site |
|---|---|---|---|
| Arctic peregrine falcon | Threatened | Apparently secure (G4) | Estuarine wetlands and beaches |
| Eastern brown pelican | Endangered | Apparently secure (G4) | Estuarine wetlands and beaches |
| Reddish egret | Threatened | Apparently secure (G4) | Estuarine wetlands and beaches |
| Sooty tern | Threatened | Secure (G5) | Estuarine wetlands and beaches |
| Swallow-tailed kite | Threatened | Secure (G5) | Tall, easily accessible trees with open areas for foraging |
| White-faced ibis | Threatened | Secure (G5) | Bayous and palustrine wetlands |
| White-tailed hawk | Threatened | Apparently secure (G4) | Estuarine wetlands dominated by salt meadow cordgrass and beaches |
| Wood stork | Threatened | Apparently secure (G4) | Bayous and palustrine wetlands |
| Alligator snapping turtle | Threatened | Vulnerable (G3) | Water bodies, particularly slow moving, deep rivers and canals; shallow tributaries; and brackish waters near river mouths |
| Smooth green snake | Threatened | Secure (G5) | Grasslands, forest, meadows, grassy marshes, moist grassy fields at forest edge, and abandoned farmland |

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity Database as common, widespread, and abundant. Apparently secure is defined as an uncommon species, but not rare. There is some cause for long-term concern. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer).

Source: NatureServe 2005

None of these species is known to inhabit the site, but a survey or habitat assessment has not been conducted.

### *Essential Fish Habitat*

No EFH is located near or within the ROWs crossed by the proposed Stratton Ridge pipelines and power lines. As stated in the introduction to section 3.7.7, the offshore brine pipeline is discussed in section 3.7.2 and appendix E.

### *Special Status Areas*

Approximately 3 miles (5 kilometers) of the co-located RWI pipeline, brine disposal pipeline, and power line ROW would cross the southwestern edge of the Brazoria National Wildlife Refuge, which is part of the Texas Mid-Coast National Wildlife Refuge Complex. In addition, 4.7 miles (7.6 kilometers) of the pipeline along the existing Bryan Mound pipeline ROW would cross the refuge along its northern border.

The brine disposal pipeline ROW from the ICW to the Gulf of Mexico would not be located in the national wildlife refuge.

Created in 1966, the Brazoria National Wildlife Refuge was established to provide habitat for migratory waterfowl and other birds. Currently, the refuge provides 44,000 acres (18,000 hectares) of coastal wetlands. The Texas Mid-Coast National Wildlife Refuge Complex is an important zone of coastal wetlands that serves as an endpoint of the Central Flyway for waterfowl in the winter. Neotropical migratory songbirds also use the refuges as stopovers during migration. These birds are in decline due in part because of loss of stopover habitat, as discussed in section 3.7.2. The wildlife refuge also provides habitat for alligators, turtles, small mammals, and other wildlife.

#### *3.7.8.1.3 Raw Water Intake*

The proposed RWI structure would be located on the coastal side of the ICW across the waterway from the Brazoria National Wildlife Refuge (see figure 2.4.6-3). The RWI structure is located about 6 miles (9.6 kilometers) southeast of the proposed storage site. DOE also would construct a 1,000-foot (300-meter) long new access road from Bay Street to the RWI.

***Plants, Wetlands, and Wildlife***

The ICW is a heavily traveled maritime corridor that is dredged regularly by USACE to maintain a proper depth for navigation. It is a tidally influenced and channelized system. The vegetation near the proposed structure is estuarine wetlands, dominated by saltmeadow cordgrass and other salt-tolerant emergent wetland species. Typical vegetation in this area includes saltgrass, seamyrtle, glasswort, and spikerush. No submerged aquatic vegetation grows along the ICW in the vicinity of the proposed RWI. Estuarine wetlands provide habitat for a variety of birds, mammals, and reptiles, including herons, spoonbills, swamp rabbits, mice, and various turtles.

The aquatic fauna found near the RWI is similar in composition to the animals described for the RWI pipeline, brine disposal pipeline, and power line ROW. Over 130 species may inhabit the ICW, which includes representatives from 40 families that are common throughout the Gulf Coast region (Page and Burr 1991; Froese and Pauly 2006; Hoese and Moore 1998; McGowan et al. 1998). Two species of commercially important shrimp are found in the estuarine systems along the ICW and the area in and around the proposed RWI.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed RWI would be located: bald eagle, brown pelican, piping plover, whooping crane, and several marine mammals and sea turtles.

A review of the conditions at the proposed RWI structure and access road and consultations with the USFWS and the Texas Parks and Wildlife Department revealed that the area may provide some suitable habitat for the federal and state-listed threatened bald eagle (see appendix H). There are no known bald eagle nests located near the proposed RWI site and access road, but open water and emergent wetland habitat in the area may be suitable for foraging bald eagles.

Appendix I identifies the species listed as threatened or endangered by the State of Texas (but are not on the federal list) in the counties in the proposed Stratton Ridge development area. Table 3.7.8-3 shows a comparison of the habitat preferences of threatened or endangered species on the state list and habitat present at the proposed Stratton Ridge RWI. None of these species is known to inhabit the site, but a survey or habitat assessment has not been conducted.

**Table 3.7.8-3: State-Listed Species With Potentially Suitable Habitat At Stratton Ridge RWI**

| Common Name | State Status | Global Status[a] | Potentially Suitable Habitat at Site |
|---|---|---|---|
| Arctic peregrine falcon | Threatened | Apparently secure (G4) | Estuarine wetlands |
| Eastern brown pelican | Endangered | Apparently secure (G4) | Estuarine wetlands |
| Reddish egret | Threatened | Apparently secure (G4) | Estuarine wetlands |
| Sooty tern | Threatened | Secure (G5) | Estuarine wetlands |
| White-faced ibis | Threatened | Secure (G5) | Bayous and palustrine wetlands |
| White-tailed hawk | Threatened | Apparently secure (G4) | Estuarine wetlands dominated by saltmeadow cordgrass |
| Wood stork | Threatened | Apparently secure (G4) | Bayous and palustrine wetlands |
| Alligator snapping turtle | Threatened | Vulnerable G3) | Water bodies, particularly slow moving, deep rivers and canals; shallow tributaries; and brackish waters (estuarine) near river mouths |

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity Database as common, widespread, and abundant. Apparently secure is defined as an uncommon species, but not rare. There is some cause for long-term concern. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer).

Source note: Natureserve 2005

***Essential Fish Habitat***

No EFH, as described in appendix E, is located within or near the boundaries of the proposed RWI.

***Special Status Areas***

The proposed RWI site would be located along the shoreline of the ICW across from the border of the Brazoria National Wildlife Refuge. The refuge is described in detail in section 3.7.2.

#### *3.7.8.1.4 Texas City Terminal*

***Plants, Wetlands, and Wildlife***

The proposed 39-acre (16-hectare) terminal would be adjacent to an existing terminal owned by TEPPCO and southwest of larger refineries owned by British Petroleum, MAP, and VALERO. The site currently contains fields that do not appear to be actively managed, although they appear to have been used for row-crop agriculture in the past. Highways flank the western and southeastern borders of the proposed site. Row-crow agriculture, pasture fields, and residential neighborhoods are the other land uses surrounding the proposed terminal site. National Wetlands Inventory data identified 12 acres (5 hectares) of palustrine emergent, forested, and scrub-shrub wetland habitat at the proposed site. These wetlands are associated with a drainage channel that originates northwest of the proposed site boundary and flows east through the site. Because of the disturbed nature of the site and of the surrounding area, the site likely provides marginal quality habitat for wildlife.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Texas City terminal would be located: Attwater's greater prairie chicken, brown pelican, Eskimo curlew, piping plover, and several marine mammals and sea turtles. A review of the conditions at the Texas City terminal revealed that the proposed site that would be disturbed does not provide suitable habitat for any federally or state-listed threatened or endangered species, species proposed for listing, or candidate species (see appendices H and I).

***Special Status Areas***

No special status areas are located within the boundary of the proposed Texas City terminal. An active interior least tern and foster's tern rookery is located about 1.6 miles (2.7 kilometers) southeast of the proposed terminal site (USFWS 2004—Texas Colonial Waterbird Database).

***Essential Fish Habitat***

No EFH is located near or within the boundaries of the proposed Texas City terminal.

#### 3.7.8.2 Impacts

##### *3.7.8.2.1 Stratton Ridge Storage Site and Associated Infrastructure*

***Plants, Wetlands, and Wildlife***

The clearing, filling, and grading associated with the proposed construction of the Stratton Ridge storage site would affect approximately 370 acres (150 hectares), including the 270-acre (110-hectare) storage site and a 300-foot (91-meter) cleared security buffer surrounding the site. Trees would be removed within the 300-foot security buffer; however, emergent wetland vegetation would be allowed to regrow postconstruction. The construction would affect the following:

- 258 acres (104 hectares) of palustrine-forested wetlands,
- 35 acres (14 hectares) of deciduous forest,
- 23 acres (9 hectares) of palustrine-emergent wetlands,
- 12 acres (5 hectares) of palustrine scrub and shrub, and
- 45 acres (18 hectares) of old field and roads.

Clearing and grading the palustrine forested wetlands would permanently remove and fill about 192 acres (78 hectares) of forested wetlands onsite and convert 66 acres (27 hectares) within the security buffer to emergent wetlands or open water. If this alternative is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible, although the entire footprint would be cleared of trees for security reasons. The placement of fill in the wetlands would cause a permanent loss of wetlands functions and values; however, clearing forested wetlands outside the facility footprint would represent only wetland conversion and some wetland functions would be preserved. Section 3.7.2 and appendix B describe the effects of clearing and filling wetlands in detail. Although the area is disturbed by cattle and feral pigs and contains tallowtrees, the palustrine forested wetlands remain an important ecological resource for the region. Palustrine emergent wetlands occur more frequently in the region than forested wetlands; however, because the emergent wetlands are associated within the forested wetlands, the habitat combination is more ecologically valuable for the region.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands and would preserve onsite emergent wetlands to the maximum extent practicable. DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in section 3.7.1.2 and in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Texas Commission on Environmental Quality. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetland impacts. If this alternative is selected, the impact to this ecologically important and relatively rare wetland type may be an adverse affect, which would be mitigated somewhat by DOE's compensation plan for jurisdictional wetland impacts.

As discussed in section 3.7.2, some wildlife would be killed or displaced to surrounding areas during construction. Because the forested wetland habitat is uncommon in the region, some wildlife species may be unable to find suitable habitat, including migrating neotropical birds that use the palustrine forested wetlands—specifically bottomland hardwood forests—as stopover habitat. Although some individuals would be affected, the impact would not alter the state population or species viability. Construction of the Stratton Ridge storage facility would reduce the quantity of forested habitat available to these birds, which would add to the stress of annual migration. Generally, common animals such as white-tailed deer and nine-banded armadillo would be able to find suitable habitat in the surrounding area. After the security fencing is constructed, wildlife use of the facility would be limited. Some mobile species and birds would probably still visit the site.

The operations and maintenance effects, described in section 3.7.2, would preclude wildlife sensitive to human disturbance from entering the area. These would either adapt to the disturbance or move to new habitat; however, only a small amount of the forested wetland habitat would remain near the proposed Stratton Ridge site. The remaining forested wetland habitat would probably not support all the displaced wildlife species that are sensitive to human disturbances. Most common species (e.g., deer, armadillo, and feral pigs) could tolerate noise and activities created by the SPR facility.

The common operational and maintenance effects on migratory birds described in section 3.7.2 could hinder migration due to night lighting, noise, and new structures; however, the proposed Stratton Ridge site already is traversed by large power lines and is adjacent to a cellular telephone tower.

With the removal of semipermanent water bodies and temporary increases in erosion, the proposed construction of the Stratton Ridge site facilities could affect aquatic species such as amphibians, reptiles, and invertebrates, and is also described in section 3.7.2. Although some individuals would be affected, the state population and species viability would not be altered.

As described in section 2.3, DOE would minimize erosion by using best management practices. An erosion- and sediment-control plan and a Texas Pollutant Discharge Elimination System stormwater permit issued by the Texas Commission on Environmental Quality for construction activities would be secured, which would require the use of best management practices to minimize the impact to water bodies.

> Mitigation: DOE would implement a plan to control Chinese tallowtree invasion on the site. DOE would control invasive species by using seed mixes devoid of exotic and

invasive species and through postconstruction monitoring of the disturbed areas. If the monitoring detected problems with invasive species, DOE would implement corrective action. DOE would continue to refine the conceptual site plan to avoid and minimize impacts to the maximum extent practicable.

Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

Mitigation: DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. DOE would use down-shielded and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. If this alternative is selected, DOE would conduct a survey for raptor nests and secure any necessary permits in accordance with USFWS requirements under the Migratory Bird Treaty Act.

***Special Status Species***

A pair of bald eagles is known to nest near Ash Lake, located approximately 1.8 miles (2.7 kilometers) northwest of the proposed Stratton Ridge site. The bald eagle is federally listed as threatened but has been proposed for delisting by the USFWS. Research has shown that most nests are not disturbed by development activities that are farther than 0.25 miles (0.4 kilometers) away. Although this nest location is farther than 0.25 miles from the proposed site and the site is not designated critical habitat, these bald eagles may be affected by the Stratton Ridge development because some habitat at the proposed site may provide suitable foraging area. DOE has determined that the bald eagle would not likely be adversely affected by the proposed site. Although there are no known bald eagle nests in the Stratton Ridge site, the bottomland hardwood forest and wetland habitat at the site may be suitable for nesting, foraging, or roosting habitat. Bald eagles are particularly sensitive to human activity when they nest in Texas from October to July; their peak egg laying occurs in December and eggs hatch in January (Wiener 2005).

Operations and maintenance activities at the site would not affect foraging bald eagles even though bald eagles are highly sensitive to human noise and interference (USFWS 1983; USFWS 1995). Once construction is complete, the SPR storage sites would not generate significant noise or activity; therefore, the facility should not interfere with roosting or foraging activity.

If the proposed Stratton Ridge site is selected for development, a biologist would survey the site for bald eagle nests and any state-listed species that are deemed to have suitable habitat or potential to inhabit the area. DOE would coordinate with USFWS and the Texas Parks and Wildlife Department if any protected species are observed or suitable habitat is determined to be present onsite. DOE would conduct formal Section 7 Consultation if any part of the project was determined to adversely affect the bald eagle.

***Essential Fish Habitat***

No EFH exists within or near the boundaries of the proposed site and no impact to EFH would occur.

***Special Status Areas***

The special status areas near the proposed storage site—Brazoria National Wildlife Refuge, Peach Point Wildlife Management Area, and San Bernard National Wildlife Refuge—are all located more than 3.5 miles (5.6 kilometers) from the proposed storage site boundaries. Because the impacts associated with Stratton Ridge construction and operations and maintenance would be localized, DOE does not expect any impacts on special status areas.

#### *3.7.8.2.2 Stratton Ridge Rights-of-Way*

***Plants, Wetlands, and Wildlife***

Construction in the pipeline and power line ROWs would result in clearing all the vegetative habitats in the ROW and would affect the following:

- 373 acres (151 hectares) of hardwood forest,
- 40 acres (16 hectares) of grassland and scrub and shrub habitat,
- 11 acres (4 hectares) of water and emergent wetlands,
- 124 acres (50 hectares) of sand flats and beach habitat, or bare soil, and
- 140 acres (33 hectares) of disturbed or managed land.

Using the USFWS National Wetlands Inventory maps and proposed ROW footprints, construction could affect the following:

- 85 acres (34 hectares) of estuarine,
- 169 acres (68 hectares) of palustrine-emergent wetlands,
- 25 acres (10 hectares) of palustrine-unconsolidated bottom wetlands,
- 2 acres (1 hectare) of palustrine-scrub shrub wetlands,
- 3 acres (1 hectare) of lacustrine wetlands, and
- 3 acres (1 hectare) of riverine wetlands.

About 78 percent of these corridors would follow existing ROW corridors, which have already been disturbed by previous construction and ongoing maintenance activities.

As discussed in section 3.7.2, approximately 33 to 40 percent of this footprint would be a permanent impact because it would be located within the permanently maintained easement. The vegetation within the construction easement would be cleared, but DOE would regrade to pre-construction contours and reseed with native species within this area to re-establish native habitat. The remaining area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands, and the nature and amount of wetland impact from the permanent and construction easements. In addition, many of these wetlands would be avoided by directional drilling from the adjacent uplands. Moreover, about 80 percent of the pipeline ROWs is within or parallel to an existing ROW. Use of existing ROW corridors to the maximum extent practicable would minimize the impacts to undisturbed communities and wildlife.

Because DOE aggregated the Texas GAP Analysis Program information to identify upland habitat, some of the National Wetlands Inventory acreage is included under other land classifications, such as hardwood forest and scrub and shrub vegetation.

Section 3.7.2 describes the ROW operations and maintenance common impacts.

DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in accordance with the Section 404/401 permit conditions, which would compensate for the jurisdictional wetland impacts.

As stated in section 3.7.2, construction in the ROWs would displace or kill some aquatic and terrestrial wildlife. Noise and human activity may temporarily preclude some organisms from using nearby habitat. The duration of construction in these areas would be short (6 to 10 weeks at any one location), and ample habitat would be available nearby for most species. The aboveground portion of the power lines to the RWI, from the site to the Brazoria National Wildlife Refuge, represents a potential strike hazard that could affect resident and migratory birds (as described in section 3.7.2). The buried portion of the power lines through the refuge to the RWI would not affect resident or migratory birds.

The impacts associated with the operations and maintenance of the ROWs are described in section 3.7.2.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters] wide) or in areas containing sensitive habitat such as wetlands or habitat for special status species. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. DOE would correct problems that are identified.
>
> DOE would bury the power lines through the Brazoria National Wildlife Refuge. In areas outside the refuge, DOE would use low power line poles (less than 75 feet [23 meters]) and would follow the guidelines outlined in *Suggested Practices for Raptor Protection on Powerlines: the State of the Art in 1996* (APLIC 1996).

***Special Status Species***

The construction of the RWI and brine disposal pipelines and power lines leading to the RWI structure may affect habitat that is potentially suitable for foraging and nesting bald eagles; however, no known nests have been identified along the ROW. It is also possible that habitats may exist for bald eagle nesting and foraging along the existing pipeline ROW to Texas City; however, the ROW currently exists and is actively managed by DOE.

Construction activities along the ROWs may affect potential habitat for species that are listed as threatened or endangered by Texas, but that are not on federal lists. Although arctic peregrine falcons may feed along the RWI and brine disposal ROWs that cross through estuarine wetlands, they should be able to find other areas of potential habitat adjacent or nearby. The estuarine wetlands and beach habitat along the ROWs are potentially suitable to reddish egrets, sooty terns, and white-tailed hawks. The forested habitat along the ROWs is potentially suitable habitat for nesting and foraging swallow-tailed kites; the fresh-water marsh (palustrine emergent wetlands) and other wetland habitats are potentially suitable to nesting white-faced ibis and wood storks. Construction could affect potential habitat for the smooth green snake, although most of the corridors are already disturbed. Pipeline construction could disturb alligator snapping turtle habitat located near the ICW, though the footprint of the RWI and pipeline would be small and disturbance temporary.

As described in section 3.7.2, ROW operations and maintenance activities would occur infrequently and should not impact state-listed species.

If DOE selects the Stratton Ridge site for development, a biologist would survey the area for eagles and suitable eagle habitat along the ROWs. If a nest is identified, DOE would initiate formal Section 7 Consultation with USFWS and consult with the Texas Parks and Wildlife Department. DOE would prepare a Biological Assessment if any portion of the project may adversely affect the bald eagle. DOE would implement appropriate mitigation strategies to avoid adverse affects. For example, construction of the pipeline could be completed to avoid nesting times where bald eagles are particularly sensitive to human activity.  DOE would directionally drill under the sand beaches along the coast to avoid potential habitat for the brown pelican.

> Mitigation:  DOE would minimize construction activities during nesting periods to the extent practicable to minimize the impact on local nesting bird populations.

***Essential Fish Habitat***

No EFH occurs near or within the ROWs for the Stratton Ridge pipelines and utilities.

***Special Status Areas***

Approximately 3 miles (5 kilometers) of the proposed ROW containing the RWI and brine disposal pipelines and the two power lines to the RWI would cross the Brazoria National Wildlife Refuge.  In addition, 4.7 miles (7.6 kilometers) of the crude oil pipeline to Texas City would cross the refuge along its northern border adjacent to the existing Bryan Mound pipeline ROW.  As described earlier, the construction through the refuge would temporarily affect wildlife and vegetation present in the refuge. After construction, the emergent wetlands and upland plant communities within the temporary construction easement would be allowed to revegetate and wildlife could move back into the ROW.

As described in section 3.7.2, ROW operations and maintenance activities such as mowing, clearing, and grubbing would occur infrequently and result in temporary impacts on vegetation and wildlife.

> Mitigation:  Because the Brazoria National Wildlife Refuge contains important habitat for migrating birds and waterfowl, DOE would avoid or minimize pipeline construction during spring or fall migration.  As described in section 2.3, DOE would bury the power lines through the refuge to the RWI to further minimize long-term impacts on vegetation and wildlife.  DOE would use the existing Bryan Mound ROW as much as possible for pipeline and staging areas to minimize the footprint of the crude oil pipeline through the refuge.  DOE would coordinate with USFWS for the easement through the wildlife refuge and would reseed ROWs with seeds of native herbaceous, shrub, and/or tree species to promote regeneration of habitat in the temporary construction easement and restore the permanent easement to preconstruction contours.  Disturbed areas would be restored with herbaceous species.

#### 3.7.8.2.3 Raw Water Intake

***Plants, Wildlife, and Wetlands***

Section 3.7.2 describes construction impacts associated with the proposed RWI.  The clearing and grading associated with construction of the RWI and access road would affect approximately 2 acres (1 hectare) of estuarine emergent wetlands.  The RWI structure itself would occupy an area of 2 acres (1 hectare). DOE would secure permits from USACE and the Texas Commission on Environmental Quality for the impact to jurisdictional waters of the United States and would provide compensation for the unavoidable impacts.  This would include an Industrial Water Conservation Plan from Texas Commission on Environmental Quality for the proposed use of surface water.

As discussed in section 3.7.2, some wildlife species would be displaced to similar vegetative and wetland communities surrounding the RWI and the access road.  Dredging required for construction of the RWI may affect some aquatic organisms and temporarily increase suspended sediment in the water column. Mobile species could move away from the construction area.  Because the ICW is an artificial navigation channel that is regularly dredged by USACE to maintain sufficient depth and width for boat traffic, most aquatic species would be tolerant of noise and human activity. Prior to construction, DOE would conduct surveys for raptor nests as typically required by the Migratory Bird Treaty Act.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands to the maximum extent practicable. DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid and minimize and compensate for wetland impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in section 3.7.2 and in accordance with the 404 permit and 401 Water Quality Certificate from USACE and Texas Commission on Environmental Quality. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the wetland impacts. As presented in chapter 2, erosion would be minimized with the use of best management practices. An erosion- and sediment-control plan and TPDES stormwater permit issued by Texas Commission on Environmental Quality for construction activities would be secured, which would require the use of best management practices to minimize the impact to water bodies.

The RWI would withdraw about 1.0 MMBD (42 million gallons per day) from the ICW for a period of 4 to 5 years during solution mining and afterwards for periodic drawdown or cavern maintenance. Because the ICW is a tidal channel, the withdrawal would not affect the river depth or flows; however, it would cause impingement and entrapment of some fish and other small aquatic organisms. The RWI would be equipped with intake screens, a relatively low intake velocity, and a traveling screen and fish bypass system to return impinged fish back to the waterway. Entrained organisms would not have an outlet or bypass. Operations and maintenance of the RWI would produce constant noise from the pumps during the cavern solution mining and periods of fill and drawdown. Noise from the RWI is estimated to be audible up to 0.7 miles (1.2 kilometers) away if noise attenuation is not used and would dissipate with increasing distance from the structure. Noise could preclude sensitive terrestrial and aquatic wildlife from using habitat in the immediate vicinity of the RWI. The proximity of the Brazoria National Wildlife Refuge to the RWI is of particular concern to the USFWS because the refuge contains habitat for hundreds of wildlife species and provides important stopover habitat for migratory birds. Because the noise produced by the RWI would be constant, however, some organisms might adapt to the background operations of the facility.

Section 3.7.2 describes other operations and maintenance impacts, including artificial lighting and increased human activity, that could affect migratory birds and other wildlife.

> Mitigation: As described in section 3.7.2, DOE would use down-shielded lights and low-mast security lighting to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year.
>
> Because the wildlife refuge would be in close proximity to the RWI, DOE would mitigate the noise impacts by using noise attenuation measures. These measures would include building a concrete enclosure for the pumps and install quieter pump equipment. The use of these strategies would decrease the noise impact and may achieve up to 10 **A-weighted decibel (dBA)** noise reduction.

***Special Status Species***

Operations and maintenance activities at the RWI may affect foraging bald eagles because they are sensitive to human noise and interference (USFWS 1983, 1995).

No known brown pelican nests are located near the proposed location for the RWI structure; therefore, the construction, operations, and maintenance of the RWI structure would not affect brown pelicans.

Construction of the RWI could affect potential habitat for species that are listed as threatened or endangered by the State of Texas, but are not on federal lists.  Although nesting sites are not likely to be adjacent to the busy ICW, the habitat near the RWI may be suitable for feeding arctic peregrine falcons, reddish egrets, sooty terns, white-tailed hawks, white-faced ibis, and wood storks.  As described in section 3.7.2, construction noise and activities may displace these species or affect their behavior.  During construction, alligator snapping turtles may be displaced and forced to use suitable adjacent habitat.  DOE does not expect that the proposed construction or operation of the RWI would cause a taking of a state-listed species.

Operations and maintenance of the RWI during cavern fill and drawdown activities would produce constant noise that may affect nearby threatened and endangered birds on state lists (e.g., arctic peregrine falcons, eastern brown pelicans, reddish egrets, sooty terns, white-tailed hawks, white-faced ibis, wood storks).  These species could move to similar habitat in the wildlife refuge.  Operation of the RWI is not expected to affect the threatened alligator snapping turtle species on the state list because the intake pipe would be equipped with screens and have intake flow velocities that are sufficiently slow that will allow larger organisms such as the turtles to escape.

> Mitigation:  To the extent practicable, DOE would minimize impacts by constructing the RWI outside important nesting periods and spring and fall bird migration.
>
> Mitigation:  Section 3.7.2 describes how DOE would use down-shielding and low-mast security lights to minimize the impacts of artificial lighting on migratory birds and other wildlife.  DOE also would use noise attenuation measures, such as pump enclosures, and low-noise pumps to minimize impacts on wildlife.

***Essential Fish Habitat***

No EFH is located within or near the RWI structure.

***Special Status Areas***

As described in section 3.7.2, construction noise and activities may affect sensitive wildlife species that use the Brazoria National Wildlife refuge.  These impacts may displace sensitive species and may affect foraging and breeding behavior of other organisms.  Mobile species may move away from the disturbance to suitable, available habitat elsewhere in the refuge.

Noise from operations and maintenance of the RWI during and following cavern construction could affect wildlife within the refuge.  These impacts may displace some sensitive species and may affect foraging and breeding behavior in others.  Mobile species would move away from the disturbance to suitable, available habitat elsewhere in the refuge.

> Mitigation:  Because the Brazoria National Wildlife Refuge provides important habitat for migratory birds, DOE would minimize or avoid construction of the RWI during

nesting periods and spring and fall migration. DOE would down-shield lights to minimize the impacts of artificial light on migratory birds and other wildlife. DOE would use noise attenuation for the pump station to minimize impacts on wildlife.

#### 3.7.8.2.4 Texas City Terminal

***Plants, Wetlands, and Wildlife***

The clearing, grading, and construction of the Texas City terminal would affect about 39 acres (16 acres). Almost 100 percent of the proposed site contains disturbed habitat. The following wetlands would be removed during construction:

- 4 acres (2 hectares) of palustrine emergent wetlands,
- 2 acres (1 hectare) of palustrine forested wetlands,
- 4 acres (2 hectares) of palustrine scrub-shrub wetlands, and
- 1 acre (0.4 hectares) of palustrine unconsolidated bottom.

If this alternative is selected, DOE would refine the conceptual site plan to avoid some of the wetlands if possible, although the entire footprint would be cleared of trees for security reasons. The placement of fill in the wetlands would cause a permanent loss of wetland functions and values. DOE would secure permits from USACE and the Texas Commission on Environmental Quality for the impact and would provide compensation for the unavoidable wetland impacts. Section 3.7.2 describes the effects of clearing and filling wetlands in detail.

After the security fencing is constructed, wildlife use of the site would be limited, though some mobile species and birds would probably still visit the site.

The operations and maintenance activities, described in section 3.7.2, may preclude wildlife sensitive to human disturbance from entering the area. The operational and maintenance activities at the terminal would be infrequent and similar to activities at the adjacent terminal to the proposed terminal and the refineries nearby. Therefore, this area has already been disturbed by past construction and habitat fragmentation.

Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

***Special Status Species***

A review of the conditions at the Texas City terminal revealed that the proposed site that would be disturbed does not provide suitable habitat for any federally or state-listed threatened or endangered species, species proposed for listing, or candidate species (see appendices H and I).

***Special Status Areas***

No special status areas are located within the boundaries of the proposed Texas City terminal. Construction and operations and maintenance activities would not affect the least tern rookery because the proposed facility is located more than 1.5 miles (2.4 kilometers) away from the nesting area.

***Essential Fish Habitat***

No EFH exists near or within the boundaries of the proposed Texas City terminal.

### 3.7.9 Bayou Choctaw Expansion Site

This section addresses the following areas:

- The proposed Bayou Choctaw expansion and associated facilities;
- One proposed pipeline ROW from the existing brine injection wells to the proposed new brine injection well field; and
- The proposed six new brine injection wells and associated infrastructure.

The brine disposal system would be upgraded by installing 3,000 feet (900 meters) of brine pipeline to connect six new injection wells to the existing brine injection wells located south of the property boundary. The existing RWI on Cavern Lake would be used and would operate within the capacity of the existing system. The use of RWI would not change the existing condition or affect biological resources and is not considered in this analysis.

#### 3.7.9.1 Affected Environment

##### *3.7.9.1.1 Bayou Choctaw Expansion Storage Site*

The proposed expansion at Bayou Choctaw involves development of two new caverns as well as acquisition of an existing commercial storage cavern that is already located within the property boundary. There would be only minor changes to the current footprint or operations from the facility upgrades required for expansion. No new offsite land acquisition is required for the Bayou Choctaw expansion.

***Plants, Wetlands, and Wildlife***

The Bayou Choctaw storage site is located in Iberville Parish, LA. The storage site occupies 356 acres (144 hectares) of fresh-water swamp (palustrine deciduous wetlands) with open water canals that join larger bodies of water offsite (DOE 2004f). The area surrounding the site is also fresh-water swamp. Bald cypress and water tupelo are the main canopy vegetation; understory vegetation includes black willow, water ash, and pumpkin ash. Dry hummocks around tree roots are vegetated with greenbriar, palmetto, blackberry, trumpet vine, Virginia creeper, holly, and grape. One-third of the storage site property (caverns and support infrastructure) has been filled and elevated. The facility is protected from flooding by flood control levees and pumps. The remainder of the site, which includes the area where the new caverns would be placed, is a fresh-water swamp with areas of open water. The site was affected by recent hurricanes, but the plant communities were not significantly damaged.

The swamp provides habitat for a diverse wildlife population, including many kinds of birds, mammals, reptiles, and amphibians. Common bird species found in the area include herons, egrets, woodpeckers, wood duck, woodcock, thrushes, vireos, and warblers. The bald cypress trees in the area provide suitable nesting and wintering habitat for other bird species. Mammals expected to be found at Bayou Choctaw include opossum, squirrels, nutria, mink, raccoon, swamp rabbit, and white-tailed deer.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the Bayou Choctaw storage site is located:  bald eagle, pallid sturgeon, and Louisiana black bear. However, following a review of conditions and consultations with USFWS and the Louisiana Department of Wildlife and Fisheries, DOE has determined that the expansion of the Bayou Choctaw site would not provide suitable habitat for any federally or state-listed threatened, endangered, or candidate species (see appendices F and I).

***Special Status Areas***

No special status areas are located within 2 miles (3 kilometers) of the Bayou Choctaw expansion site.

#### *3.7.9.1.2 Bayou Choctaw Rights-of-Way*

***Plants, Wetlands, and Wildlife***

- A proposed brine disposal pipeline ROW would extend south for 0.6 miles (0.9 kilometers) from the existing Bayou Choctaw brine injection wells to the proposed new brine injection wells.

The entire proposed ROW between the existing and new brine injection wells would cross palustrine forested wetlands.  The vegetative composition within the area of the proposed ROW is likely similar to that of the Bayou Choctaw facility, with bald cypress and water tupelo as the main canopy species. Similar wildlife would be present in the area of the proposed ROW as mentioned above in the description of the proposed expansion area.

The cypress-tupelo swamp is an important fresh-water ecosystem that provides important functions such as nutrient transformation, flood storage, and habitat for wildlife.  Wetlands reduce the impact of nonpoint source pollution, minimize flood surges, and provide economic value to the community.  Forested wetlands near the Bayou Choctaw salt dome and in other areas along the Gulf Coast provide important stopover habitat for migrating birds.  The area likely supports numerous bird species that are regulated by the Migratory Bird Treaty Act.

Forested wetlands in the vicinity of the proposed brine disposal pipeline and existing brine injection wells, as in other places in Louisiana, are experiencing pressure from other land uses in the area. Abutting the proposed ROW to the east are drained fields used for row-crop agriculture.  Oil and gas development also and wetland communities exist west of the proposed brine ROW.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Bayou Choctaw ROWs would cross:  bald eagle, pallid sturgeon, and Louisiana black bear.  However, after consultation with USFWS and the Louisiana Department of Wildlife and Fisheries, DOE has determined that the proposed ROWs would not affect any federally or state-listed threatened, endangered, or candidate species (see appendices F and I).

***Special Status Areas***

There are no special status areas located within or near the proposed brine disposal ROW.

##### *3.7.9.1.3 Bayou Choctaw Brine Injection Wells*

***Plants, Wetlands, and Wildlife***

DOE has identified a 96-acre (39-hectare) area approximately 2 miles (3.2 kilometers) south of the Bayou Choctaw storage site to construct up to six new brine injection wells and associated infrastructure. Ninety-five percent of this proposed area contains palustrine forested wetlands that likely have a similar vegetative composition as the bald cypress-tupelo swamp at the Bayou Choctaw storage site. DOE would use at most approximately 20 acres (8 hectares) for the brine injections wells and access road. This analysis assumes that all 20 acres (8 hectares) contain palustrine forested wetlands.

As stated previously, the cypress-tupelo swamp is an important fresh-water ecosystem that provides important functions such as nutrient transformation, flood storage, and habitat for wildlife. These ecosystems are experiencing serious development pressure from agriculture and the oil and gas industries near the Bayou Choctaw storage facility and in other areas within Louisiana.

This cypress-tupelo swamp in the area of the proposed brine injection wells likely supports similar wildlife as described above with the Bayou Choctaw site.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Bayou Choctaw injection wells would be located: bald eagle, pallid sturgeon, and Louisiana black bear. However, after reviewing the area and consultations with USFWS and the Louisiana Department of Wildlife and Fisheries, DOE has determined the brine injection wells would not affect any federally or state-listed threatened, endangered, or candidate species.

***Special Status Areas***

There are no special status areas located within or near the proposed brine injection wells.

#### 3.7.9.2 Impacts

##### *3.7.9.2.1 Bayou Choctaw Expansion Site*

***Plants, Wetlands, and Wildlife***

The construction activities associated with the proposed site expansion would fill about 4 acres (2 hectares) of fresh-water swamp. Construction of the two proposed caverns and construction of each new and replacement road to access the caverns would fill about 4 acres (1.6 hectares). The impacts of clearing and filling wetlands are described in section 3.7.1.2. The affected area at Bayou Choctaw would be located within the previously disturbed site boundaries. The loss of vegetation and the fill of wetlands would displace wildlife that nest and forage in the surrounding area.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands to the maximum extent practicable. Due to the engineering limitations with the cavern placement in the salt dome, under this alternative some wetlands would be affected. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in section 3.7.1.2 and in accordance with the

404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetland impacts.

Because of the small facility footprint and disturbed nature of the plant communities the expansion would cause little affect to wildlife, wetlands, plant communities, or migratory birds. Some wildlife would be killed or displaced by construction activities. These organisms would be displaced to similar areas within and surrounding the facility. Though these impacts may affect individual organisms, the construction, operations, and maintenance of the facility would not alter the regional population or species' viability.

Construction of the Bayou Choctaw site facilities would affect aquatic and terrestrial species that use the cypress swamp, such as some beavers, amphibians, small reptiles, and fish. The connecting wetlands offsite would experience sedimentation and temporary water impacts as the site's vegetation is removed and the surrounding wetlands filled. Aquatic organisms would have to find suitable aquatic habitat in the adjacent wetlands or other wetlands nearby.

Section 3.6.1.3 discusses operational and maintenance impacts common to all proposed new and expansion sites. The general operations and maintenance of the site, such as lawn maintenance, lighting, noise, and vehicular traffic in and around the facility, would be the same as current activities; therefore, there would be no impact to vegetation or wildlife communities in the area.

> Mitigation: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.
>
> Mitigation: DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the area during the year. DOE would use down-shielding and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. DOE would conduct a survey for raptor nests and secure any necessary permits in accordance with USFWS requirements under the Migratory Bird Treaty Act.

***Special Status Species***

DOE has determined that no federally or state-listed threatened, endangered, or candidate species would be affected by the proposed site expansion.

***Special Status Areas***

There are no special status areas located within or near the proposed expansion area of the Bayou Choctaw storage facility.

#### *3.7.9.2.2 Bayou Choctaw Rights-of-Way*

***Plants, Wetlands, and Wildlife***

Construction of the brine pipeline ROW would result in clearing 10 acres (4 hectares) of palustrine forested wetlands. As discussed in section 3.7.2.1, approximately 33 to 40 percent of this footprint would be a permanent impact because it is located within the permanently maintained easement. The vegetation within the construction easement would be cleared, but DOE would regrade to pre-construction contours and reseed with native species within this area to re-establish native habitat. The area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands. Appendix B provides detailed information about the types of wetlands, and the nature and amount of wetland impact from the permanent and construction easements.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in the Common Impacts section (see section 3.7.1.2) and in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetland impacts. In areas temporarily disturbed during construction, DOE would re-establish vegetation communities with native wetland species.

As stated in section 3.7.2, construction in the ROWs would displace or kill some aquatic organisms and terrestrial wildlife. Noise and human activity may temporarily preclude some organisms from using nearby habitat. The duration of construction through these areas would be short (6 to 10 weeks at any one location) and ample habitat would be available nearby for most species.

The impacts associated with the operations and maintenance of the ROWs are described in section 3.7.2.

> Mitigation: As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat. DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community. DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes. It would correct problems that are identified.

***Special Status Species***

DOE has determined that no federally or state-listed species would be affected by the proposed ROW.

***Special Status Areas***

There are no special status areas located in or near the proposed ROW.

##### 3.7.9.2.3 Bayou Choctaw Brine Injection Wells

Construction of the brine injection wells would clear and fill up to 20 acres (8 hectares) of palustrine forested wetlands. The actual construction and the permanent footprint of the six brine injections wells and connecting pipelines may be smaller than the area presented in this analysis. DOE, however, is still revising the site plan for the injection well area. Placing fill in wetlands would cause a permanent loss of wetland functions and values.

The removal of trees and other vegetation for the brine injection well pads, connecting pipelines, and access roads would create open areas where there was relatively continuous forested wetlands. Clearing of forested areas for the connecting brine disposal pipelines would represent a wetland conversion because DOE would allow emergent wetland vegetation to regenerate in the area.

If this alternative is selected, DOE would complete a wetland delineation and secure a jurisdictional determination from USACE.  In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands and would preserve onsite emergent wetlands to the maximum extent practicable.  DOE would submit a joint permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid and minimize and compensate for impacts to jurisdictional wetlands.  DOE would implement the mitigation measures described in the Impacts Common to Multiple Sites section (section 3.7.1.2) and in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality.  Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetland impacts.

The development of the site would change wetland species composition and have long-term impacts on surrounding plant and animal communities by introducing edge habitat within a relatively large continuous flooded forested area.  The operations and maintenance effects, such as noise created by the brine injection wells, would preclude wildlife sensitive to human disturbance from entering the area.  These effects are described in section 3.7.2.  Generally, any displaced organisms would find sufficient habitat in the surrounding area.  Security fencing around the well pads would limit wildlife access to the cleared habitat.  Some mobile species and birds may still have access to areas surrounding the brine injection wells.

The fill of inundated wetland areas would temporarily increase erosion and could affect aquatic species such as fish, amphibians, and invertebrates as described in section 3.7.2.  As described in section 2.3, DOE would minimize erosion by using best management practices.

> <u>Mitigation</u>:  DOE would control invasive species by using seed mixes devoid of exotic and invasive species and through postconstruction monitoring of the disturbed areas.  If the monitoring detects problems with invasive species, DOE would implement corrective action.  DOE would continue to refine the conceptual site plan to avoid and minimize impacts to wetlands to the maximum extent practicable.

***Special Status Species***

DOE has determined that no federally or state-listed threatened, endangered, or candidate species would be affected by the proposed brine injection wells.

***Special Status Areas***

There are no special status areas located within or near the proposed brine injection wells.

### 3.7.10 Big Hill Expansion Site

This section addresses the following areas:

- The proposed expansion area for the existing Big Hill storage site; and
- Two proposed pipeline ROWs:  the addition of an adjacent crude oil pipeline next to the existing ROW of the Big Hill to Sun Terminal in Nederland, TX, and the refurbishment of the existing brine disposal pipeline.

The Big Hill storage site has most of the infrastructure in place to facilitate construction and operation of additional caverns as described in section 2.3.3.  The existing RWI on the ICW would be used and withdrawal would be within existing permitted limits of the Industrial Water Conservation Plan. DOE would replace two RWI pumps within the structure without expanding the facility footprint. The use of the RWI for the expansion would not change existing biological conditions of the ICW; therefore, the operation of the RWI system is not considered in this analysis. Because of the similarity among the proposed SPR facilities in offshore environment, operations, and maintenance of the brine diffuser, the discussion of the brine diffusion system for all proposed storage facilities is covered in section 3.7.2 and appendix E. Also due to these similarities, the discussion of EFH is contained in section 3.7.2 and in appendix E.

### 3.7.10.1 Affected Environment

#### *3.7.10.1.1 Big Hill Expansion Storage Site*

***Plants, Wetlands, and Wildlife***

The Big Hill expansion site (see figure 2.5.2-1) is located in the Oak-Prairie Wildlife District in the Texas Gulf Coast Prairie Ecoregion (TPWD 2005); the existing site covers approximately 250 acres (101 hectares). The proposed 210-acre (83 hectare) Big Hill expansion area would include a 59-acre (24-hectare), 300-foot (91 meter) perimeter security buffer. The area is comprised of upland habitat characterized by a hardwood forest that is in the later stages of secondary succession. Historical records indicate that most of the expansion area was agricultural as recently as two decades ago (DOE 1992a). Since then the site has been allowed to revegetate, and currently it is a low to moderate quality forest. The mixed deciduous forest contains an invasive species (Chinese tallowtree) and the area has been disturbed from activities occurring at the current SPR storage facility and adjacent industrial facilities. Hurricanes Rita and Katrina in the fall of 2005 caused no long-term effects to the biological resources in the expansion area.

The forested areas are characterized by dense forest with patches of scrub-shrub vegetation. Canopy species include live oak, Chinese tallowtree, sweet gum, and box elder. Some live oak trees present at the site are greater than 2.5 feet (0.8 meters) in diameter and are estimated to be about 150 years old. The forest understory vegetation is dense and comprised mainly of tree saplings, blackberry, greenbriar, and Virginia creeper. The proposed expansion site boundaries encompass no large surface water bodies; however, the site does contain two intermittent streams and two small ponds. Palustrine wetlands—which comprise approximately 15 acres (6.1 hectares), or 11 percent, of the proposed expansion area—are associated with the ponds and intermittent streams.

Wildlife species inhabiting the area are common to disturbed areas along the Texas Gulf Coast. These species include white-tailed deer, nine-banded armadillo, pocket gopher, coyote, and quail. The aquatic systems onsite are not large or stable enough to support fish populations; however, they could provide habitat for invertebrates, small reptiles, and amphibians.

The area surrounding the expansion site is developed and managed mostly for agriculture and some industrial facilities. Agricultural fields and oil fields border the proposed expansion site. These areas provide habitat similar to the disturbed portion of the proposed expansion site.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the Big Hill storage facility is located: piping plover, and several marine mammals and sea turtles. However, a review of the conditions at Big Hill and consultations with USFWS and the Texas Parks and Wildlife Department revealed that the expansion area does not provide suitable habitat for and would not affect any federally listed threatened or endangered species, species proposed for listing, or candidate species (see appendix H).

Species that occur in Jefferson County, which would contain the proposed Big Hill expansion site, that are listed as threatened or endangered by the State of Texas but that are not on federal lists are identified in appendix I. Based on a comparison of the habitat preference of these species and the habitat present at the site, the species listed in table 3.7.10-1 may use the habitat at the expansion site.

**Table 3.7.10-1: Species on State Lists of Threatened and Endangered Species With Potentially Suitable Habitat at the Proposed Big Hill Expansion Site**

| Common Name | State Status | Global Status[a] | Potentially Suitable Habitat at Site |
|---|---|---|---|
| Bachman's sparrow | Threatened | Vulnerable (G3) | Secondary succession forest with live oak trees |
| Swallow-tailed kite | Threatened | Secure (G5) | Tall, easily accessible trees and open areas for foraging |
| White-faced ibis | Threatened | Secure (G5) | Palustrine wetlands |
| Wood stork | Threatened | Apparently secure (G4) | Palustrine wetlands |
| Black bear | Threatened | Secure (G5) | Hardwood forest with thick understory |
| Rafinesque's big-eared bat | Threatened | Vulnerable (G3) | Hardwood forest, particularly trees with loose bark and hollows |
| Scarlet snake | Threatened | Secure (G5) | Hardwood, pine, or mixed forest and woodland habitat |

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity database as common, widespread, and abundant. Apparently secure is defined as uncommon, but not rare. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer).

Source: NatureServe 2005

None of these species is known to occur on the site; however, surveys or habitat assessments have not been completed.

***Special Status Areas***

The proposed Big Hill expansion site contains no special status areas. Special status areas in Jefferson County near the site include the McFadden National Wildlife Refuge, 5.6 miles (9 kilometers) away; Sea Rim State Park, 8.1 miles (13 kilometers) away; and the Anahuac National Wildlife Refuge, 12 miles (20 kilometers) away. No recorded bird rookeries are located within 1 mile (1.6 kilometers) of the Big Hill expansion site.

#### *3.7.10.1.2 Big Hill Rights-of-Way*

Under the proposed expansion, construction would occur within the following two pipeline ROWs:

- A proposed crude-oil pipeline adjacent to an existing ROW for 23 miles (37 kilometers) from the site to the Sun Terminal in Nederland, TX; and
- Replacement of the first 1.3 miles (2.1 kilometers) of the existing brine disposal pipeline leaving the Big Hill site.

***Plants, Wetlands, and Wildlife***

The crude oil pipeline and the brine pipeline ROWs are existing and maintained corridors, with approximately 79 percent of the ROWs containing disturbed or managed habitat (urban, agricultural, and industrial land uses), which include some wetlands. The vegetation within both pipeline ROWs is herbaceous species with some shrubs along the edges in forested areas. Approximately 32 percent of the ROW consists of palustrine emergent wetlands, about 3 percent consists of lacustrine wetlands. Palustrine forested, palustrine scrub-shrub, palustrine unconsolidated bottom, and riverine wetlands each consists of 1 percent or less of the ROWs.

Based on the land classification types and the types of wetlands along the crude oil ROW, several common mammals, birds, amphibians, and reptiles might use the existing habitats in the ROW. The habitat is disturbed and therefore of low to moderate quality. The wildlife types would be similar to those found at the proposed Big Hill expansion site.

The small aquatic habitats along the proposed ROW consist of bayous or gullies. These systems receive some tidal influence, causing the water to be slightly brackish at times. The streams and gullies crossed by the proposed ROW do not support submerged aquatic vegetation. Typical fresh-water riverine species common throughout the Gulf Coast region can be found along the proposed ROW stream crossings.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the proposed Big Hill ROWs would be located: piping plover, and several marine mammals and sea turtles. However, a review of the conditions along the pipeline ROWs and consultations with USFWS and the Texas Parks and Wildlife Department revealed that the ROWs do not provide suitable habitat for any federally listed threatened or endangered species, species proposed for listing, or candidate species (see appendix H).

Appendix I identifies species in Jefferson County that are listed as threatened or endangered by the State of Texas, but that are not on federal lists. Table 3.7.10-2 lists the results of a comparison of species-specific habitat preferences and the potential habitat present along the pipeline ROWs for threatened or endangered species on state lists.

There are no known occurrences of these species within the proposed ROW, although no comprehensive survey or habitat assessment has been completed.

***Special Status Areas***

The J.D. Murphee Wildlife Management Area is a diverse coastal wetland community located within 0.25 miles (0.4 kilometers) of the existing pipeline ROW to Nederland, TX (see figure 2.5.2-1). The 24,000-acre (9,800-hectare) area is in the prairie-marsh zone of the upper coast of Texas, and it supports wetland communities that range from fresh-water to saline (TPWD 2006). The area is an important nesting site for mottled ducks, blue-winged teal, and snow geese. The area also provides habitat for alligators, muskrat, coyote, river otter, armadillo, bobcat, and nutria.

The portion of the brine pipeline that would be replaced is located approximately 4 miles (6 kilometers) north of the McFadden National Wildlife Refuge.

One cattle egret rookery has been documented approximately 0.7 miles (1.1 kilometers) north of the proposed crude oil pipeline ROW.

**Table 3.7.10-2: Threatened Species on State Lists Compared With Potentially Suitable Habitat Along Big Hill ROWs**

| Common Name | State Status | Global Status[a] | Potentially Suitable Habitat at Site |
|---|---|---|---|
| Bachman's sparrow | Threatened | Vulnerable (G3) | Herbaceous vegetation, shrubs, and forested areas |
| Reddish egret | Threatened | Apparently secure (G4) | Bayous and wetlands |
| Swallow-tailed kite | Threatened | Secure (G5) | Tall, easily accessible trees and open areas for foraging |
| White-faced ibis | Threatened | Secure (G5) | Bayous and palustrine wetlands |
| Wood stork | Threatened | Apparently secure (G4) | Bayous, wetlands, and brackish wetlands |
| Rafinesque's big-eared bat | Threatened | Vulnerable (G3) | Hardwood forest, particularly trees with loose bark and hollows |
| Scarlet snake | Threatened | Secure (G5) | Hardwood, pine, or mixed forest and woodland habitat |

Notes:

[a] Secure is defined by NatureServe and the Texas Natural Diversity Database as common, widespread, and abundant. Apparently secure is defined as uncommon, but not rare. Vulnerable is defined as at moderate risk of extinction due to range restrictions and relatively few populations (80 or fewer).

### 3.7.10.2 Impacts

#### *3.7.10.2.1 Big Hill Expansion Storage Site*

***Plants, Wetlands, and Wildlife***

The clearing, grading, and filling associated with the proposed Big Hill expansion area would affect the entire 210-acre (83-hectare) site. The construction would affect the following resources:

- 180 acres (73 hectares) of previously disturbed habitat, including a small number of large live oaks and wetlands,
- 8 acres (3 hectares) of hardwood forest,
- 8 acres (3 hectares) of bare soil, and
- 10 acres (4 hectares) of evergreen (pine) forest.

Clearing and grading the mixed evergreen and deciduous forest would affect the previously disturbed plant communities. The disturbance would not affect a regionally unique habitat. These impacts are described in section 3.7.1.2 (Common Impacts). Similar transitional forest is available in abandoned agricultural areas surrounding the proposed Big Hill expansion site.

DOE would fill about 15 acres (6 hectares) of palustrine forested and emergent wetlands. Similar wetland habitat occurs in the surrounding area. DOE would complete a wetland delineation and secure a jurisdictional determination from USACE. In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands and would preserve onsite emergent wetlands to the maximum extent practicable. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to jurisdictional wetlands. DOE would implement the mitigation measures described in the Common Impacts section (section 3.7. 2) and in accordance with the 404 permit and 401 Water Quality Certificate from USACE and Texas Commission on Environmental Quality. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetland impacts.

Construction of the proposed expansion site would affect the intermittent streams there because the site would be cleared and graded. Runoff associated with clearing and grading would impact water quality temporarily. The intermittent stream could be channelized, altering the aquatic habitat available for amphibians, invertebrates, and small reptiles. If possible, DOE would avoid filling in the two small ponds in the expansion area.

As described in section 2.3, DOE would minimize erosion by using best management practices. An erosion- and sediment-control plan and TPDES stormwater permit issued by Texas Commission on Environmental Quality for construction activities would be secured, which would require use of best management practices that minimize the impact to water bodies.

The habitats present in the proposed Big Hill expansion site have been disturbed previously, and they are not regionally unique habitats. As discussed in section 3.7.2, during construction some wildlife species would be killed or displaced to similar habitat surrounding the proposed expansion site. Though these impacts may affect individual organisms, the construction, operations, and maintenance of the facility would not alter the regional population or species' viability.

The general operations and maintenance of the storage site, including grounds maintenance, lighting, noise, and vehicular traffic in and around the facility, would be similar to activities already taking place at the SPR facility and at other nearby operations. The most common wildlife in the vicinity of the SPR facility already have adjusted to these activities, and they likely would not be disturbed as a result of operations and maintenance at the proposed expansion site. Fencing would exclude large mammals and removing trees would remove bird nesting sites, although some mobile species and birds would probably still visit the site.

Potential operational and maintenance impacts on migratory birds, such as artificial lighting hindering migration, are described in section 3.7.2.

> <u>Mitigation</u>: DOE, in cooperation with USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. DOE would use down-shielding and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife. If this candidate alternative is selected, DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with requirements of the Migratory Bird Treaty Act.

> <u>Mitigation</u>: DOE would implement a plan to control the Chinese tallowtree invasion on the site. DOE would control invasive species by using seed mixes devoid of exotic and invasive species and through postconstruction monitoring of the disturbed areas. If the monitoring detected problems with invasive species, DOE would implement corrective action. DOE would continue to refine the conceptual site plan to avoid and minimize impacts to wetlands to the extent practicable.

***Special Status Species***

The proposed Big Hill expansion site would not affect any federally listed threatened or endangered species, species proposed for listing, candidate species, or designated critical habitat (see appendix H).

Given the disturbed nature of the site and the surrounding industrial activity, it is unlikely the site supports any state-listed species. However, construction activities would permanently remove an area that may be suitable habitat for several species that are listed as threatened by Texas. Populations of

Bachman's sparrow, swallow-tailed kite, white ibis, and wood stork that may use the habitat located at the storage site could find similar areas of potential habitat adjacent to or near the site. Potentially displaced populations of scarlet snake and Rafinesque's big-eared bat could find suitable habitat near the proposed Big Hill expansion site. If this alternative is selected, DOE would conduct a survey or habitat screening for these species and secure a permit from Texas Parks and Wildlife Department for any unavoidable taking of a state-listed species.

The operations and maintenance of the site, including grounds maintenance, lighting, noise, and vehicular traffic in and around the facility, would be similar to activities already taking place at the SPR facility and at other operations in the region. Therefore, there would be no notable change from the existing conditions and no impact to special status species (if any are present).

***Special Status Areas***

No special status areas would be affected by the construction or operation of the proposed Big Hill expansion site.

#### *3.7.10.2.2 Big Hill Rights-of-Ways*

***Plants, Wetlands, and Wildlife***

During construction of the proposed crude oil pipeline, the existing ROW would be expanded and the existing vegetation would be cleared. Refurbishment of the brine disposal pipeline would also require the clearing of vegetation. The construction ROW would affect the following:

- 232 acres (94 hectares) of disturbed or managed habitat,
- 48 acres (19 hectares) of evergreen (pine) forest,
- 3 acres (1 hectare) of sand bar and beach,
- 3 acres (1 hectare) of grassland and scrub-shrub habitat, and
- 1 acre (0.4 hectares) of hardwood forest.

Using the USFWS' National Wetlands Inventory maps and estimated construction footprint, the ROWs would affect the following wetlands:

- 143 acres (58 hectares) of palustrine emergent wetlands,
- 12 acres (5 hectares) of lacustrine wetlands,
- 5 acres (2 hectares) of palustrine scrub-shrub wetlands,
- 5 acres (2 hectares) of palustrine unconsolidated bottom wetlands,
- 3 acres (1 hectare) of palustrine forested wetlands,
- 3 acres (1 hectare) of riverine wetlands, and
- 1 acre (.4 hectares) of other wetlands.

Because the Texas Gap Analysis Program data use different habitat classification categories than the National Wetlands Inventory data, some of the wetland acreage is captured under other land categories (e.g., disturbed or managed habitat and scrub-shrub habitat).

The entire ROW corridor follows existing pipeline corridors that already contain fragmented and disturbed plant communities. Approximately 79 percent of the existing pipeline corridor passes through disturbed or managed habitat that includes agricultural lands and industrial areas. The proposed pipeline/power line corridors would permanently affect about 33 to 40 percent of the acreage described because only a 50-foot (15.2-meter) wide easement per pipeline would be permanently maintained. The vegetation within the construction easement would be cleared, but DOE would regrade to pre-construction contours and reseed with native species within this area to re-establish native habitat.  The area within the permanent easement would be permanently maintained, but some wetland functions would be restored because the area would be regraded to preconstruction conditions and allowed to regenerate to emergent wetlands.  Appendix B provides detailed information about the types of wetlands, and the nature and amount of wetland impact from the permanent and construction easements.  In addition, many of these wetlands would be avoided by directional drilling from the adjacent uplands.

DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in accordance with the Section 404/401 permit conditions, which would compensate for the jurisdictional wetlands that were affected.

The crude oil pipeline to Nederland, TX would be constructed adjacent to existing ROWs and the timeframe for construction at any point on the pipeline would be no more than 6 to 10 weeks.  The species using the existing ROWs are tolerant of disturbances, and they would be displaced temporarily to suitable adjacent habitat.

Refurbishment of the brine disposal pipeline would take place within the existing pipeline corridor. Construction related to removing and replacing the pipeline would temporarily disturb vegetation and displace wildlife in and near the pipeline ROW.  This corridor has already been disturbed, is low to moderate quality for wildlife habitat, and would not affect the regional population or overall species viability.

Section 3.7.2 discusses operations and maintenance activities such as mowing, pipeline inspections, and stump removal.  These activities would be similar to activities already occurring in the existing ROWs. Common wildlife in the vicinity of the pipelines already have adapted to these operations and maintenance activities.  These organisms likely would not change their behavior as a result of the expanded ROWs.  The construction, operations, and maintenance impacts may disrupt individual organisms, but would not alter the regional population or species viability.

> Mitigation:  As presented in chapter 2, DOE would minimize the footprint of the maintained easement, limit the use of trenching across small water bodies, and use directional drilling under larger water bodies (greater than 100 feet [30 meters]) or in areas containing sensitive habitat.  DOE would reseed disturbed areas with native species to promote re-establishment of the impacted plant community.  DOE would conduct postconstruction monitoring of the construction easements to identify problems with erosion, invasive species, or hydrologic changes.  DOE would correct problems that are identified.

***Special Status Species***

The proposed expansion and operations and maintenance of the ROWs would not affect any federally listed threatened or endangered species, species proposed for listing, candidate species or designated critical habitat (see appendix H).

Construction activities along the ROWs temporarily would alter the palustrine emergent wetland habitat and remove small portions of forested habitat that might be used by species listed by Texas as threatened or endangered.  Construction time would be short, between 6 to 8 weeks, along any portion of the ROW. An abundance of suitable habitat would be available adjacent to the affected areas.  The 2.9 acres (1.2 hectares) of forested areas that would be converted along the ROWs could potentially be used by Rafinesque's big-eared bat and scarlet snake.  The construction, operations, and maintenance impacts may disrupt individual organisms, but would not alter the regional population or species viability. If this alternative is selected, DOE would conduct a survey or habitat screening for these species and secure a permit from the TPWD for any unavoidable taking of a state-listed species.

***Special Status Areas***

No special status areas would be affected during construction or due to operations and maintenance. The construction corridor would expand only a short distance outside of the existing pipeline ROW, and it would not overlap with the J.D. Murphee Wildlife Management area or rookeries. At the nearest point, it would be located 0.25 mile (0.4 kilometers) from the management area and 0.7 mile (1.1 kilometers) from a rookery.

### 3.7.11 West Hackberry Expansion Site

This section addresses the following areas:

- The acquisition of three existing caverns and the development of a new access road, installation of security fencing, and creation of security buffer area around the expansion site.

The West Hackberry storage site has most of the infrastructure in place for the operation of additional caverns. Expansion would require only minor upgrades to the RWI, crude oil distribution system, and the brine disposal system, as described in section 2.5.3. The activities listed above would connect the acquired caverns into the SPR storage site. Because the facility upgrades to the RWI structure, crude oil distribution system, and the brine disposal system would not increase the facility footprint or significantly change the current operation, these systems are not analyzed in this section.

#### 3.7.11.1 Affected Environment

##### *3.7.11.1.1 West Hackberry Expansion Storage Site*

***Plants, Wetlands, and Wildlife***

The West Hackberry storage facility is located in Cameron Parish. The existing storage site covers approximately 570 acres (230 hectares) on the West Hackberry salt dome. To expand the West Hackberry SPR site, DOE would purchase 3 existing caverns and 240 acres (97 hectares) of land. DOE would only expand the facility fence line around approximately 53 acres (21 hectares) of the site that contains the existing caverns. This area consists of previously disturbed habitat. An additional 27 acres (11 hectares) of vegetation surrounding the cavern area would be cleared of woody vegetation for a 300-foot (91-meter) security buffer.

The region where the West Hackberry storage facility is located contains numerous canals and natural waterways that bisect the landscape. This region consists of forested and emergent wetlands with natural ridges. These ridges typically support upland forested and herbaceous communities and affect water flow through the marshes (emergent wetlands). In many areas, lakes, bayous, and canals are densely packed so that the marsh may not seem to be a landmass, but rather a large region of small islands. The West Hackberry site was affected by recent hurricanes, but the plant communities were not significantly affected.

There are extensive emergent wetlands and open water areas surrounding the proposed West Hackberry expansion site. The purchased land area and the storage facility are adjacent to Black Lake. Many bird species frequent the area. Other inhabitants include common organisms such as red fox, raccoon, nutria, opossum, and white-tailed deer. The American alligator is common in this area. The emergent wetlands also support a variety of other reptiles, fish, shellfish, and mammals.

***Special Status Species***

A literature review indicated that the following federally listed species may be present within the county where the West Hackberry storage site is located: bald eagle, brown pelican, piping plover, gulf sturgeon, red wolf, and several marine mammals and sea turtles. However, a review of the conditions at West Hackberry and consultations with the USFWS and the Louisiana Department of Fisheries and Wildlife revealed that the portion of the expansion area that would be disturbed does not provide suitable habitat for any federally or state-listed threatened or endangered species, species proposed for listing, or candidate species (see appendices F and I).

***Essential Fish Habitat***

There is no EFH within or near the proposed West Hackberry expansion site.

***Special Status Areas***

The Sabine National Wildlife Refuge is located about 7.0 miles (11 kilometers) south of Hackberry, LA. This refuge consists of a wide range of habitats including fresh-water impoundments, bayous, ponds, lakes, wooded islands, and manmade canals and levees. The American alligator, red-eared slider turtle, mud turtle, and garter snake are found at the refuge and 250 species of birds visit the refuge during the year. The Sabine National Wildlife Refuge also supports mammals such as the otter, mink, muskrat, mink, raccoon, and opossum. No other federal or state special status areas are located near the West Hackberry site.

#### 3.7.11.2 Impacts

##### *3.7.11.2.1 West Hackberry Expansion Storage Site*

***Plants, Wetlands and Wildlife***

The proposed expansion of the facility would affect the following:

- 53 acres (21 hectares) of disturbed or managed land,
- 19 acres (8 hectares) of grassland and scrub/shrub habitat,
- 5 acres (2 hectares ) of emergent wetlands and water, and
- 3 acres (1 hectare) of other land classification categories.

Clearing and grading the grassland and managed fields would affect the previously disturbed plant communities. The disturbance would not affect a regionally unique habitat. These impacts are described in section 3.7.1.2 (Impacts Common to Multiple Sites).

The USFWS National Wetlands Inventory maps identified 5 acres (2 hectares) of palustrine scrub-shrub wetlands that would be cleared for the expansion of the site security buffer. DOE would complete a wetland delineation and secure a jurisdictional determination from USACE (USFWS 2006b). In addition, DOE would refine the conceptual site plan to avoid filling in jurisdictional wetlands and would preserve onsite emergent wetlands to the maximum extent practicable. DOE would submit a permit application under Section 404/401 of the CWA, which would require a comprehensive analysis of the steps taken to avoid, minimize, and compensate for impacts to jurisdictional wetlands. DOE would implement the compensation measures described in the Common Impacts (section 3.7.2) and in accordance with the 404 permit and 401 Water Quality Certificate from USACE and the Louisiana Department of Environmental Quality. Specifically, DOE would preserve, restore, or create wetlands or contribute to a mitigation bank in the region in accordance with the permit to compensate for the jurisdictional wetland impacts.

After the security fencing is constructed, wildlife use of the site would be limited. Some mobile species and birds would probably still visit the site. Noise from construction would be temporary.

The impacts of operations and maintenance activities for SPR facilities, such as increased noise, human disturbance, traffic, and light pollution, are described in the Common Impacts (section 3.7.2). Locally, the operations and maintenance activities associated with the proposed West Hackberry expansion would be comparable to existing activities. The plant communities associated with the proposed expansion have been previously disturbed and are adjacent to an active facility. The wildlife has already adapted to the disturbed areas and the ongoing operations and maintenance activities and would not likely be affected as a result of expansion site operations and maintenance.

> <u>Mitigation</u>: DOE, in cooperation with the USFWS, would mitigate impacts on migratory birds that frequent the facilities during the year. DOE would conduct a survey of raptor nests and secure any necessary permits in accordance with the requirements of the Migratory Bird Treaty Act. DOE would use down-shielding and low-mast lights to minimize the impacts of artificial lighting on migratory birds and other wildlife.
>
> <u>Mitigation</u>: DOE would continue to refine the facility footprint to avoid and minimize wetland impacts.

***Special Status Species***

A review of the conditions at West Hackberry and consultations with the USFWS and the Louisiana Department of Fisheries and Wildlife revealed that the portion of the expansion area that would be disturbed does not provide suitable habitat for any federally or state-listed threatened or endangered species, species proposed for listing, or candidate species (see appendices F and I).

***Essential Fish Habitat***

There is no EFH within or near the proposed West Hackberry expansion site.

***Special Status Areas***

Expansion of the West Hackberry site would have no impacts on special status areas. The nearest protected area, the Sabine National Wildlife Refuge, is located approximately 7 miles (11 kilometers) south of the site and is too distant to be affected by construction or operations and maintenance activities.

### 3.7.12 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site and if the proposed site could be developed by a commercial entity for oil and gas purposes some spill risk to biological resources could exist. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity, which could involve brine spill risk to biological resources. The onshore Clovelly Dome Storage system would continue to operate unchanged as a component of LOOP with the exception of any expansion that LOOP might undertake.

For the portions of the proposed storage site pipelines that follow existing ROWs there would be some risk of a spill and consequent impact on biological resources. The risk of a spill associated with the no-action alternative would be limited to that which exists from the existing pipelines. For the portions of the pipeline in new ROWs the no-action alternative would not present any spill risk to biological resources. For the sites of terminals that are in developed petroleum storage areas it is possible that a commercial entity could develop them for storage and some spill risk to biological resources could occur.

No additional potential impacts to plants, wetlands, wildlife, threatened and endangered species, marine habits, and protected species would be related to the selection of the no-action alternative.

## 3.8 SOCIOECONOMICS

CEQ regulations implementing NEPA state that when economic or social effects and natural or physical environmental effects are interrelated, the EIS will discuss these effects on the human environment (40 CFR 1508.14). The CEQ regulations state that the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." To the extent that the development of a new storage site or expansion of an existing one could affect the natural or physical environment, the socioeconomic analysis evaluates how elements of the human environment such as population, employment, housing, and public services might be affected. The analysis also assesses SPR employment needs and potential sources of those workers.

The organization of section 3.8 is different than most other sections of chapter 3. Section 3.8.1 presents the methodology. Then, instead of discussing the affected environment and potential impacts one site at time, section 3.8.2 summarizes the affected environment for each site. Section 3.8.3 presents a summary of potential construction and operations and maintenance impacts for all potential sites. This organization streamlines the discussion, presenting much of the information in several tables.

### 3.8.1 Methodology

> **In-migration** is the movement of people into a given geographic area.

This analysis of potential socioeconomic impacts characterizes the potentially affected areas in terms of economic activity, employment, income, population, housing, public services, and social conditions. Census, state, and local government data were evaluated to describe the baseline socioeconomic characteristics. This analysis of the SPR expansion identifies the potential economic implications such as new employment and wages, and it evaluates the subsequent effects, including **in-migration**, population changes, demand for housing and public services, and effects on local governments and traffic congestion.

The region of influence for this analysis is the potentially affected area, generally consisting of each new or expansion SPR site area plus the likely sources of workers for each site. These are the areas in which the proposed SPR activities could most influence local economic and social conditions. The socioeconomic assessment methodology recognizes that each of the potential new and expansion SPR storage sites and the associated infrastructure, while generally located in or near rural communities, is relatively close (e.g., 20 to 45 miles [32 to 72 kilometers]) to more populated urban areas. The analysis recognizes the well-established historical interaction of the oil and gas industry, including existing SPR components, with the economic conditions and characteristics of the Gulf Coast region. The population adjacent to oil- and gas-related sites evolves and adjusts in accordance with much larger, systemic relationships and trends, not merely in accordance with individual projects or industries.

The level of socioeconomic impact is largely determined by the magnitude and duration of the economic stimulus, which is primarily employment in the case of potential expansion of the SPR program. DOE has evaluated potential employment needs for each of the potential new and expansion sites. This analysis uses the peak workforce size to estimate the maximum potential socioeconomic effects of each storage site and its associated infrastructure. In all cases, the peak workforce needs would occur during construction. The operations workforce at each of the sites would be approximately 75 to 100 people, while peak construction workforces would range from about 230 to 500 people.

To assess potential changes in population resulting from the peak workforce for each site, DOE assumes that up to 40 percent of construction workers would in-migrate from outside the region of influence into the communities within the region of influence (including nearby urban areas). DOE also assumes that the average family size would be 2 people per in-migrating employee.[1] The other employees are assumed to already reside in the nearby area and commute to the SPR site.[2] SPR program workers have shown a tendency to reside in a number of communities away from the SPR sites and commute fairly long distances to their work locations. For example, workers at the three existing SPR sites that are being considered for expansion within this EIS have the following workforce residency and commuting characteristics as of early 2006:

- Of the 84-employee workforce at Bayou Choctaw, workers lived in 26 different towns, located 5 miles (8 kilometers) to over 50 miles (80 kilometers) from the Bayou Choctaw site.
- Of the 118-employee workforce at Big Hill, workers lived in 28 different towns, located from 5 miles (8 kilometers) to over 50 miles (80 kilometers) from the Big Hill site.
- Of the 123-employee workforce at West Hackberry, workers lived in 17 different towns, located from 5 miles (8 kilometers) to over 50 miles (80 kilometers) from the West Hackberry site.

Residency areas for all three SPR sites include towns of less than 1,000 persons and larger urban areas such as Baton Rouge, LA (for Bayou Choctaw), Beaumont/Port Arthur, TX (for Big Hill), and Lake Charles, LA (for West Hackberry). Based on these data from the existing sites, there is no reason to assume that most in-migrating workers at each new or expanded SPR site would choose to live in the town closest to the site, especially if that town had limited housing opportunities. Furthermore, the data show that many workers are willing to commute more than 50 miles (80 kilometers) to work at existing SPR sites.

The assumptions regarding employee in-migration and average family size provide a reasonable estimate of potential effects from employment and population. Some of the unknown factors affecting the actual number of employees in-migrating and where they will be located include the source and size of the construction contractor chosen for a given project; how local labor market conditions match needed skill categories; and the extent of employee recruiting from the local area. Results and conclusions of this analysis would not substantially change if actual in-migration rates were higher or lower than the assumptions used herein.

A large portion of the region where the new or expanded SPR sites would be located was adversely affected by Hurricanes Katrina and Rita in August and September 2005. The data included in this section reflect conditions before the hurricanes; however, the socioeconomic influence of the hurricanes on each region of influence is briefly described.

While the Gulf Coast region regularly deals with hurricanes, the effects from Hurricanes Katrina and Rita were not typical of the region; they caused devastating adverse socioeconomic effects. For example, economic activity, including employment and wages, was dramatically reduced, at least temporarily, in affected areas. A considerable portion of the existing housing stock was damaged or destroyed by wind and water, most notably in the coastal portions of Mississippi and Louisiana. The ability of local and state governments to provide public services also was reduced, and tax revenues to support these services declined. Many people were temporarily relocated, and the relocation areas such as Baton Rouge, LA incurred substantial socioeconomic effects. It will take many months or years for portions of the region of influences to recover from these effects. While this socioeconomic analysis acknowledges that the

[1] Construction workers may in-migrate into a project area with or without their families. An assumption of two people per household (including the employee) constitutes an average of some employees in-migrating without family members, some in-migrating with their spouse only, and some in-migrating with spouse and children.

[2] This analysis does not distinguish between pre- and post-hurricane residents within each region of influence.

recent hurricanes have altered socioeconomic conditions in the Gulf Coast region, it will take a substantial amount of time to systematically re-characterize baseline conditions. Many questions about the hurricanes' effects on the social and economic environments remain unanswered as the SPR program expansion mandated by EPACT progresses. In addition, further investigation of the effects of the hurricanes would not alter the basic results and conclusions of this analysis because SPR development would constitute a small fraction of economic activity and would cause a small change in population in any affected area.

### 3.8.2 Affected Environments at Storage and Expansion Sites and Associated Infrastructure

This section summarizes baseline socioeconomic conditions in the region of influence for each proposed new site or expansion site. The baseline conditions include the size of local population centers, the distance from the sites and terminals to these areas, and the nature of the local economies. The location of new infrastructure other than storage sites (e.g., terminals and pipelines) is not considered in this analysis because the crews needed to build, operate, and maintain such infrastructure would be relatively small.

Table 3.8.2-1 presents population data for each proposed or expansion site and its **Metropolitan Statistical Areas (MSAs),** counties or parishes, and some of the cities. The first column identifies the site, and the second column of the table shows the nearest MSA. The third column of the table shows neighboring parishes or counties, and the fourth column shows cities or towns in the vicinity of each site. The fifth column shows the driving distance of these jurisdictions to the nearest potential SPR site. The last two columns of the table present populations estimates for the areas listed in previous columns. The table shows that all eight potential new or expansion storage sites are located near major population centers that could serve as substantial sources of labor under typical worker commuting expectations.

> An MSA is an area containing a recognized population nucleus (such as a city) and adjacent communities (sometimes considered suburbs) that have a high degree of integration with that nucleus. One of the major purposes in defining MSAs is to provide a nationally consistent definition for collecting, tabulating, and publishing Federal statistics for a set of geographic areas.

The Bruinsburg site would be located in Claiborne County, MS, which includes the city of Port Gibson, MS. Also nearby are the City of Vicksburg, MS (40 miles or 64 kilometers) and the Jackson MSA (45 miles or 72 kilometers) (see figure 3.8.2-1). Three major economic sectors dominate the labor market in Claiborne County: agriculture (including timber), education, and power generation. Area farmers grow hay, corn, soybeans, cotton, and wheat, but timber is the largest crop. Alcorn State University is a major economic influence with about 700 employees. The Grand Gulf Nuclear Power Plant employs about 750 workers. As one of six Mississippi River system ports in the State of Mississippi, the Claiborne County Port gives area agriculture and industry efficient access to this viable transportation option. Claiborne County has a civilian labor force of approximately 4,000, while the Jackson MSA has more than 250,000 people in the civilian labor force (Mississippi Department of Employment Security 2006). The county had an average annual unemployment rate of almost 10 percent in 2004 (Mississippi Department of Employment Security 2006). The Bruinsburg site was not substantively affected by Hurricanes Katrina or Rita, but Jackson, MS experienced a substantial indirect effect from the in-migration of hurricane victims.

The Chacahoula storage site would be located in northwest Lafourche Parish, LA and close to Terrebonne Parish, LA (see figure 3.8.2-2). It is about 20 miles (32 kilometers) from the city of Houma, LA. These parishes are part of the Houma MSA. The new pipelines for this site also would be located in this socioeconomic region of influence. Lafourche and Terrebonne Parishes have substantial traditional

### Table 3.8.2-1: Population in Jurisdictions near Proposed Storage Sites (persons)

| Proposed Site | Metropolitan Statistical Area | Parish or County | City or Town | Driving Distance to Jurisdiction (miles) | 2000 Population | More Recent Population (year) |
|---|---|---|---|---|---|---|
| Bruinsburg | Jackson, MS MSA | | | 45 miles | 440,801 | 436,503 (2003) |
| | | Claiborne County, MS[a] | | N/A | 11,831 | 11,546 (2004) |
| | | | Port Gibson, MS | 10 miles | 1,840 | 1,748 (2003) |
| | | | Vicksburg, MS | 40 miles | 26,407 | 26,005 (2003) |
| Chacahoula | Houma, LA MSA[a] | | | N/A | 194,477 | 198,680 (2004) |
| | | Lafourche Parish, LA[a] | | N/A | 89,974 | 92,157 (2004) |
| | | Terrebonne Parish, LA | | 19 miles | 104,503 | 106,523 (2004) |
| | | | Houma, LA | 20 miles | 32,393 | 32,025 (2003) |
| Clovelly | Houma, LA MSA[a] | | | N/A | 32,393 | 32,025 (2003) |
| | | Terrebonne Parish, LA | | 37 miles | 104,503 | 106,523 (2004) |
| | | Lafourche Parish, LA[a] | | N/A | 89,974 | 92,157 (2004) |
| | | | Galliano, LA | 5 miles | 7,356 | NA |
| Richton | Hattiesburg, MS MSA[a] | | Hattiesburg, MS | N/A | 113,054 | 128,631 (2003) |
| | | | | 18 miles | 44,789 | 46,664 (2003) |
| | | Perry County, MS[a] | | N/A | 12,138 | 12,236 (2004) |
| | | | Richton, MS | 3 miles | 1,038 | 1,037 (2003) |
| Stratton Ridge | Houston, TX MSA[a] | | | N/A | 1,953,631 | 2,009,690 (2003) |
| | | Brazoria County, TX[a] | | N/A | 241,767 | 271,130 (2004) |
| | | | Lake Jackson, TX | 3 miles | 26,386 | 26,950 (2003) |
| | | | Clute, TX | 3 miles | 10,424 | 10,704 (2003) |
| Bayou Choctaw | Baton Rouge, LA MSA | | | N/A | 602,894 | 722,646 (2003) |
| | | Iberville Parish, LA[a] | | N/A | 33,320 | 32,497 (2004) |
| | | | Plaquemine, LA | 8 miles | 7,064 | 6,894 (2003) |
| Big Hill | Beaumont-Port Arthur, TX MSA[a] | | | N/A | 384,737 | 382,629 (2003) |
| | | Jefferson County, TX[a] | | N/A | 252,051 | 284.223 (2004) |
| | | | Port Arthur, TX | 20 miles | 57,755 | 57,042 (2003) |
| | | | Beaumont, TX | 27 miles | 113,866 | 112,434 (2003) |
| | | | Winnie, TX | 10 miles | 2,914 | N/A |
| West Hackberry | Lake Charles, LA MSA[a] | | | 20 miles | 183,577 | 194,642 (2004) |
| | | Calcasieu Parish, LA[a] | | 36 miles | 183,577 | 184,961 (2004) |
| | | Cameron Parish, LA[a] | | N/A | 9,991 | 9,681 (2004) |
| | | | Hackberry, LA | 4 miles | 1,699 | N/A |

Note: A parish, county, city, or town in the same row as an MSA is within the MSA boundaries. A city or town in the same row as a county or parish is located within that county or parish.

[a] Denotes MSA and parish or county where sites are located

1 mile = 1.609 kilomters; N/A = not available

Source: U.S. Census Bureau 2006, State & County QuickFacts

**Figure 3.8.2-1: MSAs for Mississippi Sites**

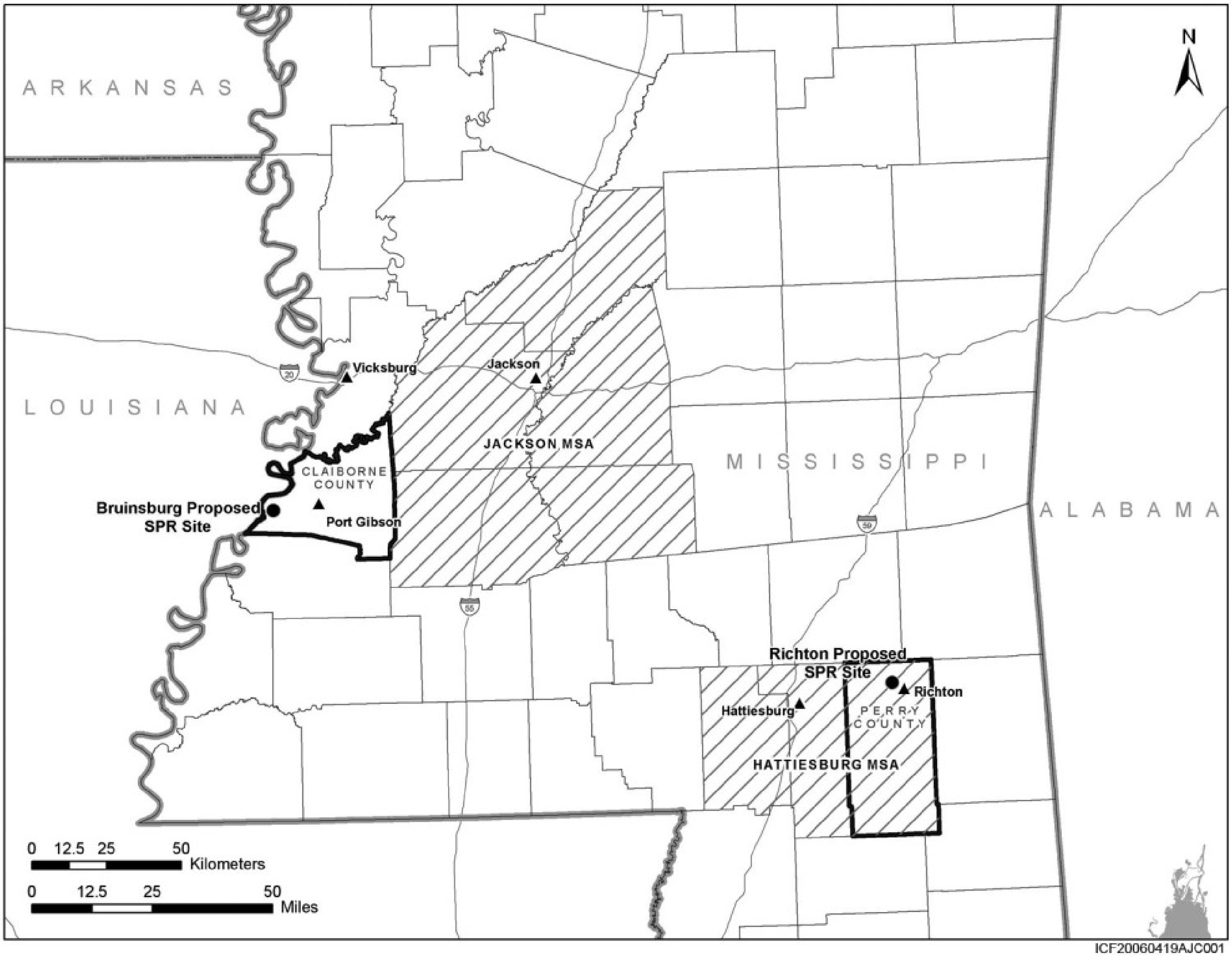
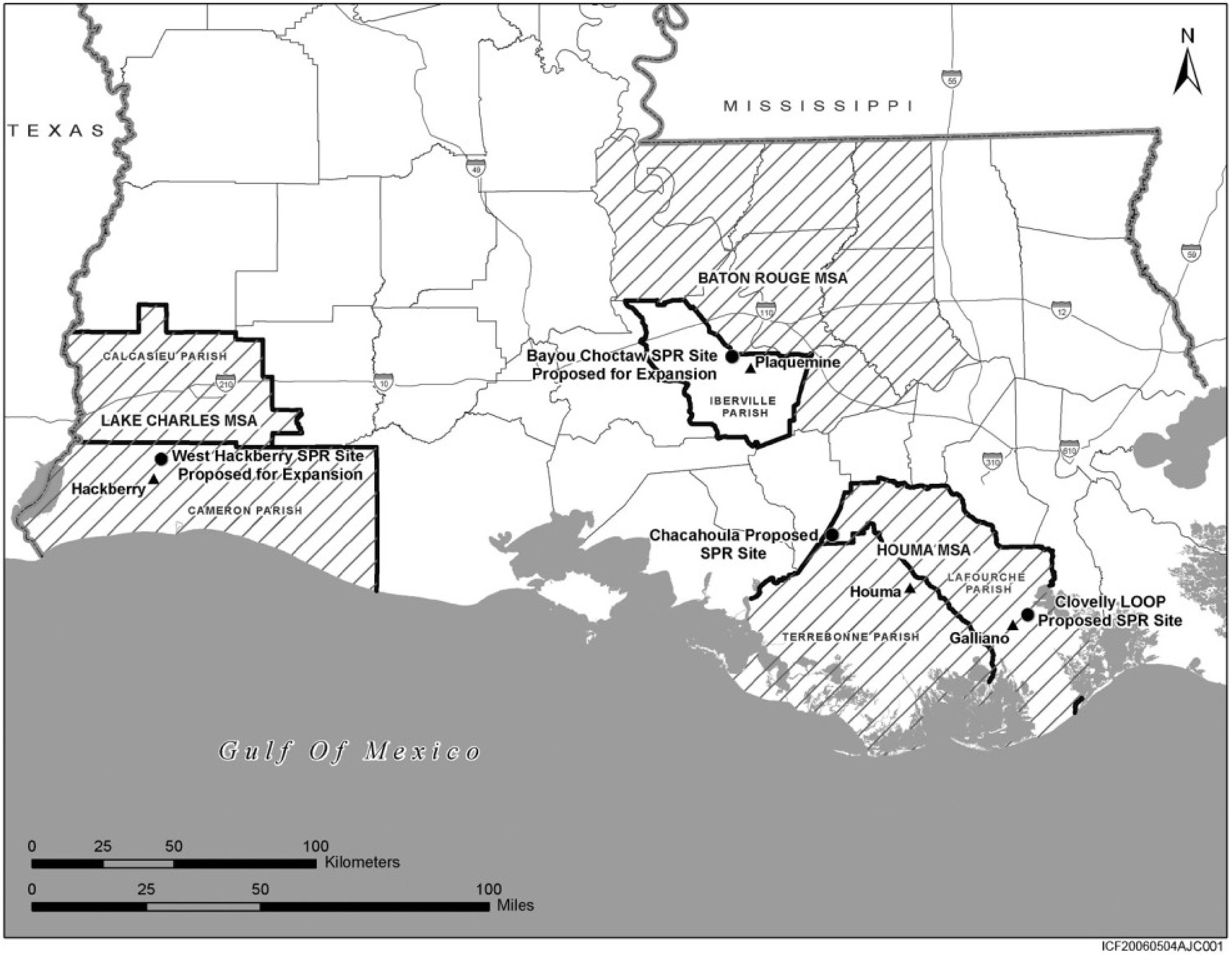


**Figure 3.8.2-2: MSAs for Louisiana Sites**



economic ties to the Gulf of Mexico and the oil and gas industry. They have a combined 100,000-person civilian labor force with an average annual unemployment rate of 3.9 percent in 2003 (Louisiana Department of Labor 2006). The Chacahoula area was in the path of Hurricane Katrina, and there was substantial damage to housing and other buildings and infrastructure in Lafourche Parish. Unemployment in the Houma MSA more than doubled from August to September 2005, but by December 2005 it had returned to pre-hurricane conditions. Hurricane recovery efforts are still underway in Lafourche Parish and its surrounding areas.

The Clovelly site would be located in Lafourche Parish, which is part of the Houma MSA, whose socioeconomic characteristics are summarized above (see figure 3.8.2-2). The site is near a number of small communities along Highway 308. It is about 5 miles from Galliano and about 25 miles (40 kilometers) from the larger city of Houma, LA. Because of the existing infrastructure associated with LOOP facilities, major construction of additional pipelines and facilities would not be needed for SPR operations at Clovelly. The Clovelly area was in the path of Hurricane Katrina, and there was substantial damage to housing and other buildings and infrastructure in Lafourche Parish. Unemployment in the Houma MSA more than doubled from August to September 2005, but by December 2005 it had returned to pre-hurricane conditions. Hurricane recovery efforts are still underway in Lafourche Parish and its surrounding areas.

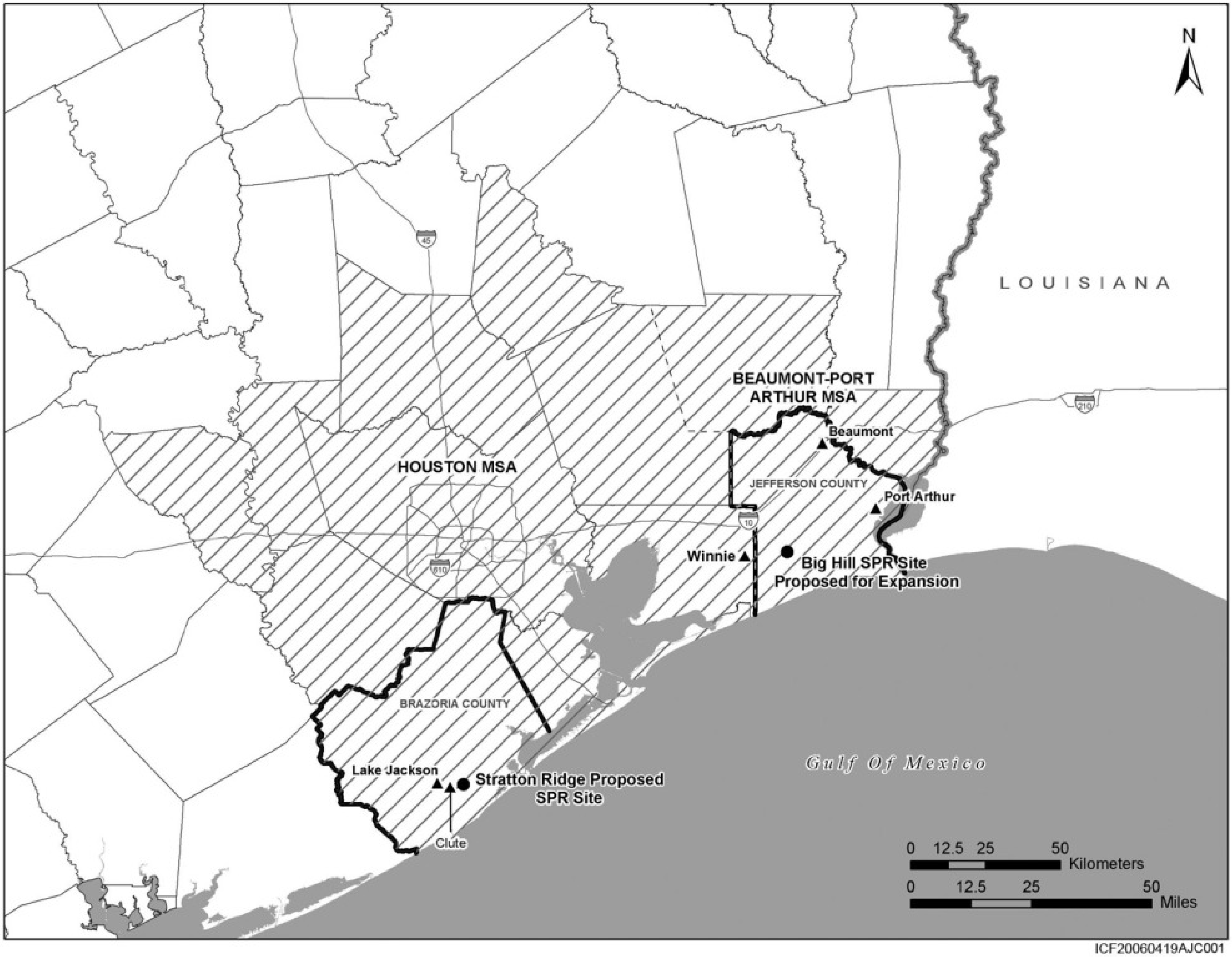
The affected socioeconomic environments for the Clovelly and Bruinsburg sites are summarized above.

The Richton site would be located in Perry County, MS, about 3 miles (4.8 kilometers) from the city of Richton, MS and about 18 miles (29 kilometers) from the City of Hattiesburg, MS (see figure 3.8.2-1). Perry County is in the Hattiesburg MSA. The local economy is driven by wholesale and retail trade, services, manufacturing, and government (including public education). Hattiesburg is the location of the University of Southern Mississippi, with about 12,000 students. The Hattiesburg MSA has a labor force of about 63,000 people and a 5.8 percent unemployment rate as of July 2005 (Mississippi Department of Employment Security 2006). The Richton site and Hattiesburg MSA were in the path of Hurricane Katrina after it made landfall. There was some flooding and wind damage in the area. While the area was disrupted (e.g., there was an approximate 2 percent jump in unemployment from August to September 2005), the effects of the hurricane were largely short-term.

The proposed Stratton Ridge site would be located in Brazoria County, TX, which is part of the Houston MSA (see figure 3.8.2-3). Nearby cities include Lake Jackson, TX (3 miles or 4.8 kilometers), Clute, TX (3 miles or 4.8 kilometers). The new pipeline corridor would be within the socioeconomic region of influence. Major employment and economic activities in Brazoria County center in the petrochemical, manufacturing, trade, services, construction, and agriculture sectors. Oil- and gas-related activity is established in the area, including the Bryan Mound SPR storage facility near Freeport, TX. The area has access to the Gulf of Mexico and the ICW, providing extensive commerce opportunities. Brazoria County has more than 130,000 people in its labor force and a 7 percent unemployment rate as of 2004 (Texas Workforce Commission 2006). The Stratton Ridge area was not substantially affected by Hurricanes Katrina and Rita.

The Bayou Choctaw site is located in Iberville Parish, LA, about 8 miles (13 kilometers) from the town of Plaquemine, LA and about 12 miles (19 kilometers) from the Baton Rouge, LA metropolitan area (see figure 3.8.2-2). Iberville Parish and the Baton Rouge MSA have strong economic and cultural ties to the Mississippi River and the opportunities it presents. The local economy is led by the trade, services, and government sectors, with emphasis on oil- and gas-related activities, such as pipelines and refining. Iberville Parish has more than 12,000 people in its labor force and a 10.4 percent unemployment rate in 2004. The Baton Rouge MSA has more diverse, broader economic activity with its labor force of more

**Figure 3.8.2-3: MSAs for Texas Sites**



than 309,000 people and an unemployment rate of 6.2 percent as of 2004 (Louisiana Department of Labor 2006). While the Baton Rouge area and the Bayou Choctaw expansion SPR site were in the path of Hurricane Katrina after it hit land, the major socioeconomic effect to this region of influence was that the area served as a major center for evacuee relocation from other hurricane-affected areas. Economic and social characteristics were substantially altered following Hurricane Katrina. Unemployment in the Baton Rouge MSA approximately doubled from August to September 2005, but by December 2005, it had returned to pre-hurricane levels. Hurricane recovery efforts are still underway, and the portion of hurricane evacuees who choose to stay in the Baton Route area or other hurricane relocation sites is unknown.

The Big Hill site is located in Jefferson County, TX, about 17 miles (27 kilometers) from Port Arthur, TX in the Beaumont-Port Arthur MSA (see figure 3.8.2-3). The town of Winnie, TX is about 10 miles (16 kilometers) away in Chambers County, TX and Houston is 70 miles (113 kilometers) away. The new pipeline corridor would also be in the region of influence. Jefferson County has both rural and urban characteristics, including two relatively large urban areas (Beaumont and Port Arthur) with deepwater port infrastructure and extensive rural land used for agriculture. The County's major economic drivers include water-related transportation and trade along the ICW and from the Gulf of Mexico, shipbuilding, the petrochemical industry, and government. The Beaumont-Port Arthur MSA has about 180,000 people in its labor force and an 8.4 percent unemployment rate as of 2004 (Texas Workforce Commission 2006). The Big Hill area, including the Beaumont-Port Arthur MSA, was substantially affected by Hurricane Rita physically and socioeconomically. The unemployment rate in Jefferson County increased by 50 percent from September to October 2005, but it had returned to prehurricane conditions by December 2005. Hurricane recovery efforts are still underway.

The West Hackberry expansion site is located in Cameron Parish, LA, about 4 miles (6.4 kilometers) from the town of Hackberry, LA, and about 20 miles (32 kilometers) from the Lake Charles, LA, area in Calcasieu Parish, LA (see figure 3.8.2-2). For this analysis, the region of influence is the Lake Charles MSA, which consists of Calcasieu and Cameron Parishes. The major sectors in the Cameron Parish economy include agriculture, oil and gas transmission, retail trade, and government. Recreation and tourism are also important because of the beaches and water bodies in the area. Lake Charles is connected to the Gulf of Mexico by means of a deep-water ship channel, which provides a substantial source of economic activity. The ICW also runs through the Parish. Cameron Parish has about 3,100 people in its labor force and a 6.4 percent unemployment rate as of 2003 (Louisiana Department of Labor). The labor force in Cameron Parish has shown substantial declines in recent years. The Lake Charles MSA and areas in Cameron Parish were substantially affected physically and socioeconomically by Hurricane Rita. Unemployment in the Lake Charles MSA essentially doubled from September to October 2005, but by December 2005 it had returned to pre-hurricane levels. Hurricane recovery efforts are still underway.

### 3.8.3 Impacts

The major project characteristics affecting socioeconomic conditions would be project-related employment, wages, and expenditures. These characteristics would subsequently affect other socioeconomic variables such as population, housing, public services, taxes, and traffic congestion. As discussed below, the number of employees who would in-migrate into each region of influence is projected to be relatively small; therefore, overall adverse socioeconomic impacts are projected to be small. The effects exerted by previous SPR development at specific sites, which are relatively small-scale, long-term projects, have generally had small socioeconomic impacts in comparison to the larger trends of oil and gas activity within the region (DOE 2004g).

While Hurricanes Katrina and Rita have affected and will continue to affect the socioeconomic environment in coastal areas for some time, the regional supply of labor in the larger urban areas near the potential SPR sites would still produce a substantial level of available labor for the projects by the time construction could begin at any of the proposed new or expansion SPR sites.  In addition, the positive direct economic effects such as employment and wages associated with SPR sites, as well as secondary effects such as local spending, would be beneficial for the individuals within the SPR workforce, affected communities, and local governments that are attempting to recover from the devastating damage inflicted by the two hurricanes.

#### 3.8.3.1 Construction Impacts

Table 3.8.3-1 summarizes the peak project-related employment needs associated with each new or expansion SPR site.  Peak employment would occur during the construction phase.  New construction wages and project spending introduced into the affected counties and MSA economies would serve as a

**Table 3.8.3-1:  Peak Construction Employment by Site**

| Site | Project Component | Peak Construction Employment |
|---|---|---|
| Bruinsburg | Site construction | 368 |
| | Pipeline construction | 86 |
| | Peak construction employment | 474 |
| Chacahoula | Site construction | 363 |
| | Pipeline construction | 82 |
| | Peak construction employment | 445 |
| Clovelly | Site construction | 238 |
| | Pipeline construction | 0 |
| | Peak construction employment | 238 |
| Clovelly-Bruinsburg | Site construction | 501 |
| | Pipeline construction | 47 |
| | Peak construction employment | 548 |
| Richton | Site construction | 363 |
| | Pipeline construction | 136 |
| | Peak construction employment | 499 |
| Stratton Ridge | Site construction | 363 |
| | Pipeline construction | 68 |
| | Peak construction employment | 431 |
| Bayou Choctaw | Site construction | 100 |
| | Pipeline construction | 0 |
| | Peak construction employment | 100 |
| Big Hill | Site construction | 100 |
| | Pipeline construction | 50 |
| | Peak construction employment | 150 |
| West Hackberry | Site construction | 100 |
| | Pipeline construction | 0 |
| | Peak construction employment | 100 |

positive economic stimulus. Average wages associated with the SPR project likely would be higher than existing average wages in the area.

Employment opportunities associated with the construction of SPR facilities at any of the sites would be highly desirable and result in beneficial effects for the residents in the vicinity of the proposed new and expansion sites. For SPR employment, construction workers generally would be willing to commute distances requiring travel time longer than the mean travel time of 20 to 27 minutes (U.S. Census Bureau 2006) typical of the jurisdictions associated with the SPR sites. Some highly skilled positions may lead to employee in-migration; however, the region of influence could provide a substantial portion of the construction workers, and these workers would commute to the SPR site from their existing residences.

Table 3.8.3-2 shows the projected peak population increase resulting from construction activities would be no more than about 400 people for any one site (including work related to pipelines and other infrastructure). This would constitute an increase of a maximum of about 0.3 percent more than existing regional populations including the nearby MSAs. Therefore, for all potential sites, the level of population change resulting from any construction workforce in-migration is expected to be small in the regional context. This small increase in population would not create noticeable charges in traffic congestion, except possibly on rural roads close to sites when work shifts start and end. Depending on a number of factors, individuals within the construction workforce may choose to leave the region of influence after SPR construction ends, thereby potentially reducing the population and the associated demand for housing and public services.

**Table 3.8.3-2: Peak In-Migration Population[a] by Site (Number of People)**

| Site | Peak Construction Employment | Peak Construction In-Migration |
|---|---|---|
| Bruinsburg | 474 | 379 |
| Chacahoula | 445 | 356 |
| Clovelly | 238 | 190 |
| Clovelly (Clovelly-Bruinsburg) | 230 | 184 |
| Bruinsburg (Clovelly-Bruinsburg) | 318 | 254 |
| Stratton Ridge | 431 | 345 |
| Bayou Choctaw | 100 | 80 |
| Big Hill | 150 | 120 |
| West Hackberry | 100 | 80 |

Notes:

[a] In-migration population estimates assume 40 percent employee in-migration plus one additional family member per in-migrating employee. In-migration population would occur in unknown locations throughout study area including rural areas and MSAs, based on factors such as willingness to commute, housing cost and availability, and family lifestyle preferences.

Some regions of influence, especially in Louisiana, are still in an intensive hurricane recovery process. The construction of new or replacement housing, other buildings, and community infrastructure is underway and will continue for several years. The market for skilled construction workers may be competitive in those areas due to hurricane-related recovery efforts. There may be localized labor market abnormalities for some time as construction projects evolve. The locations and magnitude of such abnormalities cannot be predicted at this time. While SPR facility and pipeline construction would add to the construction labor demand in these areas, labor markets will adjust to this demand over a period of time.[3] Furthermore, the effect of SPR construction activities would be very small relative to the overall hurricane recovery effort.

Overall, construction and development of any proposed new SPR site or expansion site and the associated pipelines and other facilities would provide positive economic benefits to an affected region with little change in population. With little population change and support from existing population centers in the area, construction of SPR facilities would have small direct effects on the demand for housing and public infrastructure and services. Overall, the magnitude of adverse socioeconomic impacts from construction activities would be small, and each area that was selected as an SPR site would gain the positive economic benefits of additional employment, income, and local and regional spending.

As appropriate, DOE and its contractors would establish and adhere to local hiring policies and would solicit employees accordingly. A local hiring policy encourages and supports the hiring of the local (existing residents) workforce to reduce the need for employee in-migration and maximizes opportunities for existing residents of the region of influence. Where necessary, DOE and its contractors would support employee in-migration to areas that have adequate public services and housing. These practices would further reduce any negative socioeconomic effects of developing new SPR sites or expanding existing sites.

#### 3.8.3.2 Operations and Maintenance Impacts

Socioeconomic impacts from operations and maintenance would mirror impacts from construction at each site, with the effects smaller in magnitude but longer in duration. Employment opportunities associated with the operations and maintenance of SPR facilities at any of the sites would be highly desirable and provide a substantial economic opportunity for the residents in the regions of influence. Economic benefits from SPR employment, income, and spending would accrue to the workforce, businesses, communities, and local governments.

The SPR program would provide its operations and maintenance workforce with relatively high-paying jobs in all of the regions of influence. With an operating workforce of 75 to 100 employees at each new site and an incremental increase of 25 employees at an expanded site, the operations workforce and associated in-migration into the SPR regions of influence would have negligible subsequent effects on housing demand, public infrastructure and services, and traffic congestion. The ability of affected jurisdictions to provide infrastructure and services would not be affected dramatically by the SPR program, although the economic stimulus from employment and wages would lead to increased tax revenues. Overall, the adverse socioeconomic impacts from operations and maintenance at any proposed SPR site would be small, and any area selected as an SPR site would gain the positive economic benefits of long-term employment, income, and local and regional spending.

### 3.8.4 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would remain unchanged. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain

[3] A basic premise of economic analysis is that the supply of and demand for labor will tend to adjust toward equilibrium. Workers will tend to re-locate to areas where jobs are available, with construction workers especially showing a willingness to be mobile in their employment pursuits. The timeframe for labor market adjustment is variable depending on many case-specific conditions.

undeveloped.  However, existing oil and gas activities occur near the Chacahoula storage site and the proposed site could be developed by a commercial entity for oil and gas purposes.  The Richton site would likely remain in use as a pine plantation because of the lack of development pressure.  Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity.  The onshore Clovelly Dome Storage system would continue to operate unchanged as a component of LOOP with the exception of any expansion that LOOP might undertake.  For the sites of terminals that are in developed petroleum storage areas it is possible that a commercial entity could develop them for storage.

As a result of the no-action alternative the positive short term and more modest long term economic benefits with an estimated increase of about 75 to 100 workers would not occur.

## 3.9 CULTURAL RESOURCES

This section evaluates potential impacts to **historic properties** and other cultural resources. It starts with an overview of the analytical methodology used in this draft EIS (section 3.9.1) and then summarizes the common kinds of impacts and mitigation measures that could be associated with construction and operations and maintenance at any of the candidate sites (section 3.9.2). The site-specific affected environment, potential impacts, and mitigation measures are described for each candidate site separately in sections 3.9.3 through 3.9.11. Finally, the impacts of the no-action alternative are reviewed in section 3.9.12. The chapter is supported by appendix K, which includes all of the consultation letters referenced later.

### 3.9.1 Methodology

DOE's approach for this draft EIS included an initial identification of known historic properties within proposed facility footprints based on record searches and consultations. DOE also has committed to conduct additional research and other actions needed to assess and resolve adverse effects after the SPR expansion sites are selected.

#### 3.9.1.1 Identification of Historic Properties and Other Cultural Resources

DOE informed the State Historic Preservation Officer (SHPO) in each state with proposed SPR sites of DOE's intent to use this NEPA draft EIS to document the activities required under section 106 of the National Historic Preservation Act and its implementing regulations at 36 CFR Part 800. DOE also proposed to the SHPOs that DOE would confine its initial identification effort to known historic properties in proposed facility footprints by using record searches and consultations with American Indian tribes and other interested parties. Under this proposal, DOE and the SHPO of each state would enter into a programmatic agreement to cover additional actions that would be required if a site or sites in the state were selected for development as part of the SPR expansion. The SHPOs agreed with this conceptual approach, and they expressed willingness to work with DOE to develop acceptable programmatic agreements (Holmes 2005, Oaks 2005, Watson 2005).

> As defined in 36 CFR Section 800.16 of the National Historic Preservation Act, "**historic property** means any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meets the National Register criteria."

Under the terms of programmatic agreements with the SHPO in each state, DOE in a Record of Decision has committed to identify and resolve adverse effects to historic properties in locations selected for expansion or new development. At those locations, DOE would conduct field reconnaissance and additional documentary research and consultations as appropriate to identify cultural resources including historic properties; that is, archaeological or historical sites, structures, districts, or landscapes that are eligible for listing in the National Register of Historic Places. For identified historic properties, DOE would assess project effects and resolve adverse effects in consultation with the SHPOs.

Consistent with this approach, DOE conducted record searches and consulted with interested parties to identify known archaeological sites, historic buildings and structures, state and national historic landmarks, and sites listed on the National Register of Historic Places. DOE conducted a record search at the Mississippi Department of Archives and History for the proposed new facility location at Richton and did a cursory review of mapped sites and districts along associated pipelines and ancillary facilities. For the Bruinsburg facility location, in lieu of a record search, DOE obtained information from National Park

Service personnel and the Civil War Sites Historian at the Mississippi Department of Archives and History (the office of the State Historic Preservation Officer). DOE also conducted a record search in the Texas Archeological Sites Atlas for the Stratton Ridge facility and associated pipelines and facilities. DOE did not conduct a record search for the proposed new facility locations in Louisiana (Clovelly and Chacahoula) or proposed expansion facility locations (Bayou Choctaw and West Hackberry). The record searches were not necessary because the Louisiana SHPO, responding to a letter from DOE initiating consultation, stated that no known archaeological sites or historic properties would be affected by the undertaking, based on the information provided by DOE (LeBreaux 2005).

#### 3.9.1.2 Contacts with American Indian Tribes

DOE requested that the SHPOs provide lists of American Indian tribes to consult, as well as other parties who might have concerns or information on historic properties in the proposed project areas. In response to the DOE request, Texas did not identify any tribes; Mississippi and Louisiana SHPOs both identified tribes likely to have information or concerns. DOE included these tribes in its consultation effort, in addition to other parties DOE had previously identified in Louisiana, Mississippi, and Texas as potentially concerned. DOE sent letters to initiate consultation with the following federally recognized tribes that might have information or cultural concerns about places in the area of proposed expansion activities:

- Alabama Coushatta Tribes of Texas,
- Chickasaw Nation of Oklahoma,
- Chitimacha Tribe of Louisiana,
- Choctaw Nation of Oklahoma,
- Coushatta Indian Tribe,
- Jena Band of Choctaw Indians,
- Mississippi Band of Choctaw Indians,
- Quapaw Tribe, and
- Tunica-Biloxi Tribe.

The Tribal Historic Preservation Officer for the Choctaw Nation of Oklahoma requested that the tribe be informed after sites are selected for development and expansion. If the tribe determines that any of the selected alternatives are within areas of concern to the tribe, the tribe will request and review all archaeological survey reports and participate in the assessment of project impacts and the identification of measures to resolve adverse effects (Cole 2005). The Director of the Cultural Department of the Chitimacha Tribe said that records and oral tradition do not indicate specific sites of concern in the project vicinity, although the area is part of the aboriginal Chitimacha homeland. She requested immediate contact with the tribe if archaeological remains representing a village site or burial site are encountered during construction (Walden 2005).

DOE also sent letters to the following tribes recognized by the State of Louisiana to request information about sites of cultural concern:

- Biloxi-Chitimacha Confederation of Muskogees,
- Point au Chien Tribe, and
- United Houma Nation.

#### 3.9.1.3 Assessing Project Effects

As indicated earlier, DOE will not complete the identification of cultural resources, including properties eligible for the National Register of Historic Places (“historic properties”) until after specific sites are selected for development or expansion. Only then would DOE proceed with field survey and additional information gathering for all facility locations and pipeline routes associated with each site, according to the terms of the relevant programmatic agreements. Consequently, DOE will not complete the assessment of potential effects and the identification of ways to resolve adverse effects until after site selection.

To assess effects on historic properties, DOE would follow the regulations at 36 CFR Part 800. As these regulations require, DOE would work in consultation with the appropriate SHPO and any Indian tribe that attaches cultural significance to identified properties. Together they would determine if the project "may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" (36 CFR Section 800.5). If an adverse effect were found, DOE would continue consultation to develop modifications to the project or take other measures that could avoid, minimize, or mitigate the adverse effect. For resources that have cultural significance but that are not eligible for the National Register, DOE would use an analogous approach; that is, consultation with those parties that attach cultural significance to the resource to determine if the project may alter the characteristics of the property that contribute to its cultural significance. If so, DOE would identify measures to avoid or minimize the impact.

### 3.9.2 Common Impacts

This section discusses the possible impacts that could be associated with new construction or operations and maintenance activities. Where available, more detailed information about the nature and scope of project effects on cultural resources is provided in the subsequent sections on each site.

#### 3.9.2.1 Construction Impacts

Following is a list of direct effects on historic properties and other cultural resources that might result from construction at proposed sites or pipelines:

- Damage or destruction of archaeological sites, Native American cultural sites, or historic buildings or structures within the construction zone; and

- A change in the characteristics of a property in or near the construction zone that would diminish qualities that contribute to its historic significance or its cultural importance. This might include visual contrast caused by an access road, noise from construction equipment, rerouting or resurfacing historic roadways, or other construction effects on the location, design, setting, materials, workmanship, feeling, or association of historic properties.

Potential indirect impacts could include vandalism of archaeological sites or historic structures in or near the construction zone because the sites would be more accessible.

#### 3.9.2.2 Operations and Maintenance Impacts

For historic properties and other cultural resources that may be present at a facility site or along a pipeline, direct impacts could include continuing or additional (post construction) damage to archaeological sites or Native American cultural sites. This damage could occur in the facility or along the pipeline or utility corridors by ground-disturbing activities such as road maintenance, vegetation management, or pipeline repair or replacement. Generally such impacts would be less severe than construction affects because they would fall within areas previously disturbed and because the ROWs during operations would be smaller than construction ROWs. The presence of new facilities such as buildings, well pads, or access roads could change the setting or feeling of a location such as an historic plantation, a Civil War campaign site, an historic district in a town or city, or a Native American cultural site in a way that would interfere with its use or diminish qualities that contribute to its cultural or historic significance. Traffic along new access roads likewise could have visual or noise effects on qualities that contribute to the cultural or historic significance of sites in the vicinity. Bridges, houses, or other structures that are significant solely for architectural reasons are unlikely to be affected by operations and maintenance. Potential indirect operations and maintenance impacts could include vandalism of archaeological sites or historic structures near some facilities because the sites would be more accessible.

#### 3.9.2.3 Mitigation

As indicated earlier, DOE will consult with the SHPO and other interested parties to identify measures to resolve adverse effects identified for specific historic properties or other cultural resources, after the SPR expansion sites are selected. Resolution of adverse effects may include measures such as rerouting a pipeline segment or shifting a surface facility footprint to avoid a historic property, thus no longer affecting it. Where avoidance is not possible, measures to mitigate disturbance or destruction of historic properties may include data recovery from an archaeological site or detailed documentation of a building or structure sufficient for the Historic American Buildings Survey or Historic Architectural and Engineering Records. These efforts might be followed with preparation of educational materials written to inform the public about the information gained from archaeological excavations or drawings and photographs of historic structures or other resources. Measures to address visual impacts or other alterations to the setting and feeling of an historic property might include use of vegetation or other methods to screen project facilities from visitors to the historic property. If screening is not possible, the preconstruction setting might be documented with photographs or video, with the resulting materials used to provide public access through interpretive displays or deposition in historical archives.

### 3.9.3 Bruinsburg Storage Site

#### 3.9.3.1 Affected Environment

The floodplain where the Bruinsburg facility would be developed is the site where the Union Army, under General Grant, disembarked after crossing the Mississippi River on April 30, 1863, to begin the invasion of Mississippi that culminated in the surrender of Vicksburg on July 4, 1863 (Winschel 2005). In 1863, the Mississippi River's course followed what is now Bayou Pierre. The Union Army's landing place was at or very close to the historic town of Bruinsburg, which was a riverfront town at that time. The crosshatched area shown on figure 3.9.3-1 approximates the area that was traversed by troops after landing as they prepared for the subsequent march. The cross-hatched area is likely to contain archaeological remains of troop presence. Remains of at least one of the ships that sank during the invasion are likely to lie northwest of the facility boundary. The historic Bruinsburg Road (shown on figure 3.9.3-1 as a double interrupted line) is reportedly still visible on the floodplain and along the route of the climb up the escarpment. After scaling the escarpment, Grant's troops turned south on what is now State Route 552, passed Windsor (now in ruins), and continued south for about 2.5 miles (4 kilometers) before turning east toward Port Gibson, where a major battle was fought (Winschel 1999). The Civil War Sites Historian of the Mississippi Department of Archives and History, who works on the staff of Mississippi's SHPO, considers the site to be "much more than a campsite or march route." He expects that the Bruinsburg landing location and associated march route would be determined to be National Register eligible as a core/study area, that is, a site closely associated with a major engagement. He also noted that the landing site and the approach route along the bluff are closely associated with the inland campaign portion of the Vicksburg Campaign and the Battle of Port Gibson, which is a designated as a National Historic Landmark (Woodrick 2005).

On the escarpment where buildings would be constructed and traversed by the power line and crude oil pipeline to Peetsville are prehistoric earthworks (labeled “Indian Mound” on figure 3.9.3-1). These may be significant to the Choctaw; the Windsor Ruins, a fire-damaged plantation house that is a well-known historical symbol of Mississippi; and a segment of the march route of Grant’s troops, as described earlier.

#### 3.9.3.2 Impacts

On the floodplain, clearing for the security zone, fence installation, construction of the berms and wellheads for the storage caverns in the northern part of the facility, and construction of initial segments of the power line extending north from the facility might affect remains associated with the troop landing or prehistoric sites. Prehistoric sites might be also be affected by construction of the power lines and pipelines (RWI, brine disposal, and crude oil) extending along the floodplain from the southwest. On the escarpment, clearing for the security zone, fence installation, and other construction within the northeastern portion of the facility site, along the access road, and at the power line and crude oil pipeline crossing of State Route 552 could affect remains associated with the historic line of march of the Vicksburg campaign or prehistoric sites. Prehistoric sites might also be affected by construction elsewhere within the facility site on the escarpment, as well as along the power lines and crude oil pipeline corridor. With regard to indirect effects, construction activities on the floodplain would affect the setting and feeling of the troop-landing site. Construction traffic on State Route 552 and upgrading the access road extending from it to the facility might draw the attention of the visitors to the Windsor Ruins, but the ruins are reasonably screened from the road. Construction activities likely would not affect the mapped Indian mound shown on figure 3.9.3-1 because of distance from it. Other construction impacts of the kind described in section 3.9.2.1 would be expected in connection with cultural resources elsewhere along the pipeline routes and power line routes and around the tank farms at Anchorage and Peetsville.

Following construction, the presence of operations and maintenance of the security zone, fence, berms, and access roads on the floodplain would affect the setting and feeling of the portion of the troop-landing site near the escarpment as seen from some viewpoints. Depending upon the viewer’s location, these facilities might or might not be visible. State Route 552 and the graveled road from it descending to the floodplain have been upgraded since the 1860s; therefore, upgrade of the graveled road to provide access to the facility and the crossings of State Route 552 by the pipeline access road and power line would only add to the lack of integrity of the setting of the march route along the escarpment. Because of the distance separating them from project facilities, the setting and feeling of the Indian mound and Windsor Ruins would likely not be affected by the facility buildings, fence, security buffer zone, power line, pipelines, or access road across the escarpment.

#### 3.9.3.3 Mitigation

Several measures could mitigate the effects of altering the setting at the troop-landing site, which is already changed from the original site because the river channel moved west and the town of Bruinsburg was abandoned. The mitigation measures might include improved access for history students to the area by the access road to the new facility, possibly including construction of a viewpoint on the descent of the escarpment. In addition, DOE might offer some financial support to the National Park Service interpretive program. Currently, access is possible only by special permission from the private landowner; interpretive signs are posted only along public roads, not at the actual site. Mitigation of damage or destruction of archaeological remains associated with the landing and troop movements would be avoidance if possible, or data recovery if not. Based on the initial consultation and review of the Bruinsburg area, staff from the Mississippi SHPO recommended avoiding the area altogether (Woodrick 2005). The current conceptual design with most buildings and other surface structures on the escarpment, however, would minimize the effect on the landing area proper.

Other potential effects of construction on cultural resources that might be identified during an investigation following selection of the Bruinsburg site might be mitigated using other measures described in section 3.9.2.3.

### 3.9.4 Chacahoula Storage Site

#### 3.9.4.1 Affected Environment

As noted in section 3.9.1, the Louisiana SHPO indicated that no known archaeological sites or historic properties would be affected by SPR development at any of the proposed Louisiana locations for new storage facilities or expansion (LeBreaux 2005). For proposed pipeline corridors associated with the Chacahoula facility, SHPO staff indicated that any of the areas near major streams and tributaries are high sensitivity areas for both Native American archaeological sites and historic sites such as plantations. Lands near the Gulf of Mexico and the shallow water that would be traversed by the proposed brine pipeline are high-sensitivity areas for Native American archaeological sites because the land has subsided and sites that were near the shoreline are now under water (Watson 2005). It is unlikely that any historic buildings or structures are present in the construction zone at the Chacahoula facility site because so much of the site is submerged and historically has been submerged, although submerged Native American archaeological sites might be present.

#### 3.9.4.2 Impacts

Based on the response from the Louisiana SHPO, no construction or operations and maintenance impacts have been identified at the potential Chacahoula SPR storage facility location or along pipeline routes. Because the proposed pipeline routes cross many areas that are archaeologically and historically sensitive, impacts like those described in section 3.9.2 would likely be identified following survey if the alternative is selected; except that vandalism of any submerged sites would be unlikely because the presence of new facilities or the brine pipeline would not improve access to submerged sites.

#### 3.9.4.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate effects identified in an investigation following the selection of Chacahoula for development, if it is selected.

### 3.9.5 Clovelly Storage Site

#### 3.9.5.1 Affected Environment

As noted in section 3.9.1, the Louisiana SHPO indicated that no known archaeological sites or historic properties would be affected by the undertaking at any of the Louisiana locations proposed for new storage facilities (LeBreaux 2005). It is unlikely that any historic buildings or structures are present in the proposed construction zone above the salt dome because so much of the site is submerged and has been submerged historically, although submerged Native American archaeological sites might be present. The proposed off-dome DOE building area may contain remains of historic structures or archaeological sites.

#### 3.9.5.2 Impacts

Based on the response from the Louisiana SHPO, no construction or operations and maintenance impacts have been identified at the potential Clovelly SPR storage facility site. Construction of new facilities near the salt dome could damage or destroy submerged archaeological sites, if any are present. Vandalism during construction or operations would be unlikely because the presence of new facilities would not improve access to submerged sites. Construction at the proposed off-dome DOE building area could cause impacts like those identified in section 3.9.2.

#### 3.9.5.3 Mitigation

Redesign or data recovery as described in section 3.9.2.3 could be used to mitigate adverse effects identified by an investigation following the selection of Clovelly, if selected.

### 3.9.6 Clovelly and Bruinsburg Storage Sites

#### 3.9.6.1 Affected Environment

Sections 3.9.3.1 and 3.9.5.1 describe the affected environment for the Bruinsburg and Clovelly locations, respectively. The Clovelly-Bruinsburg combination would be different from the individual Bruinsburg and independent Clovelly sites and associated infrastructure in the following ways:

- As illustrated in figure 3.9.6-1, the crude oil pipeline from Bruinsburg to Vicksburg would traverse a smaller portion of the troop-landing area than the crude oil pipeline to Peetsville under the Bruinsburg only alternative.
- The absence of a pipeline to Anchorage under the combination alternative would result in less disturbance of the corridor shared with the RWI and brine disposal pipelines.
- The potential effects in the area of the proposed tank farms in Anchorage and Peetsville would be avoided, but instead there would be potential affects in the area of the proposed tank farm in Jackson,
- The Bruinsburg facility footprint on the floodplain would be slightly smaller in the historically and archaeologically sensitive troop-landing area.
- The Clovelly facility footprint also would be slightly smaller under this alternative.

#### 3.9.6.2 Impacts

On the floodplain at Bruinsburg, clearing the security zone, installing a fence, constructing the berms and wellheads for the storage caverns in the northwestern part of the facility, and constructing the initial segment of the crude oil pipeline to Vicksburg and the power lines in the same corridor might affect remains associated with the troop landing or prehistoric sites. Prehistoric sites might be also be affected by construction of the power lines and pipelines (RWI and brine disposal) extending along the floodplain from the southwest. On the escarpment, clearing for the security zone, fence installation, and other construction within the northeastern portion of the facility site, along the access road, and at the power line crossing of State Route 552 could affect remains associated with the historic line of march of the Vicksburg campaign or prehistoric sites. Prehistoric sites might also be affected by construction elsewhere within the facility site on the escarpment, as well as along the power line corridors. With regard to indirect effects, construction activities on the floodplain would affect the setting and feeling of the troop-landing site. Construction traffic on State Route 552 and upgrading the access road extending from it to the facility might draw the attention of visitors to the Windsor Ruins, but the ruins are reasonably screened from the road. Construction activities likely would not affect the mapped Indian mound shown on figure 3.9.6-1 because of distance from it. Other construction impacts of the kind described in section 3.9.2.1 would be expected in connection with cultural resources elsewhere along the pipeline and power line routes and around the tank farm at Jackson.

Following construction, the presence of operations and maintenance of the security zone, fence, berms, and access roads on the floodplain would affect the setting and feeling of the portion of the troop-landing site near the escarpment as seen from some viewpoints. Depending upon the viewer's location, these facilities might or might not be visible. State Route 552 and the graveled road from it descending to the floodplain have been upgraded since the 1860s; therefore, upgrade of the graveled road to provide access to the facility and the crossing of State Route 552 by the power line would only add to the lack of integrity of the setting of the march route along the escarpment. Because of the distance separating them from project facilities, the setting and feeling of the Indian mound and Windsor Ruins would likely not be affected by the facility buildings, fence, security buffer zone, power line, or access road across the escarpment.

Construction and operations impacts at Clovelly are unlikely, unless some submerged archaeological sites are encountered above the salt dome or sites are encountered at the off-dome DOE building site, as discussed in section 3.9.5.2. The smaller footprint at the Clovelly site would reduce the likelihood for encountering submerged sites to even less than what could be expected if Clovelly were to provide all of the new facility capacity.

Impacts to subsurface archaeological remains might be fewer for the Bruinsburg-Clovelly alternative than for the individual Bruinsburg and Clovelly alternatives because of smaller footprints at both facility locations, but the adverse effect on the visual setting and feeling of the historic troop-landing location would not be noticeably less than the independent Bruinsburg or Clovelly alternative.

#### 3.9.6.3 Mitigation

General mitigation measures described in section 3.9.2.3 could be used, in addition to specific measures for Bruinsburg impacts provided in section 3.9.3.3. As indicated in that section, staff of the Mississippi SHPO recommended avoidance of the Bruinsburg area altogether (Woodrick 2005). The current conceptual design with most buildings and other surface structures on the escarpment, however, would minimize the effect on the landing area proper.

### 3.9.7 Richton Storage Site

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#### 3.9.7.1 Affected Environment

DOE searched archaeological and historic site records at the Historic Preservation Division of the Mississippi Department of Archives and History in October 2005 for a 2-mile (3.2-kilometer) radius around the center of the proposed Richton facility footprint. The search found no sites listed on the National Register of Historic Places nor any national or state historic landmarks in or near the facility footprint. No archaeological surveys were shown within the footprint, and only one survey—a linear survey for utility lines along a road to the east of the site—falls in the 2-mile (3.2-kilometer) radius. Nevertheless, based on reports by a local landowner, a number of sites had been recorded in the vicinity. None has been formally evaluated for National Register eligibility.

There is one recorded archaeological site in the proposed facility footprint. The site record, based on a report from a property owner (who had not visited the site) does not give exact boundaries. The site is a **lithic scatter** with some ceramics in an area that previously was disturbed by logging and replanting activities.

A **lithic scatter** is a distribution of cultural items that consists primarily of lithic (i.e., stone) material. The scatter may include formed tools such as points or knives, or it may contain only chipping debris from tool making activities.

Within a 2-mile (3.2-kilometer) radius from the center of the proposed facility footprint, an additional 15 archaeological sites have been recorded, most discovered by the landowner inspecting the area after logging and replanting activities. Most of those recorded sites are northeast of the proposed facility footprint above Beaver Dam Creek or its tributaries. Most of these sites are reported as lithic scatters with a few ceramic potsherds. In a few cases, possible **midden soil** was noted, in one case up to 2-feet (0.61 meters) deep, at a site that was excavated by a field school from University of Southern Mississippi, according to the site record. In several cases the recorder suggests that a site may be a part of an adjacent site.

**Midden soil** is soil that has been changed by long-term human occupation, and it typically contains bits of charcoal and other organic materials derived from human use. Midden soil is often darker in color and has a looser texture than surrounding soils. Archaeologists consider midden soil as evidence that a site was used for long-term residence or revisited regularly over many years, rather than reflecting short-term activities.

No historic structures are recorded within the facility footprint or the 2-mile (3.2-kilometer) radius.

The results of the record search for the proposed Richton facility location indicate some archaeological sensitivity of the area as well as substantial ground disturbance from forestry activities. These results suggest that a field survey in the footprint would identify a number of archaeological sites, of which some might be so badly damaged that they would be ineligible for the National Register.

DOE conducted a cursory review of site records for the proposed Richton alternative pipeline routes and marine terminal. Two historic houses listed on the National Register of Historic Places are near the pipeline from the Richton facility to Liberty. These are Tall Pines on Memorial Drive in Hattiesburg and the Lea, Wilford Zachariah House on Mississippi Highway 569 North, 2 miles (3.2 kilometers) north of Liberty. There are many National Register-eligible historic districts in larger communities, such as in Hattiesburg, which is near the proposed storage site; in Pascagoula, the location of the proposed terminal; and along the pipeline routes. In these areas, there also are many individually recorded archaeological sites and historic buildings, bridges, and other structures that have not been evaluated for National Register eligibility. These results indicate that the pipeline routes traverse or pass near historically and archaeologically sensitive areas.

#### 3.9.7.2 Impacts

Based on the record search, no specific construction or operations and maintenance impacts can be identified for the proposed Richton site, pipelines, terminal tank form, and pump station. Nevertheless, the results of the record search suggest that impacts such as those described in section 3.9.2 likely would be identified following a field survey if the Richton alternative were selected. Impacts to prehistoric archaeological sites would be expected at the facility location, while impacts to historic structures and historic districts as well as prehistoric archaeological sites could be expected along pipeline routes, the marine terminal in Pascagoula, tank farm in Liberty, and pump station along the pipeline to Liberty.

#### 3.9.7.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

### 3.9.8 Stratton Ridge Storage Site

#### 3.9.8.1 Affected Environment

The Texas SHPO indicated that the Stratton Ridge location has not been surveyed for cultural resources except for a pipeline ROW that parallels the road about 328 feet (100 meters) north of Oyster Creek. The Texas SHPO also noted that one **shell midden** site has been recorded on the south side of Oyster Creek immediately across from the project area, suggesting that other sites might be present on the north side of the creek within the project area (Oaks 2005). The SHPO indicated that the entire area should be surveyed.

DOE conducted a record search of the Texas Archeological Sites Atlas for the proposed facility footprint and a 2-mile (3.2-kilometer) radius. The search identified no sites listed on the National Register of Historic Places nor any national or state historic landmarks. About 10 archaeological sites are recorded within a 2-mile (3.2-kilometer) radius of the center of the facility footprint; none has been formally evaluated for eligibility on the National Register. Most are shell middens or **shell scatters**, some with ceramics. Two sites consist of historic Anglo structure foundations of brick with associated glass, iron, and ceramic fragments. The distribution of the sites suggests that the lower lands within the 2-mile (3.2-kilometers) radius are prehistoric. Lands near Oyster Creek and its tributaries or other surface water, such as Chubb Lake, are more sensitive than the uplands. It also could mean this distribution simply may reflect greater development associated with levees, bridges, and roads in the lower lands. According to the site records, some of the sites have been disturbed by development, while others are in excellent condition. Based on these findings, DOE expects that the pipeline routes also would be archaeologically sensitive in similar low-lying areas near bayous, streams, and coastal wetlands.

> **Shell midden** is a subtype of midden-soil that has been altered by human occupation. Shell midden includes large amounts of fragmented shell mixed with charcoal and other organic materials derived from human use. Archaeologists interpret shell midden sites as the result of long-term residence or regular reuse, where the debris from a shellfish-rich diet has become part of the site. **Shell scatters** are distributions of cultural material that consist primarily of shell fragments. Shell scatters do not contain the visibly and texturally different soil of shell middens, and they are interpreted as the result of short-term use or use for only a single activity (such as shellfish harvesting) rather than residence.

#### 3.9.8.2 Impacts

Based on the record search, DOE is unable to identify specific construction or operations and maintenance impacts for the proposed Stratton Ridge site, tank farm, and pipelines. Nevertheless, the results of the record search suggest that impacts such as those described in section 3.9.2 likely would be identified following a field survey if Stratton Ridge were selected.

#### 3.9.8.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

### 3.9.9 Bayou Choctaw Expansion Site

#### 3.9.9.1 Affected Environment

As noted in section 3.9.1, the Louisiana SHPO indicated that no known archaeological sites or historic properties would be affected by the undertaking at any of the Louisiana locations proposed for new storage facilities or expansion (LeBreaux 2005). DOE reviewed sites listed on the Louisiana State Plan in 1976 in its evaluation of impacts prior to construction of the original Bayou Choctaw facility and identified one Indian village site within 1 mile (1.6 kilometers) of the facility location, a historic plantation within 3 miles (4.8 kilometers), and other plantation and Indian village sites in the surrounding area (DOE 1976). The distribution of the listed sites is consistent with the observation of SHPO staff regarding Chacahoula: Areas around major streams and tributaries are sensitive for Native American archaeological sites and historic plantation sites (see section 3.9.4). The review found one site listed on the National Register, a historic Mississippi River lock more than 4 miles (6.4 kilometers) from the facility location. In the description of preconstruction site conditions, the closest residences identified were 1.6 miles (3.2-kilometers) from the facility, and the review made no mention of existing structures on the facility site, which suggests the absence of any historic plantation remains. The review did note the land use during the past 100 years has been agriculture (DOE 1976).

Because the facility is situated in a geographic setting that is considered archaeologically sensitive, it is expected that Native American archaeological sites might be identified during a survey of areas where ground would be disturbed during expansion. As indicated earlier, there is no suggestion that plantation structures would be found.

#### 3.9.9.2 Impacts

Based on the response from the Louisiana SHPO, no construction or operations and maintenance impacts have been identified at the Bayou Choctaw facility location. Impacts to prehistoric archaeological sites as described in section 3.9.2 might be identified following a field survey if the Bayou Choctaw site is selected. Impacts to historic structures are unlikely.

#### 3.9.9.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

### 3.9.10 Big Hill Expansion Site

#### 3.9.10.1 Affected Environment

The Texas SHPO indicated that the Big Hill facility and expansion area have never been surveyed for cultural resources and that no archaeological sites have been recorded in the vicinity (Oaks 2005). Because the Big Hill landform is unique, the SHPO believes that it may have attracted Native American populations, and that any previously undisturbed areas should be surveyed for archaeological sites. The SHPO also noted that because the SPR facility was not constructed until 1987, none of the buildings associated with it would be old enough to be considered historic properties.

A record search performed by the Texas Archaeological Research Laboratory for the 1992 draft EIS identified no recorded archaeological or historical sites located within the Big Hill salt dome project area that would be affected by the construction of expanded storage capacity at Big Hill (DOE 1992a). The Archaeology Division of the Texas Historical Commission has no record of field reconnaissance within the footprint or the expansion acreage to the north before or since the existing facility was constructed;

thus, the negative findings of the record search are not surprising. Archeology Division staff believes that the presence of archaeological sites on the hill above the floodplain within the Big Hill expansion footprint is likely (Martin 2005).

#### 3.9.10.2 Impacts

Based on the response from the Texas SHPO and an earlier record search, no construction or operations and maintenance impacts can be identified at the Big Hill expansion facility location. Impacts to prehistoric archaeological sites as described in section 3.9.2 might be identified following field survey of the previously undisturbed areas within the facility and along the pipeline ROW as well as of the expansion area to be added to the facility. Impacts to historic structures are unlikely.

#### 3.9.10.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

### 3.9.11 West Hackberry Expansion Site

#### 3.9.11.1 Affected Environment

As noted in section 3.9.1, the Louisiana SHPO indicated that no known archaeological sites or historic properties would be affected by the undertaking at any of the Louisiana locations proposed for new storage facilities or expansion (LeBreaux 2005). For the 1976 EIS for West Hackberry, DOE reviewed National Register listings and requested that the Louisiana SHPO review state registers. No National Register sites were listed for Cameron or Calcasieu Parish and none of three historic markers in Calcasieu Parish was located in the facility area (DOE 1976). It is possible that unrecorded historic structures or prehistoric archaeological sites exist in the security area to be cleared or along the new site access road to be constructed. Around new access roads and well-pad sites within the existing facility, historic structures are unlikely, but prehistoric archaeological sites might be present.

#### 3.9.11.2 Impacts

Based on the response from the Louisiana SHPO, no construction or operations and maintenance impacts have been identified at the West Hackberry facility location. Impacts to prehistoric archaeological sites as described in section 3.9.2 might be identified following field survey. Impacts to historic structures are unlikely, except in the perimeter zone.

#### 3.9.11.3 Mitigation

Measures described in section 3.9.2.3 could be used to mitigate identified effects.

### 3.9.12 No Action Alternative

The No-Action alternative would limit the impacts from SPR construction and operations to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing environments for the proposed new SPR storage site alternatives would be maintained. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. However, existing oil and gas activities occur near the Chacahoula storage site and the proposed site could be developed by a commercial entity for oil and gas purposes. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity.

The onshore Clovelly Dome Storage system would continue to operate unchanged as a component of LOOP with the exception of any expansion that LOOP might undertake. For the sites of terminals that are in developed petroleum storage areas, it is possible that a commercial entity could develop them for further storage.

If DOE selected the No-Action alternative, there would be no additional potential impact of disturbing cultural resources that include archaeological sites, historic sites, or historic visual settings.

## 3.10 NOISE

This section analyzes potential noise impacts. It is organized in two sections: Section 3.10.1 describes the methodology and section 3.10.2 discusses the affected environment and potential impacts. Unlike most other resource sections in chapter 3, this analysis does not include a common impacts section or separate sections for each site's affected environment and impacts. The streamlined organization is appropriate because most information is on the affected environment, namely ambient sound levels, and potential impacts is effectively presented in one table.

### 3.10.1 Methodology

Noise impacts from construction and operations and maintenance of the potential new and expansion SPR facilities are evaluated on the basis of two different but important approaches: (1) comparison of estimated noise level with an absolute noise level standard, and (2) comparison of estimated noise level with the estimated existing ambient noise level.

#### 3.10.1.1 Methodology to Estimate Existing Ambient Noise Levels

No sound monitoring data are currently available for any of the proposed new or expansion SPR sites. In the absence of such data, DOE estimated ambient sound levels based on a U.S. EPA study (EPA 1974) that correlated **Day Night Average Noise Level** as a function of population density. The Day Night Average Noise Level is essentially a 24-hour average noise level with a 10-**decibel**, nighttime-noise penalty to account for peoples' increased sensitivity to noise at night. Day Night Average Noise Levels are measured in A-weighted decibels (dBA), as defined in the adjacent text box. Population density data used in this study are based on U.S. Census data.

> **A-weighted decibels** (dBA) is a measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

Using this approach, DOE estimates ambient noise levels within approximately 1 mile (1.6 kilometers) of the proposed new or expansion SPR sites. The extent to which project construction and operations and maintenance noise levels are greater than ambient noise levels determines how audible project noise levels would be at sensitive receptor locations. The audibility of project-related sound itself does not necessarily constitute an impact, but provides context for potential changes in the acoustic environment. Ambient noise levels were estimated at both existing and proposed SPR sites using population data, thus conservatively ignoring potentially higher existing noise levels from operations at existing sites which would reduce the impact of additional noise from SPR expansion. Ambient noise levels along pipelines and access roads were not estimated since construction noise in those areas would be temporary. Thus, DOE evaluated the noise along pipelines and access roads only by comparing their estimated construction noise to an absolute noise level standard. Power lines will also be installed along pipeline routes, but construction noise associated with this activity is minor compared with pipeline and road construction, so construction noise due to power line installation was not analyzed.

#### 3.10.1.2 Methodology to Estimate Construction Noise

The following construction activities would result in noise:

- Drilling of new cavern entrances;
- Support facility construction;
- Pipeline construction;

- RWI structure construction
- Road construction; and
- Tank farm construction

DOE has measured noise levels for these activities in past SPR studies (DOE 1992), and extrapolated these data to 500 feet (150 meters) as shown in table 3.10-1. These noise levels incorporate the noise levels from trucks used in construction activities. Drilling of shafts and construction of support facilities would occur within the site boundary. Construction of pipelines, terminals, and access roadways would occur largely offsite.

**Table 3.10-1: Estimated Construction Activity Noise Level Contributions at 500 feet (150 meters)**

| Activity | Sound Level, Leq (dBA) |
|---|---|
| Drilling of shafts | 67 |
| Support facility construction | 68 |
| Pipeline construction | 69 |
| Access roadway construction | 68 |

Leq = Level equivalent

Source: DOE 1992

**Level equivalent (Leq)** is the level of noise (in decibels) averaged over a period of time.

DOE estimates noise levels at any distance from these activities by assuming that noise sources are point sources and that noise levels attenuate by 6 decibels as the distance from the noise source doubles. Construction noise levels were estimated at sensitive receptors closest to the construction activities. The construction noise analysis accounts for noise generated onsite, as well as pipeline and road construction noise along the entire length of the corridor.

DOE identified sensitive receptors by reviewing USGS maps. The USGS maps typically use dark rectangles to represent homes. Because of the limited resolution and date of the available maps, DOE assumed that the rectangles could represent other types of structures. Thus, DOE conservatively assumed that every structure identified on the USGS maps could be noise-sensitive, meaning residential, schools, libraries, retirement communities, and nursing homes.

The threshold values for construction noise impacts are generally higher than threshold values for operations and maintenance because construction noise is temporary. While standardized criteria have not been developed for assessing construction noise impacts, the Federal Transit Administration (FTA) has construction noise guidelines that have been applied to a wide variety of construction projects (FTA 1995). These guidelines are shown in table 3.10-2.

**Table 3.10-2: FTA Construction Noise Guidelines**

| Land Use | 8-hour Leq (dBA) | | 30-day Average DNL or Leq (dBA) |
|---|---|---|---|
| | Day | Night | |
| Residential | 80 | 70 | DNL = 75[a] |
| Commercial | 85 | 85 | Leq = 80[b] |
| Industrial | 90 | 90 | Leq = 85[b] |

Notes:

[a] In urban areas with very high ambient noise levels (DNL > 65 dBA), DNL from construction projects should not exceed existing ambient + 10 decibels

[b] 24-hour Leq is used, not DNL, since people do not sleep at commercial and industrial locations

DNL = day night average noise level; dBA = A-weighted decibels; Leq = level equivalent

Source: FTA 1995

#### 3.10.1.3 Methodology to Estimate Operations and Maintenance Noise

During operations and maintenance, noise sources would consist of the brine disposal pump pad, well pad, and the RWI pad. Based on noise measurements from previous SPR studies (DOE 1992), noise levels from the brine disposal pad and well pad would be about 60 A-weighted decibels at 500 feet (150 meters) from the source and 57 dBA at 500 feet (150 meters) from the raw water intake. These data can be used to estimate noise levels at any distance, assuming point source propagation. Noise levels were estimated at sensitive receptors closest to the operations and maintenance activities. Sensitive receptors were identified by reviewing USGS maps.

Estimated operations and maintenance noise levels were compared with the criteria of the Department of Housing and Urban Development (HUD), as shown in table 3.10-3 (HUD 2002). As shown in this table, 65 dBA Day Night Average Noise Level is the dividing line between acceptable and unacceptable noise levels for residential locations. This standard is widely accepted by state and Federal agencies and has been adopted in several other standards.

**Table 3.10-3: HUD Land Use Compatibility Guidelines for Noise**

| Land Use Category | Sound Pressure Level (DNL, dBA) | | | |
|---|---|---|---|---|
| | Clearly Acceptable | Normally Acceptable | Normally Unacceptable | Clearly Unacceptable |
| Residential | <60 | 60–65 | 65–75 | >75 |
| Livestock farming | <60 | 60–75 | 75–80 | >80 |
| Office buildings | <65 | 65–75 | 75–80 | >80 |
| Wholesale, industrial, manufacturing and utilities | <70 | 70–80 | 80–85 | >85 |

Notes:

DNL = day night average noise level; dBA = A-weighted decibels

### 3.10.2 Impact Analysis

Table 3-10-4 also presents data for all eight proposed new and expansion sites on the following:

- The estimated noise resulting from onsite storage facility construction, offsite pipeline and road construction, and raw water intake.
- The estimated noise resulting from operations and maintenance noise from the storage facility. Data on estimated operations at maintenance noise at the raw water intake structure is presented in the text.
- Whether the estimated noise levels would be audible, would exceed the applicable guidelines of the FTA or the HUD guidelines, and would create potential impacts.

#### 3.10.2.1 Construction Impacts

The construction noise analysis for each storage site is divided into two categories of noise-generating activities: (1) shaft drilling and support facility construction and (2) pipeline and access roadway construction. For each of these categories, the table presents the approximate distance of these activities to the closest sensitive receptor.

Noise levels are presented in terms of both Level equivalent and Day Night Average Noise Level, with the latter metric based upon the assumption that construction activities would take place only during the day. Comparing the projected level to the existing ambient level indicates whether the construction noise would be audible at certain locations. For example, at Chacahoula, the Day Night Average Noise Level for shaft drilling and support facility construction is estimated at 49, which is substantially greater than the estimated existing ambient noise level of 39. Therefore, construction noise would likely be audible in certain locations near this site.

The Bruinsburg, Bayou Choctaw, Big Hill, Richton, and West Hackberry storage sites also have estimated construction noise levels substantially above the existing ambient levels, indicating that construction noise would likely be audible at certain locations. At the Clovelly site, the noise levels are equal to the existing ambient noise level of 37 Day Night Average Noise Level, so the audibility of construction noise would be limited to just a few locations. Similarly, at the Stratton Ridge site, construction noise levels are only somewhat higher than the estimated ambient noise level, so construction noise may be barely audible at certain locations. All of the sites have noise levels lower than the FTA guidelines, as presented in table 3.10-2.

For the pipeline and roads, the estimated noise levels at the nearest sensitive receptors would be below FTA guidelines; and therefore, there would be no significant noise impacts would occur and mitigation would not be necessary.

Tank farms with significant new construction would be located in Peetsville, MS; Anchorage, LA; Jackson, MS; Liberty Station, MS; Pascagoula, MS; and Texas City, TX. Construction activities at these locations are sufficiently far from sensitive receptors such that construction noise levels would be less than the values shown in table 3.10-2, and therefore no significant construction noise impacts would be expected.

**Table 3-10.4: Site-Specific Noise Analysis**

| | | Bruinsburg | Chacahoula | Clovelly | Richton | Stratton Ridge | Bayou Choctaw | Big Hill | West Hackberry |
|---|---|---|---|---|---|---|---|---|---|
| Existing ambient noise | Population density (persons/mile$^2$) | 57 | 47 | 32 | 31 | 33 | 30 | 3 | 8 |
| | Estimated ambient noise level (DNL) | 40 | 39 | 37 | 37 | 37 | 37 | 27 | 31 |
| Construction noise | **From storage site** | | | | | | | | |
| | Distance to closest receptors (feet) | 6,230 | 3,570 | 13,770 | 4,490 | 10,720 | 3,990 | 2,130 | 2,650 |
| | Noise level (dBA, Leq) | 46 | 51 | 39 | 49 | 41 | 50 | 55 | 54 |
| | Noise level (dBA, DNL) | 44 | 49 | 37 | 47 | 39 | 48 | 53 | 52 |
| | Audible construction noise? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | Higher than FTA guidelines? | No | No | No | No | No | No | No | No |
| | Construction noise impacts? | No | No | No | No | No | No | No | No |
| | **From pipeline, power line, and road construction**[a] | | | | | | | | |
| | Distance to closest receptors (feet) | 390 | 2,710 | 11,120 | 240 | 9,810 | NA | 210 | N/A |
| | Noise level (dBA, Leq) | 71 | 54 | 42 | 75 | 43 | NA | 76 | N/A |
| | Noise level (dBA, DNL) | 69 | 52 | 40 | 73 | 41 | NA | 74 | N/A |
| | Higher than FTA guidelines? | No | No | No | No | No | NA | No | N/A |
| | Construction noise impacts? | No | No | No | No | No | NA | No | N/A |
| Operations and maintenance noise for storage site | Distance to closest receptors (feet) | 6,230 | 3,570 | 13,770 | 4,490 | 10,720 | 3,990 | 2,130 | 2,650 |
| | Noise level (dBA, Leq) | 38 | 43 | N/A | 41 | N/A | N/A | N/A | N/A |
| | Noise level (dBA, DNL) | 36 | 41 | 29 | 39 | 31 | 40 | 45 | 44 |
| | Audible O&M noise? | No | Yes | No | Yes | No | Yes | Yes | Yes |
| | Higher than HUD guidelines? | No | No | No | No | No | No | No | No |
| | O&M noise impacts? | No | No | No | No | No | No | No | No |

Notes:

[a] Audibility of noise from pipeline, power line, and road construction was not estimated.

dBA = A-weighted decibels; DNL = day night average noise level; Leq = Level equivalent; N/A = not applicable; O&M = operations and maintenance; mile$^2$ = 2.59 kilometers$^2$; feet = 0.3048 meters

#### 3.10.2.2 Operations and Maintenance Impacts

The estimated operations and maintenance noise analysis includes data for the distance of the closest sensitive receptors from the following sources of noise: brine disposal pump pad, well pad, and RWI pad. The resulting noise levels are presented in terms of A-weighted and Day Night Average Noise Level, with the latter measurement based upon the assumption that operations and maintenance activities will take place only during the daytime hours. As with estimated construction noise, the operations noise levels are compared with the existing ambient levels to determine whether noise will be audible at the receptor distance. If one were to precisely calculate operational noise levels, estimated noise levels would be logarithmically added to ambient noise levels. This extra calculation is unnecessary in determining whether or not operations would be audible. Audibility can be determined by comparing estimated noise level to the ambient noise level.

At the Clovelly, Bruinsburg, and Stratton Ridge storage sites, the operations and maintenance noise level would be lower than the existing ambient levels, so noise sources would not likely be audible at nearby receptors. At the Chacahoula, Richton, and Bayou Choctaw sites, the operations and maintenance levels would be slightly greater than the estimated ambient noise level, so noise sources might be barely audible at certain nearby receptors. At the Big Hill and West Hackberry sites, the operations and maintenance levels would be substantially higher than the estimated ambient noise levels, so noise sources would be audible at nearby receptors. Estimated operations and maintenance noise levels at all sites, however, would be lower than the HUD Land Use Compatibility Guidelines (as presented in table 3.10-3), so no significant noise impacts associated with operations and maintenance would occur, and mitigation would be unnecessary.

Sensitive receptors do not appear to be near the raw water intake at the proposed sites except for Stratton Ridge where, based on aerial photographs, receptors are as close as 1,640 feet (500 meters). At that distance, raw water intake noise would be approximately 45 DNL, which is greater than the estimated ambient level (36 DNL) at this location. Consequently, raw water intake noise would be audible at these receptors, but would not constitute a significant impact since the noise level would be substantially lower than the HUD guidelines. A wildlife sanctuary is also in the vicinity of the raw water intake, and some wildlife noise impacts might occur depending on the exact proximity to the raw water intake. The raw water intake would be located just across the ICW from the sanctuary. See section 3.7.8 for a discussion of the potential impact of the noise on the wildlife in the sanctuary.

Both construction and operation and maintenance would cause only minor noise impacts based on the location of the nearest of residences and other sensitive receptors around the proposed new and expansion sites, past experience with the construction and operations and maintenance of existing SPR sites, and the results of this noise analysis.

## 3.11 ENVIRONMENTAL JUSTICE

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (EPA 1999). Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, tasks "each Federal agency [to] make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high adverse human health and environmental effects of its programs, policies, and activities on minority populations and low-income populations." Federal agencies must provide minority and low-income communities with access to information on matters relating to human health or the environment and opportunities for input in the NEPA process, including input on potential effects and mitigation measures. The environmental justice analysis is described in this section. Demographic information supporting the analysis is presented in appendix J.

### 3.11.1 Methodology

CEQ oversees the Federal government's compliance with Executive Order 12898 and the NEPA process. CEQ has prepared guidance to assist Federal agencies with their NEPA procedures to ensure that agencies identify and consider environmental justice concerns (CEQ 1997). Based on CEQ and DOE guidance (DOE 2004f), this draft EIS uses a three-step methodology to evaluate potential environmental justice impacts:

- Step 1: Identify the potential environmental justice populations that are located in the project area or could otherwise be affected by the proposed action. Environmental justice populations are minority groups and low-income populations.

    - CEQ defines the following groups as minorities: Black/African American, Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, and Hispanic populations (regardless of race). According to CEQ, a minority population exists where either: (a) the minority population of the affected area exceeds 50 percent; or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In addition to the 50 percent threshold, DOE used both the United States and the state in which a city, town, or country/parish is located as the "general population." In other words, a population is minority if its percentage is either greater than 50 percent or greater than the percentage in the United States or its state.

    - CEQ defines low-income by using the annual statistical poverty thresholds from the U.S. Census Bureau. A low-income community exists when the low-income population percentage in the area of interest is "meaningfully greater" than the low-income population in the general population. For purposes of the analysis of low-income communities, DOE used both the United States and the state in which a city, town, or county/parish is located as the "general population." In other words, a population is low-income if its percentage of low-income residents is greater than the percentage in the United States, its state, or both. In addition, DOE used the population below the poverty level to define low-income population.

- Step 2: Identify the potential human health and environmental effects of the proposed alternatives.

- Step 3: Assess whether there are any potential significant adverse effects to minority and low-income populations that would be disproportionately high and adverse, that is, would appreciably exceed impacts to the general population or other appropriate comparison group. This assessment also considers whether minority and low-income populations would be affected by an alternative in different ways than the general population, such as through unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources.

For step 1, DOE identified potential environmental justice populations for each proposed new and expansion site (see appendix J for more details). For each proposed site, DOE collected demographic data for the areas where the proposed storage site support facilities, RWI, pipelines, and oil distribution facilities would be located. DOE identified all counties or parishes in which the proposed project was located, and cities and towns of a population greater than 1,000 close to the proposed project. Towns with a population of less than 1,000 people were not included because of the large number of very small towns in rural areas near the project sites. The county or parish data cover these small towns. For the storage sites, DOE identified cities and towns within 5 miles (8 kilometers) of the site. For pipelines and other infrastructure, DOE identified cities and towns within 2 miles (3.2 kilometers) of the proposed infrastructure. DOE used a shorter distance for the pipelines and other infrastructure than for the storage sites because the potential impacts of the infrastructure generally would be smaller and more localized than for the storage sites. DOE supplemented these data with U.S. Census block information in a few instances where there are no nearby cities and towns of a population greater than 1,000. Finally, DOE compared demographic data on minority and low-income populations in these areas to similar state and national data to identify potential environmental justice communities.

The demographic data used in this analysis predate Hurricanes Katrina and Rita, which may have had systematic demographic effects on many of the potentially affected areas. DOE could not avoid this limitation because detailed post-hurricane data were not yet available. This limitation does not affect the conclusions of the environmental justice analysis because DOE finds no potential high and adverse impacts (see section 3.11.3).

### 3.11.2 Affected Environment

Table 3.11-1 identifies the minority and low-income populations associated with each proposed site and its associated infrastructure. A check mark in the table indicates that one or more jurisdictions or Census tracts in the potentially affected area for the proposed site may have an environmental justice community. Detailed information on the populations in each relevant jurisdiction for each proposed site is presented in appendix J.

As shown in table 3.11-1, each proposed site has at least two potential environmental justice communities. For example, low-income communities and Black or African American communities, as defined by CEQ, are located in the potentially affected areas for each site.

### 3.11.3 Impacts

Sections 3.2 through 3.10 describe the potential health and environmental impacts to resource areas. Based on that analysis and further consideration of whether minority and low-income populations would have different ways than the general population of being affected by an alternative (e.g., unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources), the discussion below indicates that no environmental justice population would incur disproportionately high and adverse impacts in any resource category.

**Table 3.11-1: Potential Environmental Justice Populations**

| Proposed Site | Potentially Affected States | Overall Minority | Black or African American | American Indian or Alaska Native | Asian | Native Hawaiian or Other Pacific Islander | Hispanic or Latino Origin | Low Income |
|---|---|---|---|---|---|---|---|---|
| Bruinsburg | Louisiana & Mississippi | ✓ | ✓ | | ✓ | | | ✓ |
| Chacahoula | Louisiana | ✓ | ✓ | ✓ | | | | ✓ |
| Clovelly | Louisiana | | ✓ | ✓ | ✓ | | | ✓ |
| Clovelly-Bruinsburg | Louisiana & Mississippi | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| Richton | Mississippi | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Stratton Ridge | Texas | ✓ | ✓ | ✓ | | | ✓ | ✓ |
| Bayou Choctaw | Louisiana | ✓ | ✓ | | | | | ✓ |
| Big Hill | Texas | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |
| West Hackberry | Louisiana | | ✓ | | | | | ✓ |

**Environmental Risks and Occupational Health and Safety:** Based on SPR projections presented in section 3.2, the probability of a spill of brine, crude oil, or hazardous materials would be low. While some spills are likely to occur, they generally would be small, contained, and quickly cleaned up without causing significant or long-term impacts. Based on historical data, any fires would result in minor injuries and no environmental impacts or long-term impacts to SPR site operations. the risks to occupational safety would be small, generally lower than for comparable types of facilities. Overall the impacts would be small and minority and low-income populations would likely be affected in the same way as the general population.

- Land use conflicts: The proposed sites and their infrastructure generally would not conflict with existing land uses, largely because the storage facilities and associated infrastructure would be located primarily in undeveloped, rural areas away from existing land uses. While pipelines would cross land used for agricultural and recreational purposes, the impacts would be temporary because the pipelines would be buried and, following construction, prior uses of the land could continue. Where project infrastructure would be in developed areas, conflicts would not occur because the pipelines would be underground and other new infrastructure would not conflict with existing land uses. Potential land use conflicts, however, would arise where proposed pipelines:

    - For the Bruinsburg alternative would cross the Natchez Trace National Scenic Trail, the Natchez Trace Parkway, and the proclamation area for the Homochitto National Forest,
    - For the Clovelly-Bruinsburg alternative would cross the Natchez Trace National Scenic Trail, the Natchez Trace Parkway,
    - For the Richton alternative would cross the Percy Quinn State Park; and
    - For the Stratton Ridge alternative would cross the Brazoria Wildlife Refuge.

    In these instances, the impacts to minority and low-income communities would not appreciably exceed the impacts to the general population and would not be affected in different ways than the general population.

- Visual resource impacts: Throughout the region of influence for the proposed SPR development, storage facilities, pipelines, power lines, and industrial facilities are common. Many viewers of the proposed project would be familiar with the purpose and use of SPR facilities, pipelines, and power lines and tolerant of the visual changes. Viewers would be more sensitive to visual contrasts on lands with special designations that pipelines would cross, as noted above, which may be visited more often and serve a greater aesthetic or uniquely scenic purpose. In those situations, the visual impacts would not be significant, because, the amount of land area involved is small, pipelines would be underground, and the ROWs would be managed to minimize visual contrast with adjacent vegetation. In addition, minority and low-income communities would not be affected in different ways than the general population by visual resource impacts.

- Farmlands: The construction of some proposed SPR facilities would make prime farmland unavailable for agricultural purposes. Based on DOE's consultation with the USDA's NRCS, the conversion of farmlands to non-agricultural uses would not be significant, based on the amount, condition, and location of the land to be converted. Also, minority and low-income communities would not be affected in different ways than the general population by the conversion of farmland to other uses.

- Coastal zone: DOE will coordinate its required Coastal Determination processes with both the applicable state agencies and with the U.S. Army Corps of Engineers, which will have a CWA Section 404 permitting responsibilities. The applicable state agencies in Texas, Louisiana, and Mississippi often use joint review processes with the U.S. Corps of Engineers on permit applications affected lands within the designated coastal zone. DOE has determined that any potential impacts to human health and the environment in coastal zone areas would not be significant to environmental justice communities. The only significant potential impacts may be to wetlands in coastal zones, which are discussed below under biological resources Also, minority and low-income communities would not be affected in different ways than the general population by coastal zone impacts.

**Geology and Soils:** The potential subsidence at new SPR caverns would be only a few feet on the salt domes and any resulting environmental impacts would be small. The development of SPR caverns also would not affect other uses of the salt dome. Overall, geological and soil impacts would be small and minority and low-income communities would not be affected in different ways than the general population.

**Air Quality:** As discussed in section 3.5, the proposed action would not cause any significant air quality impacts. At all of the candidate sites, modeling indicates that airborne emissions from construction activities, even under a set of conservative assumptions, would not result in a local exceedance of the NAAQS for particulate matter, $NO_x$, CO, and ozone. Modeling and historical operating data from existing SPR sites also show that emissions from the proposed operation and maintenance activities would not result in a level of air pollution that exceeds the NAAQS. EPA has established the NAAQS taking into account evidence of potential risks to sensitive populations, such as children, the elderly, and individuals with respiratory and cardiovascular disease. EPA also periodically reviews and revises the NAAQS based on the best available evidence related to potential health effects, including health effects in sensitive, minority, and disadvantaged groups. Therefore, compliance with the NAAQS provides a high degree of assurance that public health–including among minority and low-income populations–would be protected. Thus, minority and low-income communities would not be affected in different ways than the general population.

**Water Resources:** The proposed project would increase salinity from brine disposal in the Gulf Coast, temporarily increase turbidity and suspended nutrients and organic matter during construction, and would decrease water flows during the operation of the RWI facility. None of these and other potential water resource impacts, however, would be significant. Neither surface water nor groundwater would be contaminated with pollutants that would create special pathways of concern or harm human health. The availability of groundwater and surface water resources also would not be significantly affected. Also, minority and low-income communities would not be affected in different ways than the general population by water resource impacts.

**Biological Resources:** The proposed action would have significant impacts on wetlands, endangered species, and, for the Richton site, fish populations due to the withdrawal of water from the Leaf River. Minority and low-income communities would not incur appreciably higher impacts than the general public and they would not be affected in different ways than the general population.

- No biological resources would be contaminated with pollutants that would create risks to human health (excluding spills, which are discussed above). Thus, unique exposure pathways or rates of exposure to pollutants would not be a concern.

- Little if any subsistence fishing, hunting, or gathering of plants occurs at the proposed storage sites or nearby. In addition, the proposed sites either have limited access or are surrounded by similar habitat that might be available for subsistence activities.

- While subsistence activities may occur along the associated infrastructure, such as pipeline or power line ROWs, the impacts of the infrastructure would be small. The ROWs are narrow; similar activities could be pursued nearby; and most construction impacts are short term.

- While the withdrawal of water from the Leaf River might reduce the fish populations, no substantial subsistence fishing occurs in that river (Beiser 2006).

**Socioeconomics:** The project would have positive effects on local employment, wages, expenditures, and tax revenue. Any effects from in-migration, the associated increased demand on housing and public services, and increased traffic would be minor. Also, minority and low-income communities would not be affected in different ways than the general population.

**Cultural Resources:** DOE will not complete the identification of cultural resources until after DOE selects a proposed alternative. Only then would DOE proceed with field survey and additional information gathering for all facility locations and pipeline routes associated with each site, according to the terms of the relevant programmatic agreements. Consequently, DOE will not complete the assessment of potential effects and the identification of ways to resolve any adverse effects until after site selection. Thus, DOE lacks information on the potential cultural impacts to minority and low-income populations. But if any impacts would occur, DOE would consider mitigation measures.

**Noise:** Construction activities would cause, at most, only minor, short-term noise impacts because the proposed facilities are generally located in rural areas with few nearby residences and other sensitive receptors. SPR operations and maintenance noise impacts also would be low. In addition, minority and low-income communities would not be affected in different ways than the general population.

### 3.11.4 No-Action Alternative

The no-action alternative would limit the impacts from SPR construction and operation to those that have already occurred or that will occur at the existing SPR storage sites at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. The existing conditions at the proposed new SPR storage site alternatives would remain unchanged. The Bruinsburg storage site would likely remain in agricultural use because of the lack of development pressure. The Chacahoula storage site could remain undeveloped. Since oil and gas activities occur near the Chacahoula storage site, the proposed site could be developed by a commercial entity for oil and gas production. The Richton site would likely remain in use as a pine plantation because of the lack of development pressure. Dow, British Petroleum, Conoco, and Occidental energy companies have storage facilities on the Stratton Ridge dome and it is possible that the Stratton Ridge storage site could be developed for cavern storage by a commercial entity. The onshore Clovelly dome storage system would continue to operate unchanged as a component of LOOP, except for any expansion that LOOP might undertake. At proposed SPR oil distribution facility locations that are near existing oil distribution facilities, a commercial entity could develop them for oil storage.

The no-action alternative would leave regional socioeconomics unchanged and afford no opportunity for disproportionate impacts on populations subject to environmental justice considerations.

# Chapter 4. Cumulative Impacts

## 4.1 INTRODUCTION

This section of the draft EIS evaluates the potential cumulative impacts associated with the potential development of new or expanded SPR sites in combination with the potential impacts associated with other relevant activities that have occurred, are occurring, or may occur in the vicinity of the proposed new or expanded storage sites and their infrastructure. The primary goal of the cumulative impact analysis is to determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative effects of other past, present, and future actions. Cumulative impact analysis is required by the CEQ regulations. The definition of cumulative impacts is:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Impacts subject to the cumulative impacts analysis were identified by determining the potential environmental impacts associated with the proposed expansion of SPR facilities, establishing the geographic scope of the potential impacts, establishing the time frame of the analysis, and identifying other past, present, or future actions that have affected, or could affect, the resources of concern.

The cumulative impact assessment identifies activities in the region that have the potential interaction in time or space with the effects from the proposed SPR program expansion. The geographic scope and time frame of the cumulative impacts analysis varies depending on the environmental resource category under consideration. DOE analyzed the cumulative impacts for those situations where planned or reasonably foreseeable projects overlapped with the proposed SPR expansion in terms of geographic area and time frame. Cumulative impacts can stem from both construction and operations impacts. This analysis differentiates, where appropriate, between cumulative impacts associated with short-term, but overlapping, construction impacts and longer-term overlapping impacts associated with operations. The analysis considers all potential activities including Federal, other government, and private actions.

Because the potential sites extend over a wide geographic area within three states, the cumulative analysis considers both site-specific activities that could have cumulative impacts with the SPR and general categories of activities relevant to the Gulf Coast region as a whole. Impacts of activities within the Gulf Coast region are discussed on the ecoregion province scale because these ecologic units describe the interaction of various natural resources and environmental conditions and characteristics. Ecoregion provinces are characterized by climatic subzones and similar soil orders, factors that lead to similar natural vegetation and the establishment of similar natural resources and environmental conditions and characteristics within each zone.

## 4.2 METHODOLOGY

To evaluate the potential for cumulative impacts, public and private activities in the Gulf Coast were identified and reviewed to determine if the impacts associated with these actions could coincide in time and space with the impacts from the new or expanded SPR sites. The search for potential projects entailed researching projects from four sources, as shown in table 4.2-1.

**Table 4.2-1: Sources for Projects for Potential Inclusion in Cumulative Impacts Analysis**

| Source | Expected Type of Project |
|---|---|
| USACE: New Orleans, Vicksburg, Galveston, and Mobile District Web sites (USACE 2005b, 2006a, 2006b, 2006c) | Projects affecting waterways or wetlands, including water-related projects managed by USACE |
| Louisiana Coastal Wetlands Conservation and Restoration Task Force Web site (www.lacoast.gov) (CWPPRA 2006) | Projects funded by the Coastal Wetlands Planning, Protection and Restoration Act aimed at wetlands restoration along the coast of Louisiana; such projects might be carried out by USACE, EPA, NOAA Fisheries, NRCS, or USFWS |
| State Transportation Improvement Programs for Texas, Louisiana, and Mississippi (LADOTO 2006; MDOT 2004; TxDOT 2005) | Large transportation projects |
| City and county governments | Private land development projects; local government projects |
| Federal Energy Regulatory Commission (FERC) | Liquefied natural gas (LNG) developments |

For each source, projects were sought for inclusion in initial lists for each proposed SPR site and associated facilities. The lists were then narrowed down through multiple passes to eliminate projects based on a variety of factors, including proximity to SPR facilities, size of project, type of project, and date of expected completion. The methods used for developing the final lists from each of these sources are discussed below.

### 4.2.1 U.S. Army Corps of Engineers

In addition to planning, designing, building, and operating aspects of civil works projects, the USACE is responsible for regulating the use of water resources by private organizations and government agencies. USACE District Web sites were searched for USACE-sponsored operations and both USACE and non-USACE permit applications to generate a list of projects that could potentially contribute to the cumulative impacts of SPR construction and operations. After initial county- and parish-level lists were compiled from the Web sites, multiple screening stages narrowed the lists. The screening stages included discussions with district staff regarding specific projects.

As shown in table 4.2.1-1 below, SPR proposed project sites and associated facilities are located in four USACE districts: Galveston, New Orleans, Vicksburg, and Mobile.

**Table 4.2.1-1: USACE Districts and SPR Sites**

| District | SPR Sites |
|---|---|
| Galveston | Stratton Ridge, Big Hill |
| New Orleans | West Hackberry, Bayou Choctaw, Chacahoula, Clovelly, Bruinsburg |
| Vicksburg | Bruinsburg |
| Mobile | Richton |

For each of these districts, lists were compiled for all ongoing and foreseeable projects, including projects in the construction and operation phases, as well as projects pending approval of regulatory permits. DOE then singled out projects occurring within the counties or parishes of interest for each potential SPR site. A county or parish was included in the assessment if it contained any planned SPR infrastructure or pipeline ROWs. Although differences in district Web sites forced a variety of search techniques, the process generally relied on public notice documents, pending permit application lists, and specific project

Web sites in order to populate the lists. In some cases, Web sites had not been updated recently and may have been missing projects started within the last year and recently filed permit applications.

Candidate projects for the four districts were collected from public notices of pending permit applications and other information contained in the district Web sites, sorted by county. The Galveston District's pending applications list was current as of March 2004, and its current public notice list was current as of February 2006. The New Orleans and Vicksburg Districts also provided a monthly backlog of completed projects, but gave little information regarding scale or location. A search of these lists was made dating back to January of 2004. The majority of these operations were maintenance dredging, filling, and surveying. The completed projects were listed, but not enough information was available to map the projects or conduct cumulative impact assessments. This combination of searches produced a county- and parish-wide list of projects.

DOE used several criteria to narrow the lists further. Projects that were significantly out of range of SPR operations were not considered for cumulative impact analysis, unless they influenced an entire watershed or affected large areas. Due to the scope of their effects, several of the hurricane and flood protection projects, as well as the Louisiana Coastal Area Ecosystem Restoration Project, were included for cumulative impact assessment with multiple proposed SPR sites. Many of the permits issued to individuals, as opposed to government agencies or corporations, were intended for small projects and not included on the final lists. For the same reason, permit applications for projects influencing less than 2 acres (0.8 hectares) were not considered. In addition, the process focused on permits for specific construction projects. General permits and regulatory permits did not provide precise locations and were omitted from the final lists. Finally, projects whose description area was very general or whose location could not be determined (e.g., Gulf of Mexico, ICW) were not retained. These criteria were used to create the final project lists.

**Table 4.2.1-2: USACE Project Results by Screening Stage**

| SPR Site and Associated Facilities | Number of Projects Resulting from County/Parish Level Screen | Number of Projects Resulting from Intermediate Stage Screen | Number of USACE Projects on Shortlist |
|---|---|---|---|
| Bruinsburg | 8 | 10 | 13 |
| Chacahoula | 37 | 7 | 7 |
| Clovelly | 12 | 6 | 6 |
| Richton | 6 | 4 | 2 |
| Stratton Ridge | 251 | 200+ | 122 |
| Bayou Choctaw | 5 | 5 | 5 |
| Big Hill | 29 | 26 | 13 |
| West Hackberry | 9 | 5 | 5 |
| Totals | 338 | 260+ | 173 |

### 4.2.2 Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Projects in Louisiana

Congress passed the CWPPRA in 1990, designating approximately $50 million per year for wetlands restoration work in Louisiana. Projects are planned by a cooperative commission and carried out by a number of different agencies, including USACE, EPA, NMFS, NRCS, and USFWS. The Web site for Louisiana Coastal Wetlands Planning, Protection and Restoration Act work (www.lacoast.gov) lists past, ongoing, and future projects taking place within Louisiana coastal wetlands (CWPPRA 2006). SPR sites with associated facilities in these areas include West Hackberry, Chacahoula, and Clovelly.

Using the Coastal Wetlands Planning, Protection and Restoration Act Louisiana Web site, a list of projects occurring in the same basin as SPR facilities was developed. This list was then narrowed by excluding projects already completed and by locating projects on maps to determine proximity to proposed SPR facilities. Projects more than 10 miles (16 kilometers) from proposed SPR facilities were excluded from the final lists. Results from the screening process are shown in table 4.2.2-1 below.

**Table 4.2.2-1: Coastal Wetlands Planning, Protection and Restoration Act Screening**

| SPR Site and Associated Facilities | Number of Projects Resulting from Basin Level Screen | Number of Projects Resulting from Intermediate Stage Screen | Number of Projects on Shortlist |
|---|---|---|---|
| Chacahoula & Clovelly | 50 | 27 | 9 |
| West Hackberry | 18 | 4 | 2 |
| Totals | 68 | 31 | 11 |

### 4.2.3 State Transportation Improvement Programs

State departments of transportation are responsible for developing lists of projects that will be funded by local, state, and federal sources on a three-year basis. These documents are called State Transportation Improvement Programs and include lists of all projects in the state that are expected to receive funding for the given improvement program's period. Table 4.1.3-1 below shows the improvement program documents reviewed for projects and the relevant SPR site.

**Table 4.2.3-1: State Transportation Improvement Programs and SPR Sites**

| State Transportation Improvement Programs | SPR Sites and Associated Infrastructure |
|---|---|
| Louisiana, 2005–2007 | Bruinsburg; Chacahoula; Clovelly; Covelly-Bruinsburg; Bayou Choctaw; West Hackberry |
| Mississippi, 2005–2007 | Bruinsburg; Richton |
| Texas, 2006–2008 | Stratton Ridge; Big Hill |

The program documentation provide limited information about projects, including a project's description, location (generally a road name or route number and the project termini), cost, and, sometimes other information such as expected completion date, sponsor, and phase (ROW, engineering, or construction).

The above STIPs were reviewed and initial lists of projects that were occurring in the counties and parishes where SPR facilities are being proposed were compiled. Small projects were omitted (generally those under $3 million), as well as projects that consisted of re-constructing existing facilities. The process instead focused on new construction, such as new alignments, re-alignments, or widenings. Each project was then located on maps and compared with proposed SPR facility locations. Based on this more specific locating, several projects were eliminated from consideration, producing the shortlist. Results from the screening process are shown in table 4.2.3-2 below.

**Table 4.2.3-2: Transportation Project Results by Screening Stage**

| SPR Site and Associated Facilities | Number of Projects Resulting from County/Parish Level Screen | Number of Projects Resulting from Intermediate Stage Screen | Number of Projects on Shortlist |
|---|---|---|---|
| Bruinsburg | 30 | 8 | 8 |
| Chacahoula | 6 | 2 | 0 |
| Clovelly | 2 | 2 | 0 |
| Richton | 10 | 3 | 3 |
| Stratton Ridge | 35 | 5 | 3 |
| Bayou Choctaw | 0 | 0 | 0 |
| Big Hill | 6 | 4 | 3 |
| West Hackberry | 1 | 1 | 0 |
| Totals | 90 | 25 | 17 |

### 4.2.4 City and County Governments

Staff at city and county governments where SPR sites are proposed were contacted to inquire about large potential land development or local government projects known to be proposed in the vicinity of SPR facilities (Falgout 2006; Floyd Batiste 2006; Johnston 2006). The process focused on the vicinity of the sites themselves, rather than the associated pipeline facilities.

### 4.2.5 Federal Energy Regulatory Commission

ID Dockets at FERC were researched to identify new LNG project developments in the region and in particular those proposed within a 50-mile (62-kilomenter) spatial region of influence of the proposed new SPR storage sites in Bruinsburg, MS; Chacahoula, LA; Clovelly, LA; Richton, MS; and Stratton Ridge, TX; and the expansion sites at Bayou Choctaw, LA; Big Hill, TX; and West Hackberry, LA. The Gulf Coast region is well suited for LNG development because of underlying attributes that include: a Gulf-based point of entry for inbound LNG shipments, a large market for natural gas users, and considerable existing infrastructure that supports LNG regasification, storage, and pipeline distribution. Overall estimates have been made of up to $1 billion in positive economic impact from future regional development of low-cost LNG and the creation of approximately 12,000 jobs.

LNG-related projects that lay within the region of influence of proposed and existing sites and supporting ancillary facilities that were considered for cumulative impact analysis were identified as:

- *West Hackberry, LA:* A new LNG terminal, LNG terminal expansion, and new pipelines to be located at Hackberry, Cameron, and Calcasieu Parishes, LA; underground storage at Starks salt dome in Calcasieu Parish, LA; and two natural gas storage caverns with associated distribution pipelines in Calcasieu Parish, LA.

- *Ancillary Pascagoula Tank Farm (Richton, MS):* Proposed LNG import marine terminal and related facilities in Pascagoula, MS.

Other existing and proposed LNG terminals and pipeline construction in the Gulf Coast region include: approved expansion at Lake Charles, LA; LNG terminals in the Gulf of Mexico; proposed terminals at Freeport, TX, Sabine, LA, and Sabine, TX; and planned terminal and expansions at Lake Charles, LA.

LNG-related activities that were located outside the region of influence were not considered in the cumulative impact analyses.

#### 4.2.6 Hurricane Recovery

Hurricane Katrina was one of the most destructive storms to ever hit the United States, causing extensive damage to the coastal regions of Louisiana, Mississippi, and Alabama. Katrina was a Category 4 hurricane when it made landfall on August 29, 2005 with maximum sustained winds of 143 miles per hour (230 kilometers per hour) and gusts to 165 miles per hour (266 kilometers per hour). Hurricane Rita made landfall as a Category 3 hurricane on the Louisiana-Texas border, about a month later on September 24, 2005, with maximum sustained winds of 120 miles per hour (193 kilometers per hour). A combination of high winds and water surges made these two storms the most costly natural disasters in the modern history of the United States. By far the most devastated area impacted by these two storms was the New Orleans MSA. Estimates of recovery and rebuilding range upwards of $200 billion over the next decade. Rebuilding and recovery is well underway in 2006 in all of the major elements of the regional economy, including housing, industry, education, tourism, oil and gas production, construction, and the undertaking of these efforts will ripple throughout all major job sectors. Recovery on this scale also will affect regional economic stimulus and can bring about positive benefits.

These hurricanes impacted Lafourche Parish, host to the Clovelly site and proposed Chacahoula site; and the existing Bayou Choctaw, Big Hill, and West Hackberry expansion sites. Recovery efforts have been undertaken in these areas. The Bruinsburg, Richton, and Stratton Ridge proposed sites were not substantially impacted. DOE has found that the cumulative effects of the proposed action at proposed new sites or existing expansion sites were not discernable against the scale of regional recovery efforts and infrastructure rebuilding (much of which is focused on the levee systems and housing in the New Orleans MSA). Hence analysis is not detailed below for individual sites.

#### 4.2.7 Gulf of Mexico Coastal Wetlands and Floodplains

The coastal areas along the Gulf of Mexico have lost more than 1.3 million acres of coastal wetlands associated with agricultural activities, land development, natural land subsidence, and erosive forces. Louisiana is experiencing the nation’s highest rate of coastal wetland loss and represents about 80 percent of the wetland loss in the entire continental United States. Louisiana coastal areas have lost over 900,000 acres (364,217 hectares) of wetlands and associated floodplains since the 1930s. As recently as the 1970s, the loss rate for Louisiana coastal wetlands was as high as 25,600 acres (10,360 hectares) per year. The current rate of wetland loss is about 16,000 acres (6,475 hectares) per year. Studies estimate that Louisiana will experience a 320,000 acre (129,500 hectares) net loss of wetlands by the year 2050 (Louisiana Coast 2006).

Mississippi wetlands and floodplains have been under significant development pressure in recent decades. By the 1980s Mississippi had lost about 60 percent of its wetlands and floodplains due to agricultural activities and more recently, residential and commercial coastal development (MDEQ 2002).

The coastal wetlands of Texas also have come under similar pressures as Louisiana and Mississippi. The majority of the estuarine wetland loss in Texas has occurred in the Galveston Bay system according to the Galveston Bay Estuary Program report. The report attributes the accelerated loss of wetlands around Galveston Bay relative to the rest of Texas coast to subsidence induced by withdrawal of groundwater, oil, and gas. About 52 percent of the coastal freshwater wetlands have been lost due to agricultural activities and residential and commercial development (GBEP 1994).

The loss of Gulf Coast wetlands and floodplains and their associated functions/values increased the damage caused in the region by the 2005 hurricane season. Because of the importance of the wetlands and floodplains in the region and the potential direct effects of the proposed SPR expansion on those resources, the cumulative impact section concentrates on the biology and water issues of the region. DOE evaluated the potential direct and cumulative impacts to land use, environmental risks and health, air quality, socioeconomics, noise, and environmental justice for the various alternatives and concluded that there were no overlapping impacts of any consequence. The following sections describe the potential cumulative impacts associated with the proposed development of new and expanded SPR sites in combination with the potential impacts associated with other relevant activities that have occurred, are occurring, or may occur in the vicinity of the proposed new and expanded storage sites and their infrastructure. The potential cumulative impacts for each SPR new site and expansion site are discussed below. DOE evaluated and described the impact of each new SPR site and each expansion site separately because they are located within different ecoregions and watersheds. The selected alternative would actually include one or two new SPR sites plus two or three expansion sites.

## 4.3 BRUINSBURG STORAGE SITE AND ASSOCIATED INFRASTRUCTURE

### 4.3.1 Reasonably Foreseeable Activities On or Near the Bruinsburg Storage Site

In the area around the Bruinsburg site, agriculture and timber production have traditionally been and are still important economic and land use drivers. In addition, the hardwood forests in the area also provide hunting and fishing opportunities. The Grand Gulf nuclear power plant is located about 15 miles (24 kilometers) north of the SPR site. The region has extensive historic resources associated with the Civil War and the Natchez Trace Parkway.

There are no known proposed future uses of the proposed SPR site for other purposes, and the existing site-specific and adjacent land uses would likely continue into the future if the SPR site at Bruinsburg were not developed. The Grand Gulf nuclear power plant is planning for a second nuclear unit at the site, but the expansion would be built within the confines of the existing site.

No overlapping impacts exist between the storage site and the expansion of the nuclear power plant that the draft EIS could assess at this time. The cumulative potential impacts of the RWI and the nuclear power plant’s water withdrawal are discussed below.

### 4.3.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Bruinsburg

The following activities are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Bruinsburg site (Johnston 2006; LADOT 2006; MDOT 2004; USACE 2006c).

| Known Activity | Description |
|---|---|
| Grand Gulf Nuclear Power Plant expansion, 6 miles from raw water pipeline | The Grand Gulf nuclear station lies on a 2,100-acre site near Vicksburg. The site is wooded and contains two lakes. The plant has a 520-foot cooling tower. Plans have been submitted for a simplified boiling water reactor. |
| Lakes Casino Complex, northern end of the northwest branch of the crude oil pipeline near the Mississippi River | Construction of Lakes Vicksburg Casino Resort, including clearing and filling wetlands and other waters, concrete pile foundations, asphalt roadways, and parking areas for a casino, hotel, access road, parking garage and overflow parking area on 160 acres of land. |
| Groom Road widening, East Baton Rouge Parish, LA, 2 miles from crude pipeline | Removal of two-lane asphalt road and replacement with two-lane concrete road with turn lanes and sidewalks. No details available regarding potential wetlands effects. Does not appear to cross any perennial water bodies. |

| Known Activity | Description |
|---|---|
| US 61 paving, Jefferson County, MS, beginning 2 miles from crude oil pipeline | Paving of US 61. Improvements are slated for the interchange at US 61 and Natchez Trace Parkway. No details available regarding potential wetlands effects. |
| LA 19, E. Baton Rouge Parish, 1 mile from crude oil pipeline | Widening of LA 19 from Lavey Lane to Twin Oak. No details available regarding potential wetlands effects. Does not appear to cross any perennial water bodies. |

Notes:

1 foot = 0.30 meter; 1 mile = 1.609 kilometers; 1 acre = 0.404 hectare

### 4.3.3 Cumulative Impacts Discussion

#### 4.3.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, wildlife and fish communities, including EFH and threatened and endangered species from the above-listed projects. The Lakes Casino Complex project was the only other project for which information on biological impacts was available.

The Bruinsburg alternative would require over 150 miles (245 kilometers) of ROW for pipeline and powerlines. The Lakes Vicksburg Casino Resort would be constructed on a 160-acre (65-hectare) parcel adjacent to the proposed raw water line near the Mississippi River. The casino parcel consists of about 48 acres (19 hectares) of wetlands and 112 acres (45 hectares) of active pastureland. Based on available information it appears that the construction and operation Bruinsburg alternative and the casino would have no adverse effects to EFH.

The projects listed in the table have the potential to affect wetland resources, including wetlands and floodplains, located in the Bruinsburg's ecoregion. The Bruinsburg storage site, associated facilities, and ROW would affect 464 acres (188 hectares) of wetlands. Information about impacts for other projects in the same watershed was lacking, except for the proposed Lakes Casino Complex project, which would potentially impact 20 acres (8 hectares) of wetlands associated with the casino building and parking facilities.

The Bruinsburg alternative would include either two or three of the SPR expansion sites thereby increasing the cumulative impacts to wetlands and floodplains within the region. The cumulative impacts to wetlands associated with the Bruinsburg alternative and the expansion sites would increase from 464 acres (188 hectares) to 687 acres (278 hectares) with two expansion sites and to 692 acres (280 hectares) with three expansion sites. The Bruinsburg alternative and the other projects in the area would have to secure regulatory permits and meet regulatory requirements for any impacts to jurisdictional wetlands and waters of the United States.

The regulatory permits for filling and impacting jurisdictional wetlands would require mitigation or compensation to ensure there is no net loss of jurisdictional wetlands within the project watershed. A combination of wetland and stream restoration, creation, or preservation in the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to mitigate for the impact and impacts. The proposed Bruinsburg storage site would cause the clearing and filling of an ecologically important bald cypress forest. Therefore, DOE has determined that the Bruinsburg alternative and other planned or foreseeable projects would have a potentially adverse impact to wetlands. The adverse impact would be mitigated by compensation for jurisdictional impacts through wetland creation, restoration, preservation or use of a mitigation bank in accordance with the 404/401 permit.

The proposed Bruinsburg project may affect the pallid sturgeon (Federally endangered) and fat pocketbook mussell (Federally endangered). It is possible that the proposed water withdrawal from the Grand Gulf Power Plant may affect these species, but no information is available. If this site is selected for development, DOE would initiate formal Section 7 Consultation with the USFWS and NMFS if the proposed Bruinsburg site may adversely affect these species. DOE would prepare a Biological Assessment and implement the conditions of the Biological Opinion (if required). These actions would ensure that any cumulative impact did not adversely affect the species viability or designated critical habitat.

#### 4.3.3.2 Water

DOE evaluated the potential cumulative impacts to water resources that include floodplains, surface water and groundwater in the Bruinsburg watershed. DOE concluded the Grand Gulf nuclear power plant expansion is the only other project that would have measurable effects to surface water and groundwater within the same watershed. Public information about impacts to floodplains and surface waters for the power plant expansion project is currently not available. It appears that the power plant expansion would require additional surface or groundwater for the cooling towers. The power plant withdraws groundwater under the influence of surface water from collector wells under the Mississippi River for a period of 4-5 years. The Bruinsburg alternative would withdraw about 50 mgd raw water directly from the Mississippi River. This represents less than 0.003 percent of the average flow in the river. A significant portion of the raw water used in the power plant cooling process is ultimately discharged back into the Mississippi River. Water would be lost during the cooling process but the percentage of water loss is not available for this draft EIS. Permits would be required for the Bruinsburg RWI and the power plant withdrawals, which would establish a minimum instream flow that could not be depleted. This would ensure that withdrawal rates would not pose adverse effects to surface water and groundwater resources. The Bruinsburg storage site, associated facilities, and ROW would affect about 241 acres (98 hectares) of 100-year floodplain and about 21 acres (9 hectares) of 500-year floodplain. The proposed Bruinsburg storage site is located in a predominantly undeveloped area that has numerous floodplains associated with the Mississippi River and Bayou Pierre, and their tributaries. No information was available to determine if the power plant would affect floodplains. DOE would comply with floodplain protection requirements of the local and state government. Therefore, DOE has determined that the Bruinsburg alternative and other planned or foreseeable projects in the region would have a cumulative adverse impact to water resources or floodplains.

## 4.4 CHACAHOULA STORAGE SITE AND ASSOCIATED INFRASTRUCTURE

### 4.4.1 Chacahoula Storage Site

The salt dome at Chacahoula has historically been the site of extractive operations for production of hydrocarbons, brine, and sulfur. There is also evidence of historical oil and gas exploration and development on the south and northeast sides of the dome. Sulfur production occurred from 1955 to 1962 and 1967 to 1970 along the northeastern part of the dome. The Texas Brine Company operates three brine caverns in the south-central dome area. Infrastructure to support these operations includes roads, power lines, pipeline ROWs, well pads, and flood control levees. Areas have been filled or dredged to support these operations, resulting in alterations to the natural swamp habitat and hydrology. With the exception of the brining operations, there are presently no other activities on the dome. Other local activities include hunting, fishing, and tourism. There are no known proposed future uses of the proposed SPR site for other purposes, and the existing site-specific and adjacent land uses would likely continue into the future if the SPR site at Chacahoula were not developed.

### 4.4.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Chacahoula

The following activities are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Chacahoula site (Falgout 2006; CWPPRA 2006; USACE 2006b).

| Known Activity | Description |
|---|---|
| Ring levee for Samson Contour, Lafourche Parish, LA, less than 1 mile from crude pipeline | Installation of board road and fill for a ring levee and culvert crossing for a drilling well, with 2 acres of bottomland hardwoods affected |
| Airport runway expansion, Clovelly, 2 miles from end of crude pipeline | Expansion of runway to 6,500 feet, including minor re-routing of levee. Project involves grading, but no dredging, and no wetlands will be affected |
| Penchant Basin Natural Resources Plan, Terrebonne Parish, LA, near the brine pipeline | Project may include rock and steel sheet-pile weirs, rock bank stabilization, dredging and marsh creation, and shell plugs, 140,000 acres |
| Grand Bayou hydrologic restoration, Lafourche Parish, LA, 5 miles from the crude pipeline | Installation of a major water control structure in Bayou Pointe au Chien and water control structures through the existing levee along the west side of the Grand Bayou, 16,000 acres |
| Little Lake shoreline protection and dedicated dredging near Round Lake, Lafourche Parish, LA, 5 miles from crude pipeline | Project includes 21,000 feet of shoreline protection constructed parallel to existing shoreline, and marsh creation along the Little Lake shoreline, 1,400 acres |
| Mississippi River reintroduction to Bayou Lafourche, Lafourche Parish, LA, 5 miles from the crude pipeline | Project features include a receiving intake structure at the point of diversion in the Mississippi River, a pump-siphon system, a discharge pond at Donaldsonville, modification of weir structures, bank stabilization, monitoring stations, and dredging of Bayou Lafourche, 85,000 acres |
| Mississippi River reintroduction to Barataria Basin, St. James Parish, LA, 5 miles from crude pipeline | Restoration strategy includes installing two siphons, gapping spoil banks, culverts, and plantings, 5,000 acres |
| Delta building diversion at Myrtle Grove, Jefferson and Lafourche Parishes, 5 miles from crude pipeline | Installation of gated box culverts on Mississippi River, 416,000 acres |
| South Lake De Cade freshwater introduction, Terrebonne Parish, LA, 5 miles from the brine pipeline | Control structures, enlargement of Lapeyrouse Canal for controlled diversion of Atchafalaya River, outfall management structures, and installation of a rock dike along the shoreline, 1,700 acres |
| ICW bank restoration of critical areas, Terrebonne Parish, 1 mile from the brine pipeline | Restoration and stabilization of deteriorated channel banks with hard shoreline materials |
| North Lake Mechant landbridge restoration, Terrebonne Parish, LA, 1 mile from the brine pipeline | Creation of marsh using dredged material from Lake Mechant, planting of smooth cordgrass along shoreline, and repair of breeches formed by erosion and oilfield access canals, 7,600 acres |

Notes:

1 foot = 0.30 meter; 1 mile = 1.609 kilometers; 1 acre = 0.404 hectare

### 4.4.3 Cumulative Impacts Discussion

#### 4.4.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, wildlife and fish communities, including EFH, and threatened and endangered species from the above listed projects. The majority of the projects listed above consist of wetlands and waters of the United States restoration and protection activities initiated by the CWPPRA. The CWPPRA designs and constructs projects to preserve and restore Louisiana's coastal landscape. The USACE administers accounting and tracks project status of all CWPPRA projects. The projects listed above have restored, created, and preserved over 600,000 acres (240,000 hectares) of wetland and waters and associated wildlife habitat.

According to publicly available information, there are two known development projects in the vicinity of the Chacahoula alternative including the Ring Levee project (about 1 mile [1.6 kilometers] from the crude pipeline) and the Clovelly Airport runway extension (about 2 miles [3.2 kilometers] from the crude pipeline). The Ring Levee project would impact about 2 acres (1 hectare) of bottomland hardwood forest, and the Clovelly Airport project would not affect wetlands or waters of the United States but could affect the surrounding natural habitat where the expansion is planned.

The Chacahoula alternative and the Ring Levee project would potentially affect 2,258 acres (915 hectares) of wetlands, including clearing and filling of a bald cypress forest for the site storage area. The initial review of both the projects indicates that no significant effects to EFH would result from construction and operation. The Chacahoula storage site area and proposed ROWs may affect the bald eagle, which is a Federally-threatened species that has been proposed for de-listing. The brown pelican, a Federally endangered species may be affected by the ROW for the crude oil pipeline to Clovelly. It is not known if the Ring Levee project may affect these species. DOE would initiate formal Section 7 Consultation if the project may adversely affect those species. DOE would prepare a Biological Assessment and implement any conditions of a Biological Opinion. These actions would ensure that the cumulative impact of the projects did not interfere with the continued viability of the species or adversely affect designated critical habitat.

Public information providing detailed wetland and waters of the U.S. impacts for the projects in the same watershed was not available, except for the proposed Ring Levee project, which would potentially affect 2 acres (1 hectare) of wetlands. Both the Chacahoula alternative and Ring Levee project would have to secure regulatory permits and meet regulatory requirements for impacts to jurisdictional wetlands and waters of the United States. Compensation for the jurisdictional wetland impacts would be required before the actions were authorized.

The Chacahoula alternative would include either two or three of the SPR expansion sites, increasing the cumulative impacts to wetlands and floodplains within the region. The cumulative impacts to wetlands associated with the Chacahoula alternative and the expansion sites would increase from 2,258 acres (914 hectares) to 2,479 acres (1003 hectares) with two expansion sites and to 2,484 acres (1005 hectares) with three expansion sites.

The regulatory permits for filling jurisdictional wetlands would require compensation or mitigation to ensure there is no net loss of jurisdictional wetlands in the project area watershed. A combination of wetland and stream creation, restoration, or preservation in the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to mitigate for wetland impacts. In addition, the number of wetland restoration and creation projects within the region far outnumbers the anticipated impacts from the proposed projects. Therefore, DOE has determined that the Chacahoula alternative and other planned or foreseeable projects would not have a cumulative adverse impact to wetland resources.

#### 4.4.3.2 Water

DOE evaluated the potential cumulative impacts to water resources, which includes surface water, floodplains, and groundwater in the Chacahoula ecoregion.  DOE concluded that the water-related projects within the project area include multiple stream and floodplain restoration projects, which would improve the water quality, and water resources in the ecoregion.  Public information about other proposed projects that affect water resources and floodplains for the area are not available.  The Chacahoula storage site and associated facilities would affect about 136 acres (55 hectares) of 100-year floodplain and the site is outside the 500-year floodplain.  The floodplain in which the Chacahoula site is located extends over thousands of acres, and is part of the Louisiana Western Gulf Coastal Plain Province.  DOE has determined that the Chacahoula alternative and the other planned or reasonably foreseeable projects would not have a cumulative adverse impact.  The impacts from the Chacahoula site development would be mitigated by securing permits for the proposed filling or discharges to surface water and compensating for the permanent impacts to jurisdictional surface water bodies through the Section 404/401 permit process.

## 4.5 CLOVELLY STORAGE SITE AND ASSOCIATED INFRASTRUCTURE

### 4.5.1 Clovelly Storage Site

The Clovelly site consists of brackish marsh and wooded wetlands.  Features that influence the site include cheniers (water-deposited and wind-driven deposition associated with high water marks), open beaches, levees, and dredge spoil banks.  The area has a long history of oil and gas-related activity.  The existing Clovelly Dome Storage Terminal is part of the LOOP project.  Oil received at LOOP's offshore facilities flows to the Clovelly terminal through a pipeline from the Fourchon station, the point where LOOP's oil comes onshore.  The Clovelly terminal within the LOOP system is used to store crude oil in underground salt domes before it is shipped to the various regional and midwest refineries.  The Clovelly terminal currently consists of eight caverns, a pump station, meters to measure the crude oil receipts and deliveries, and a brine storage reservoir.  If chosen as an SPR site, the SPR operation would use LOOP's existing oil distribution infrastructure.  LOOP operations dominate the area and are an established activity.  This makes alternative land uses of the site difficult.  There are no known proposed uses of the SPR site for other purposes, and the existing site-specific and adjacent land uses would likely continue into the future if the SPR site at Clovelly were not developed.  SPR development at Clovelly would essentially be an expansion of existing operations at the site.

### 4.5.2 Clovelly Associated Infrastructure

No modifications for pipelines are being proposed for the Clovelly site; however, a new RWI would be built to meet the independent needs of DOE.

### 4.5.3 Cumulative Impacts Discussion

#### 4.5.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, wildlife and fish communities, including EFH and threatened and endangered species from the Clovelly alternative.  No expected activities or projects were found to occur within close proximity of this alternative.

The Clovelly storage site, associated facilities, and ROW would permanently affect about 10 acres (4 hectares) of wetlands.  The affected wetlands have been disturbed by past development of the site and invasion of exotic plants, including tallow trees.  The Clovelly site development would have no adverse effect on EFH and no effect on any federally listed threatened or endangered species or designated critical habitat.

The Clovelly alternative would include either two or three of the SPR expansion sites, increasing the cumulative impacts to wetlands within the region. The cumulative impacts to wetlands associated with the Clovelly alternative and the expansion sites would increase from 10 acres (4 hectares) to 238 acres (96 hectares) with three expansion sites. The Clovelly alternative would have to secure regulatory permits and meet regulatory requirements for impacts to jurisdictional wetlands and waters of the United States.

The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional wetlands in the project area watershed. A combination of wetland and stream restoration, creation, or preservation in the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid adverse cumulative impacts. Therefore, DOE has determined that the Clovelly alternative and other planned or foreseeable projects would not have a cumulative adverse impact to wetland resources.

#### 4.5.3.2 Water

DOE evaluated the potential cumulative impacts to water resources, which include surface water floodplains and groundwater in the Clovelly watershed. The Clovelly storage site would affect the open waters and navigable channels located in the project area because of dredging and filling activities. These impacts would be mitigated by compliance with the regulatory permit. The Clovelly storage site and associated facilities would affect about 21 acres (9 hectares) of 100-year floodplain and it would be outside the 500-year floodplain. The impacts to floodplains from the storage site are expected to be minimal due to the overall size of the floodplain system, the small amount of aboveground construction and the use of elevated platforms to support most of the infrastructure. Therefore, DOE has determined that the Clovelly alternative and the other planned or reasonably foreseeable projects would not have a cumulative adverse impact to water resources.

## 4.6 CLOVELLY-BRUINSBURG STORAGE SITES AND ASSOCIATED INFRASTRUCTURE

### 4.6.1 Reasonably Foreseeable Activities On or Near the Clovelly-Bruinsburg Storage Sites

The reasonably foreseeable activities on or near the Clovelly-Bruinsburg storage sites are the same activities as the individually proposed Bruinsburg and Clovelly projects described previously.

### 4.6.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Clovelly-Bruinsburg

The reasonably foreseeable activities near the associated infrastructure for the Clovelly-Bruinsburg alternative are the same activities as the individually proposed Bruinsburg and Clovelly projects described previously.

### 4.6.3 Cumulative Impacts Discussion

#### 4.6.3.1 Biology

Construction and operation of the Clovelly-Bruinsburg alternative would not adversely affect EFH or any state or federally listed threatened or endangered species or critical habitat.

The projects listed in the table have the potential to affect wetland resources located in the vicinity of the Clovelly-Bruinsburg alternative. The Clovelly-Bruinsburg storage sites and associated facilities and ROW would affect about 530 acres (215 hectares) of wetlands and associated water bodies. The impacts for the projects in the same watershed was lacking, except for the proposed Lakes Casino Complex project, which would potentially impact 20 acres (8 hectares) of wetlands associated with the casino building and parking facilities.

The Clovelly-Bruinsburg alternative would include either two or three of the SPR expansion sites, increasing the cumulative impacts to wetlands and floodplains within the region. The cumulative impacts to wetlands associated with the Clovelly-Bruinsburg alternative and the expansion sites would increase from 530 acres (215 hectares) to 753 acres (305 hectares) with two expansion sites and to 758 acres (307 hectares) with three expansion sites. The Clovelly-Bruinsburg alternative and the other projects in the area would have to secure regulatory permits and meet regulatory requirements for any impacts to jurisdictional wetlands and waters of the United States.

The regulatory permits for filling and impacting jurisdictional wetlands would require an adequate compensation ratio to ensure there is no net loss of jurisdictional wetlands within the project watershed. A combination of wetland and stream restoration in the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid adverse cumulative impacts. Therefore, DOE has determined that the Clovelly-Bruinsburg alternative and other planned or foreseeable projects would have a cumulative adverse impact to biological resources. However, the impacts would be mitigated minimizing the permanent adverse impacts.

#### 4.6.3.2 Water

The Clovelly-Bruinsburg alternative would affect about 136 acres (55 hectares) of 100-year floodplain and about 48 acres (19 hectares) of 500-year floodplain. The 80 MMB Bruinsburg storage site and associated infrastructure would be located in an extensive floodplain system with numerous floodplains associated with the Mississippi River and Bayou Pierre, and their tributaries.

## 4.7 RICHTON STORAGE SITE AND ASSOCIATED INFRASTRUCTURE

### 4.7.1 Richton Storage Site

The Richton site currently consists of a slash pine plantation, overgrown fields (former timber stands and crops), forested, emergent, and open water wetlands, and an active chicken farm. The slash pine plantation consists of stands with ages varying between 10 to 20 years. The overgrown fields include portions of former slash pine timber stands and old cropland. Forested and emergent wetlands and open water are associated with a constructed pond located along the central portion of the western boundary. The town of Richton is about 1 mile (1.6 kilometers) from the site, and residential development is scattered near the site. While the area is not a historical oil and gas development area, there is an extensive network of oil and gas pipelines nearby. The Richton storage site and the locations of all its proposed ancillary facilities including Pascagoula were impacted significantly by Hurricane Katrina.

While disturbed, the Richton site has no known proposed future uses other than SPR development or continued agricultural use. There has been discussion of use of the site for natural gas storage in past years, but there is no formal proposal for this project at the current time. The town of Richton is in close proximity to the site, and future residential development near the proposed SPR site is possible. The existing site-specific and adjacent land uses would likely continue into the future if the SPR site at Richton were not developed.

### 4.7.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Richton

The following activities are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Richton site (MDOT 2004).

| Project | Description |
|---|---|
| SR 48 paving, Amite County, MS, following the crude pipeline for approximately 20 miles east of McComb | Paving of SR 48 |
| US 98 widening, Pike County, MS, parallel and within 2 miles of the crude pipeline | Widening of highway for two additional lanes. No wetlands impact information is known at this time. |

1 mile = 1.609 kilometers

An LNG import marine terminal and related facilities in Pascagoula, MS, has been proposed for construction and operation, and would be located within 5 miles (8 kilometers) of the tank farm that would be located on the former Naval Station on Singing River Island just outside of the main port of Pascagoula.

### 4.7.3 Cumulative Impacts Discussion

#### 4.7.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, wildlife and fish communities, including EFH and threatened and endangered species from the above-listed projects. Two roadway projects parallel the crude oil pipeline for various distances. The SR 48 project follows the crude pipeline for approximately 20 miles (32 kilometers) and consists of repaving the road surface. No direct impacts to wetlands or other biological resources would likely result from the project construction. The US 98 project parallels the crude pipeline and is located about 2 miles (3.2 kilometers) from the Richton ROW. The US 98 roadway project consists of widening the existing road from two lanes to four lanes. No information concerning project impacts to biological resources was available at this date.

The Richton storage site, associated facilities, and ROWs would affect about 1,305 acres (529 hectares) of wetlands. The impacts associated with the above-referenced road improvement projects are unknown, but considering the project descriptions, it appears that impacts to biological resources would likely be minimal because the projects are following existing road ROW. The construction and operation of the Richton alternative would not adversely affect EFH. DOE determined that the Richton project may have a potential adverse effect on the gulf sturgeon (Federally threatened) and pearl darter (Federal candidate species) due to the possible impingement and entrainment of these fish by the RWI and modification of the flow and habitat in the Leaf River. No adverse effect would occur to other state or federally listed rare, threatened or endangered species or designated critical habitat. The US 98 widening project parallels the crude oil pipeline but does not cross the Leaf River. Therefore, it appears that the roadway project would not affect these special status species located in the project area.

The Richton alternative would include either two or three of the SPR expansion sites, increasing the cumulative impacts to wetlands and floodplains in the region. The cumulative impacts to wetlands associated with the Richton alternative and the expansion sites would increase from 1,305 acres (529 hectares) to 1,528 acres (619 hectares) with two expansion sites and to 1,533 acres (621 hectares) with three expansion sites. Both the Richton alternative and US 98 roadway project would have to secure regulatory permits and meet regulatory requirements, including compensation for impacts to jurisdictional wetlands.

The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional wetlands in the ecoregion. A combination of wetland and stream restoration in the watershed and use of authorized mitigation banks or in-lieu fees would be utilized by these projects to mitigate for impacts. DOE has determined that the Richton alternative and other planned or reasonably foreseeable projects may have a cumulative adverse impact on wetland resources. However, the impacts would be mitigated through the compensation process required by the Section 404/401 permit.

### 4.7.4 Water

DOE evaluated the potential cumulative impacts to water resources, which include surface water and groundwater in the Richton ecoregion. DOE concluded that the US 98 roadway widening project is the only other project in the area that would affect surface waters, mainly as a result of stream crossings. No public information concerning water resources within the US 98 project was available, but it appears that the roadway would cross six streams or drainage ways. The Richton alternative ROWs would cross about 67 water bodies most of which are in different watersheds. Most of these crossings would be considered a temporary impact because either directional drilling would be utilized or stream banks would be restored to preexisting conditions. DOE determined that the impact of the Richton RWI would have a potential adverse effect on the minimum in-stream flow in the Leaf River. The impact could be mitigated by conditions in the Stream Diversion and Use of Public Waters Permit from the Mississippi DEQ and CWA Section 404 permit, which would ensure the protection of the minimum in-stream flow. The Richton storage site and associated facilities would affect about 63 acres (26 hectares) of 100-year floodplain and would be outside the 500-year floodplain. The area surrounding the proposed storage site and associated infrastructure consists of several floodplains associated with various streams mostly in the Pascagoula or Pearl River drainage basins. DOE has determined that the Richton alternative and the other planned or reasonably foreseeable projects would have a cumulative adverse impact on water resources.

## 4.8 STRATTON RIDGE STORAGE SITE AND ASSOCIATED INFRASTRUCTURE

### 4.8.1 Stratton Ridge Storage Site

Although mostly forested, the Stratton Ridge site has been disturbed by human activities. Most of the site is classified as evergreen forested wetlands with pockets of emergent wetlands and deciduous forest. Open fields associated with ROWs are evident in the area. Three areas of permanent and semi-permanent standing water with emergent vegetation are located on the proposed SPR site. Cattle and feral pigs roam throughout the site. The Stratton Ridge site includes pipeline ROWs for several oil, gas, and chemical/petrochemical plants and large power lines that run across the site’s northeast corner. Agriculture is also a prominent local land use.

The proposed Stratton Ridge storage site is the last remaining major undeveloped area on the Stratton Ridge dome, and there is some competition for this land for oil/gas development. There has been some discussion of use of the site as a future natural gas storage area, although there is no formal proposal for that development. There is a proposed LNG storage cavern, a part of the Freeport LNG project, in close proximity to the proposed site of the DOE caverns. The LNG storage cavern would be a major development in the area and would create cumulative site development changes with the potential SPR use.

### 4.8.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Stratton Ridge

The following projects are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Stratton Ridge site (TxDOT 2005; USACE 2006a).

| Project | Description |
|---|---|
| SH 146 Expansion, Texas City, TX, crosses the crude pipeline | Construction of two-lane, southbound frontage road, and bridge across Dickinson Bayou along and parallel to existing two-lane portion of SH 146. Project would affect 1.3 acres of wetlands, and includes 10 acres of salt marsh habitat restoration as mitigation |
| I-45 expansion, Galveston County, TX, 1 mile from crude pipeline | Major upgrades to I-45, including widening to eight lanes and improved access ramps |
| SH 3 widening, Galveston County, TX, 1 mile from crude pipeline | Widening and re-surfacing of SH 3 |

Notes:

1 mile = 1.609 kilometers; 1 acre = 0.404 hectare

### 4.8.3 Cumulative Impacts Discussion

#### 4.8.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, wildlife and fish communities, including EFH, and threatened and endangered species from the above listed projects. The projects located within the Stratton Ridge ecoregion include various roadway improvement projects and multiple USACE permit applications located near Texas City and Freeport. No detailed information of the USACE permits was available for this analysis.

The SH 146 Expansion project, which crosses the crude pipeline, is in Texas City and would affect 1.3 acres (0.5 hectares) of wetlands. Both the I-45 Expansion project and the SH 4 widening project would require upgrades and would potentially impacts wetlands and other natural resources. No information concerning project impacts to natural resources is available to the public to date.

The Stratton Ridge storage site, associated facilities, and ROW would permanently impact about 598 acres (242 hectares) of wetlands and waters of the United States. The impacts associated with the other projects are unknown but considering the project descriptions it appears that impacts to natural resources would likely be minimal because the projects are following existing road ROWs. The Stratton Ridge alternative would have no adverse effect on EFH. The proposed roadway projects would occur in developed areas of Texas City and follow existing ROWs and therefore it is unlikely they would affect the bald eagle. DOE determined that the Stratton Ridge storage site and ROWs may affect roosting and foraging habitat for the bald eagle. The bald eagle is Federally threatened, but is proposed for de-listing. DOE would initiate formal Section 7 Consultation with the USFWS if the project may adversely affect the species or designated critical habitat. DOE would prepare a Biological Assessment and implement conditions of a Biological Opinion. These actions would ensure that the cumulative impact of the projects did not interfere with the continued viability of the species or adversely affect designated critical habitat.

The SH 146 Expansion project would impact about 1 acre (0.4 hectares) of wetlands. According to the project permit, 10 acres (4 hectares) of salt marsh habitat restoration is proposed as mitigation.

The Stratton Ridge alternative would include either two or three of the SPR expansion sites, increasing the cumulative impacts to wetlands and floodplains within the region. The cumulative impacts to wetlands associated with the Stratton Ridge alternative and the expansion sites would increase from 598 acres (242 hectares) to 821 acres (332 hectares) with two expansion sites and to 826 acres (334 hectares) with expansion sites. The Stratton Ridge alternative and above-mentioned projects would have to secure regulatory permits and meet regulatory requirements for impacts to jurisdictional wetlands.

The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional wetlands in the project watershed. A combination of wetland and stream restoration in the project vicinity and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid cumulative adverse impacts. DOE has determined that the Stratton Ridge alternative and other planned or foreseeable projects would have a cumulative adverse impact on wetlands. However, the impacts would be mitigated through the wetland compensation plan.

#### 4.8.3.2 Water

DOE evaluated the potential cumulative impacts to water resources that include surface water, floodplains, and groundwater in the Stratton Ridge area. The Stratton Ridge alternative would cross about 20 water bodies (mainly manmade channels through marshlands). The Stratton Ridge storage site and associated facilities would affect about 124 acres (50 hectares) of 100-year floodplain and about 186 acres (75 hectares) of 500-year floodplain. The floodplain surrounding the proposed storage site and associated infrastructure is large, extending over thousands of acres and is part of the San Jacinto-Brazos Coastal Basin. The above-referenced projects would have impacts to water resources in the project vicinity, but the cumulative impacts were not available. However, the projects would require a Section 404/401 permit and compensation for any permanent impacts to jurisdictional waters. Therefore, DOE has determined that the Stratton Ridge alternative and the other planned or reasonably foreseeable projects would not have a cumulative adverse impact on water resources.

## 4.9 BAYOU CHOCTAW EXPANSION SITE AND ASSOCIATED INFRASTRUCTURE

### 4.9.1 Bayou Choctaw Expansion Site

Bayou Choctaw is an existing SPR storage site. The extensive diversions and control structures added elsewhere to protect populated areas have made water levels at the site particularly uncertain. However, the existing SPR site is normally dry and protected from spring flooding by the site’s flood control levees and pumps. The area surrounding the site is a fresh-water swamp, which includes substantial stands of bottomland hardwoods with interconnecting waterways. The original cypress wetlands at the SPR site was clear-cut long before SPR development began. The region has experienced widespread petroleum extraction activity. The Choctaw field was already a mature producer prior to the advent of SPR oil storage. Most of the wells in the area have been abandoned. Union Texas Petroleum operates seven hydrocarbon storage caverns and two brine caverns on the dome, closely interspersed with the SPR caverns.

As an existing SPR site, expansion of the Bayou Choctaw site would be a logical extension of activity. There are no known competing uses proposed for this site or in the adjacent area that would compete with or add to development of the site as SPR expansion. If the Bayou Choctaw site is not used for SPR expansion purposes, it is likely that the existing site would remain as is for the foreseeable future.

### 4.9.2 Cumulative Impacts Discussion

#### 4.9.2.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, floodplains, wildlife and fish communities, including EFH, and threatened and endangered species from the Bayou Choctaw alternative. No expected activities were found to occur within close proximity to this alternative. However, the Bayou Choctaw expansion site would permanently affect 34 acres (14 hectares) of wetlands associated with the storage site expansion and upgrades.

The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional wetlands in the project area. A combination of wetland and stream restoration, creation, and preservation within the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid cumulative adverse effects. Therefore, DOE has determined that the cumulative effects to biological resources from the Richton alternative and other planned or foreseeable projects would not be adverse.

#### 4.9.2.2 Water

DOE evaluated the potential cumulative impacts to water resources, which include surface water and groundwater in the Bayou Choctaw ecoregion. No stream crossings or waterbody crossings would result from the alternative. Expansion of the Bayou Choctaw storage site and associated facilities would affect about 187 acres (76 hectares) of 100-year floodplain and would be outside the 500-year floodplain. The expansion site is located in the Louisiana portion of the Western Gulf Coastal Plain Province and is composed of the Mississippi River floodplain, which is extensive. Therefore, DOE has determined that the Bayou Choctaw expansion site would not have an adverse cumulative impact to water resources.

## 4.10 BIG HILL EXPANSION SITE AND ASSOCIATED INFRASTRUCTURE

### 4.10.1 Big Hill Expansion Site

Big Hill is an existing SPR storage site. The area surrounding the SPR expansion proposed site is primarily agricultural with rice and cattle grazing the two main land uses. The site is situated within a small area of industrial-use land with large areas of croplands and pastures to the north and west, and extensive marshlands to the south and southeast that stretch to the coast. Hunting and fishing occurs in the marsh areas. There are two historical liquid petroleum gas storage caverns just north of the proposed expansion area with access roads. Areas where brine has been either disposed of or spilled are void of vegetation. The area has water control structures including levees, and hunting, fishing, and fish and wildlife management activities occur nearby. Hurricane Rita had identifiable effects on the natural environment and infrastructure at the Big Hill site.

As an existing SPR site, expansion of the Big Hill site would be a logical extension of activity. There are no known competing uses proposed for this site or in the adjacent area that would compete with or add to development of the site as SPR expansion. If the Big Hill site is not used for SPR expansion purposes, it is likely that the existing site would remain as is for the foreseeable future.

### 4.10.2 Reasonably Foreseeable Activities Near the Associated Infrastructure for Big Hill

The following activities are expected to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the Big Hill site (Floyd Batiste 2006; TxDOT 2005; USACE 2006a).

| Project | Description |
|---|---|
| Flood control improvements, Jefferson County, TX, near the crude pipeline | Flood control improvements to Green Pond Gully and Taylor Bayou, including regional detention and levee construction, channel improvements, and a diversion channel, affecting 700 acres of wetlands |
| FM 365 widening, Jefferson County, TX, 3 miles from crude pipeline | FM 365 widening, including a grade-separated intersection at W. Port Arthur Road and a grade-separated bridge at the UP railroad tracks |
| New land development along SR 73, Jefferson County, TX, 1 mile from crude pipeline | Construction of 81 new homes and a commercial development that includes a hotel, covering 50 acres. Impacts to wetlands are unknown |

Notes:

1 mile = 1.609 kilometers; 1 acre = 0.404 hectare

### 4.10.3 Cumulative Impacts Discussion

#### 4.10.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, floodplains, wildlife and fish communities, including EFH, and threatened and endangered species from the above-listed projects. Projects located within the Big Hill vicinity include a flood control project, the FM 365 Widening project, a residential/commercial development, and multiple USACE permits currently under review.

The flood control improvements to Green Pond Gully and Taylor Bayou are located in Jefferson County near the crude pipeline. The proposed project includes regional detention and levee construction, channel improvements, and a diversion channel, all of which would impact about 700 acres (283 hectares) of wetlands. The FM 365 widening, the new land development project and the multiple USACE permit applications could affect wetlands and other natural resources but details were not available to the public.

The Big Hill expansion site would potentially affect about 189 acres (77 hectares) of wetlands. The impacts associated with the above referenced projects include 700 acres (283 hectares) associated with the flood control improvements in Jefferson County. The remaining impacts are unknown but impacts to wetlands would be mitigated because the projects would be required to undergo the USACE Section 404/401 permitting process. The Big Hill alternative would have no adverse effects on EFH or any state or federally listed rare, threatened or endangered species or critical habitat.

Both the Big Hill alternative and flood control improvement project would have to secure regulatory permits and meet regulatory requirements for impacts to jurisdictional wetlands and waters of the United States. The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional wetlands in the project area watershed. A combination of wetland and stream restoration, creation, and preservation in the watershed and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid cumulative adverse impacts. Therefore, DOE has determined that the Big Hill expansion site and other planned or foreseeable projects would not have a cumulative adverse impact to biological resources.

#### 4.10.3.2 Water

DOE evaluated the potential cumulative impacts to water resources, which include surface and ground water in the Big Hill ecoregion. No information concerning the number of stream crossings that would result from the above referenced projects was available. The Big Hill alternative ROWs would cross about 11 water bodies including open water, marsh, and the ICW. Most of these crossings would be considered a temporary impact because either directional drilling would be utilized or stream banks would be restored to preexisting conditions. Appropriate Section 404/401 permits would be secured for the impacts to jurisdictional waters. Expansion of the Big Hill storage site and associated facilities would affect about 11 acres (5 hectares) of 100-year floodplain and about 27 acres (11 hectares) of 500-year floodplain. The proposed Big Hill expansion site is located in a predominantly undeveloped, extensive floodplain system. Therefore, DOE has determined that the Big Hill expansion site and the other planned or reasonably foreseeable projects would not have a cumulative adverse impact to water resources.

## 4.11 WEST HACKBERRY EXPANSION SITE AND ASSOCIATED INFRASTRUCTURE

### 4.11.1 West Hackberry Expansion Site

West Hackberry is an existing SPR storage site. In addition to the SPR facilities, numerous canals and natural waterways bisect the area. The area surrounding the SPR site consists of marshland with natural ridges. The major historical land use of the area has been oil and gas exploration and development. Exploration for oil began on the dome in 1902. Extensive exploration for sulfur also took place, but no records indicate that the dome was mined for sulfur. Olin Corporation and its predecessors have been producing brine since 1934. Hurricane Rita had identifiable effects on the natural environment and infrastructure at the West Hackberry site.

As an existing SPR site, expansion of the West Hackberry site would be a logical extension of activity. There are no known competing uses proposed for this site or in the adjacent area that would compete with or add to development of the site as SPR expansion. If the West Hackberry site is not used for SPR expansion purposes, it is likely that the existing site would remain as is for the foreseeable future.

### 4.11.2 West Hackberry Associated Infrastructure

No expected activities were found to occur within 5 miles (8 kilometers) of the proposed ROWs for the crude oil and brine pipelines associated with the West Hackberry site. However the following LNG development activities were identified in the host Parishes of Cameroon and Calcasieu: A new LNG terminal, LNG terminal expansion, and new pipelines to be located at Hackberry, Cameron and Calcasieu Parishes; underground gas storage at Starks salt dome, Calcasieu Parish; and two natural gas storage caverns with associated distribution pipelines, Calcasieu Parish.

### 4.11.3 Cumulative Impacts Discussion

#### 4.11.3.1 Biology

DOE evaluated the potential cumulative impacts to plant communities, wetlands, floodplains, wildlife and fish communities, including EFH, and threatened and endangered species from the ecoregion for the West Hackberry alternative. No expected activities were found to occur within the vicinity of this expansion site.

The West Hackberry alternative would impact about 5 acres (2 hectares) of wetlands and waters of the United States. Expansion of the West Hackberry site would have no adverse effect on EFH or any state or federally listed rare, threatened or endangered species or critical habitat would result from construction and operation of the project.

The West Hackberry alternative would have to secure Section 404/401 permits and meet regulatory requirements for impacts to jurisdictional wetlands.

The regulatory permits for filling and impacting jurisdictional wetlands would require compensation to ensure there is no net loss of jurisdictional wetlands in the project area. A combination of on-site wetland

and stream restoration, creation, and preservation and use of authorized mitigation sites (bank sites/creation sites or in-lieu fees) would be utilized by these projects to avoid cumulative adverse impacts. Therefore, DOE has determined that the cumulative impacts to biological resources from the Richton alternative and other planned or foreseeable projects would not be adverse.

#### 4.11.3.2 Water

DOE evaluated the potential cumulative impacts to water resources, which include surface water and groundwater in the West Hackberry ecoregion. No information concerning the number of stream crossings that would result from the above referenced projects was available. In addition, the expansion of the West Hackberry site would not affect any 100-year or 500-year floodplains. Therefore, DOE has determined that the cumulative impact to water resources, including surface water and groundwater from the West Hackberry ecoregion alternative and the other planned or reasonably foreseeable projects would not be adverse.

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# Chapter 5. Irreversible and Irretrievable Commitment of Resources

This section describes the amounts and types of resources that would be irreversibly and irretrievably committed if the proposed expansion of the SPR is undertaken. The principal resource that would be would be committed to SPR expansion is the land that would be required for the construction and expansion of the proposed sites, pipeline ROWs, and marine terminals. Construction of storage caverns in the salt domes at the proposed new and expansion sites would also result in the irretrievable loss of the salt, which would be either discharged as brine to the Gulf of Mexico or disposed of by underground injection, and irretrievable use of the water needed to dissolve the salt. Additional water would be used during drawdown. Other resources that would be committed to the proposed new and expansion sites include construction materials (e.g., steel, concrete) and energy (e.g., electricity, fuel) used for construction and operation.

## 5.1 LAND RESOURCES

The amount of land that would be committed during construction of the proposed new and expansion sites would include land used for the SPR site construction, pipeline construction ROWs, RWI structure construction, tank farm, and other terminal construction, and, to a lesser extent, road construction. While not all the acreage required for SPR construction would actually be developed, standard security measures require that the entire site be enclosed in fencing. This would effectively preclude use of the fenced-in land for the duration of the operation.

The land required for proposed new and expansion site and pipeline construction would include both uplands and wetlands. Temporary easements would be required during pipeline construction, and permanent easements would be maintained for the pipeline ROWs. Permanent easement lands would be considered to be irretrievable resources. Temporary easement lands would not ordinarily be considered as irretrievable resources; however, impacts to temporary easement lands during construction would be degraded for the duration of the SPR operation. The total acreage that would be committed for each proposed new and expansion site, including both temporary and permanent easements, is shown in table 5.1-1, and the total acreage that would be committed for each alternative is shown in table 5.1-2. (See chapter 2 for more information on the alternatives). The land area of the temporary easements for pipeline construction is approximately 50 percent of the total area of the crude oil, brine, and raw water pipeline ROWs.

For the proposed Clovelly site, the proposed caverns would be co-located with the existing Clovelly LOOP caverns and would be largely submerged. Affected areas for the proposed Clovelly site include dredged and filled areas. The total area of the Clovelly site is shown in tables 5.1-1 and 5.1-2. For the Bayou Choctaw and Big Hill sites, the land required for expansion would be the same regardless of the additional storage capacity and number of additional storage caverns. The West Hackberry site would either be expanded through acquisition of three existing storage caverns or not expanded at all. The total area of the West Hackberry site shown in tables 5.1-1 and 5.1-2 includes the disturbed areas and buffer for the proposed expansion but does not include an additional 240 acres (97 hectares) of land adjacent to the existing West Hackberry site that would be purchased by DOE but not developed.

**Table 5.1-1: Commitment of Land for Proposed New and Expansion SPR Sites (acres)**

| Site | MMB | SPR Site Construction and Buffer | Terminal, Pump Station, and Tank Farm | RWI Structure | Power Line ROW | Crude Oil Pipeline ROW | Brine Pipeline ROW | Brine Injection Well Area | Raw Water Pipeline ROW | Access Road Area | Total Land Area |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bayou Choctaw | 20 | 0 | 0 | 0 | 0 | 0 | 7 | 96 | 0 | 2 | 105 |
| | 30 | 2 | 0 | 0 | 0 | 0 | 7 | 96 | 0 | 2 | 107 |
| Big Hill | 108 | 206 | 0 | 0 | 0 | 278 | 16 | 0 | 0 | 0 | 500 |
| | 96 | 206 | 0 | 0 | 0 | 278 | 16 | 0 | 0 | 0 | 500 |
| | 84 | 206 | 0 | 0 | 0 | 278 | 16 | 0 | 0 | 0 | 500 |
| | 80 | 206 | 0 | 0 | 0 | 278 | 16 | 0 | 0 | 0 | 500 |
| | 72 | 206 | 0 | 0 | 0 | 278 | 16 | 0 | 0 | 0 | 500 |
| Bruinsburg | 160 | 365 | 141 | 1 | 194 | 1,742 | 214 | 73 | 7 | 47 | 2,784 |
| | 80 | 254 | 71 | 0.8 | 234 | 813 | 128 | 36 | 7 | 22 | 1,566 |
| Chacahoula | 160 | 320 | 0 | 1 | 382 | 899 | 553 | 0 | 28 | 15 | 2,198 |
| Clovelly | 120 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.4 | 5 |
| | 90 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.4 | 5 |
| | 80 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0.4 | 5 |
| Richton | 160 | 350 | 130 | 1 | 201 | 3,060 | 0 | 0 | 56 | 10 | 3,808 |
| Stratton Ridge | 160 | 371 | 39 | 1 | 45 | 911 | 9 | 0 | 125 | 4 | 1,505 |
| West Hackberry | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 15 | 81 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 81 |

**Table 5.1-2: Commitment of Land for Proposed New and Expansion SPR Alternatives (acres)**

| Alternative | SPR Site Construction and Buffer | Terminal, Pump Station, and Tank Farm | RWI Structure | Power Line ROW | Crude Oil Pipeline ROW | Brine Pipeline ROW | Brine Injection Well Area | Raw Water Pipeline ROW | Access Road Area | Total Land Area |
|---|---|---|---|---|---|---|---|---|---|---|
| Bruinsburg w/3 Expansion Sites | 652 | 141 | 1 | 194 | 2,020 | 237 | 169 | 7 | 49 | 3,470 |
| Bruinsburg w/2 Expansion Sites | 571 | 141 | 1 | 194 | 2,020 | 237 | 169 | 7 | 49 | 3,389 |
| Chacahoula w/3 Expansion Sites | 607 | 0 | 1 | 382 | 1,177 | 576 | 96 | 28 | 17 | 2,884 |
| Chacahoula w/2 Expansion Sites | 526 | 0 | 1 | 382 | 1,177 | 576 | 96 | 28 | 17 | 2,803 |
| Clovelly | 289 | 4 | 1 | 0 | 278 | 23 | 96 | 0 | 2 | 693 |
| Clovelly 80 MMB-Bruinsburg 80 MMB w/3 Expansion Sites | 335 | 75 | 1.8 | 234 | 813 | 135 | 132 | 7 | 24 | 1,757 |
| Clovelly 80 MMB-Bruinsburg 80 MMB w/2 Expansion Sites | 460 | 75 | 1.8 | 234 | 1,091 | 151 | 132 | 7 | 24.4 | 2,176 |
| Clovelly 90 MMB-Bruinsburg 80 MMB w/3 Expansion Sites | 541 | 75 | 1.8 | 234 | 1,091 | 151 | 132 | 7 | 24 | 2,257 |
| Clovelly 90 MMB-Bruinsburg 80 MMB w/2 Expansion Sites | 460 | 75 | 1.8 | 234 | 1,091 | 151 | 132 | 7 | 24 | 2,176 |
| Richton w/3 Expansion Sites | 637 | 130 | 1 | 201 | 3,338 | 23 | 96 | 56 | 12 | 4,494 |
| Richton w/2 Expansion Sites | 556 | 130 | 1 | 201 | 3,338 | 23 | 96 | 56 | 12 | 4,413 |
| Stratton Ridge w/3 Expansion Sites | 658 | 39 | 1 | 45 | 1,189 | 32 | 96 | 125 | 6 | 2,191 |
| Stratton Ridge w/2 Expansion Sites | 577 | 39 | 1 | 45 | 1,189 | 32 | 96 | 125 | 6 | 2,110 |
| No Action | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Notes:

1 acre = 0.405 hectare

## 5.2 WATER RESOURCES

There are three primary uses of water during site construction and operation: cavern leaching, cavern fill, and drawdown. Water used for both leaching and drawdown would be discharged or disposed of as brine. Such water use is considered an irretrievably committed resource for each of the proposed new and expansion sites. No significant water resources would be required for construction of the pipelines or terminals or for SPR operations other than fill and drawdown. Leaching requires a volume of water equal to approximately seven times the potential storage capacity of the leached cavern, in other words, seven barrels of water will create storage capacity for one barrel of oil. Quantities of water that would be required for leaching storage caverns for each site and for each alternative are shown in table 5.2-1 and table 5.2-2. Storage cavern fill and drawdown cycles require a water volume approximately equal to the displaced volume of oil (i.e., one barrel of water/one barrel of oil). Water requirements for fill/withdrawal for each alternative are also shown in table 5.2-1 and table 5.2-2, assuming five drawdown/fill cycles over the operating life of each proposed new and expansion SPR site.

## 5.3 MATERIAL AND ENERGY RESOURCES

Material and energy resources committed for development of the SPR expansion sites would include construction materials (e.g., steel and concrete), electricity, fuel (e.g., diesel and gasoline), salt, and crude oil through evaporation losses during cavern fill, storage, and drawdown. All energy used during construction and operation would be irretrievable. Relative to the potential energy stored in the form of crude oil in the caverns, the energy consumed during construction and operation would be very small. In addition, the amount of crude oil lost to evaporation during fill, storage, and drawdown would be small.

The amount of construction materials used in constructing the proposed new and expansion SPR sites would also be small as compared to overall consumption of construction materials. The salt, which is potentially economically valuable, would be leached from the caverns and disposed of as brine and its economic value would be irreversibly lost. The amount of salt lost during cavern leaching would have a volume equal to the storage capacity of the oil storage caverns. The volume of salt that would be lost during leaching may be estimated from the cavern volume using an average density of 2.16 grams per cubic centimeter (135 pounds per cubic foot). For a single 10 MMB storage cavern, the volume of salt is equivalent to 3.4 million metric tons (3.7 million short tons) of salt. For all of the alternatives, the amount of salt lost would be approximately 95 million metric tons (105 million short tons).

**Table 5.2-1: Water Required for Construction and Operation of Proposed New and Expansion SPR Sites (MMB)**

| Site | Capacity | Leaching | Fill/Withdrawal | Total |
|---|---|---|---|---|
| Bruinsburg | 160 | 1,120 | 800 | 1,920 |
| Chacahoula | 160 | 1,120 | 800 | 1,920 |
| Clovelly | 120 | 840 | 600 | 1,440 |
| Clovelly 80 MMB and Bruinsburg 80 MMB | 160 | 1,120 | 800 | 1,920 |
| Clovelly 90 MMB and Bruinsburg 80 MMB | 170 | 1,190 | 850 | 2,040 |
| Richton | 160 | 1,120 | 800 | 1,920 |
| Stratton Ridge | 160 | 1,120 | 800 | 1,920 |
| Bayou Choctaw | 20 | 140 | 100 | 240 |
| Bayou Choctaw | 30 | 140 | 150 | 290 |
| Big Hill | 108 | 756 | 540 | 1,296 |
| Big Hill | 96 | 672 | 480 | 1,152 |
| Big Hill | 84 | 588 | 420 | 1,008 |
| Big Hill | 80 | 560 | 400 | 960 |
| Big Hill | 72 | 504 | 360 | 864 |
| West Hackberry | 0 | 0 | 0 | 0 |
| West Hackberry | 15 | 0 | 75 | 75 |

**Table 5.2-2: Water Required for Construction and Operation of SPR Expansion Alternatives (MMB)**

| Alternative | Capacity | Leaching | Fill/Withdrawal | Total |
|---|---|---|---|---|
| Bruinsburg w/3 Expansion Sites | 275 | 1,820 | 1,375 | 3,195 |
| Bruinsburg w/2 Expansion Sites | 276 | 1,932 | 1,380 | 3,312 |
| Chacahoula w/3 Expansion Sites | 275 | 1,820 | 1,375 | 3,195 |
| Chacahoula w/2 Expansion Sites | 276 | 1,932 | 1,380 | 3,312 |
| Clovelly | 273 | 1,736 | 1,365 | 3,101 |
| Clovelly 80 MMB-Bruinsburg 80 MMB w/3 Expansion Sites | 275 | 1,820 | 1,375 | 3,195 |
| Clovelly 80 MMB-Bruinsburg 80 MMB w/2 Expansion Sites | 276 | 1,932 | 1,380 | 3,312 |
| Clovelly 90 MMB-Bruinsburg w/3 80 MMB Expansion Sites | 277 | 1,834 | 1,385 | 3,219 |
| Clovelly 90 MMB-Bruinsburg w/2 80 MMB Expansion Sites | 274 | 1,918 | 1,370 | 3,288 |
| Richton w/3 Expansion Sites | 275 | 1,820 | 1,375 | 3,195 |
| Richton w/2 Expansion Sites | 276 | 1,932 | 1,380 | 3,312 |
| Stratton Ridge w/3 Expansion Sites | 275 | 1,820 | 1,375 | 3,195 |
| Stratton Ridge w/2 Expansion Sites | 276 | 1,932 | 1,380 | 3,312 |
| No-Action | 0 | 0 | 0 | 0 |

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# Chapter 6. List of Preparers

## 6.1 DEPARTMENT OF ENERGY OFFICE OF PETROLEUM RESERVES

| | |
|---|---|
| Donald Silawsky | Document Manager<br>DOE Office of Petroleum Reserve |

## 6.2 CONTRACTORS

ICF Consulting and its subcontractors were responsible for supporting the Department of Energy in conducting its environmental analysis and preparing the EIS.

| **Name, Firm, Project Function** | **Qualifications/Experience** |
|---|---|
| **Project Management** | |
| Alan Summerville, ICF Consulting<br>Project Manager | M.A., City Planning; B.A., Economics and Political Science<br>15 years of experience participating in and managing the preparation of EISs and EAs |
| Todd Stribley, ICF Consulting<br>Deputy Project Manager | M.S., Environmental Science and Policy; B.S., Biology<br>11 years of experience supporting environmental projects |
| Stephen Wyngarden, ICF Consulting<br>Technical Guidance | M.E.M., Environmental Management; B.S., Applied Biology<br>15 years of experience in human health and environmental impact assessment, waste management, and environmental policy analysis |
| Michael Berg, ICF Consulting<br>Document Manager | J.D., Law; M.P.P., Public Policy; B.A., Economics/Political Science<br>24 years of experience managing and conducting economic, policy, scientific, and other technical analyses |
| **Technical and Other Expertise (alphabetically)** | |
| Lisa Bendixen, ICF Consulting<br>Environmental Risk and Health and Safety | S.M., Operations Research; S.B., Applied Mathematics<br>25 years of experience in risk assessment for safety and spills/releases from fixed facilities and transportation systems, and NEPA |
| Henry Camp, ICF Consulting<br>Engineering Interface | B.A., Biology<br>21 years of experience in environmental analysis, environmental impact assessment, and NEPA documentation |
| Ed Carr, ICF Consulting<br>Air Quality | M.S., Atmospheric Science<br>19 years experience in air quality assessments and analysis, source assessment impact analysis, and State Implementation Planning |

| Name, Firm, Project Function | Qualifications/Experience |
|---|---|
| Joshua Cleland, ICF Consulting<br>Biological Resources (special status species) | M.E.M., Resources Economics and Policy; B.S., Biology<br>14 years of experience in risk and environmental assessment |
| Karen Fadely, ICF Consulting<br>Biological Resources | M.E.M., Conservation Science and Policy; B.S., Biology<br>5 years of experience in environmental sciences and communication |
| Ian G. Frost, EEE Consulting, Inc.<br>Biological Resources, Water Resources, Wetlands | M.S., Zoology; B.S., Zoology<br>22 years experience in water resource and biological studies, NEPA documents, and wetlands |
| Erin Healy, ICF Consulting<br>Water Resources | M.S., Marine Science; B.A., Geology/Biology<br>18 years experience in environmental assessment, water resources, and hazardous materials |
| Walter Palmer, ICF Consulting<br>Water Resources | M.S., Environmental Management; B.S. Biology/Chemistry<br>28 years of experience in environmental management and environmental impact assessment |
| Ami Parekh, ICF Consulting<br>Water Resources | M.P.H., Environmental Health; B.A., Geology<br>4 years of experience in environmental site assessments, water resources, and human health risk assessments |
| Robert Randall, Consultant<br>Brine Discharge Modeling | Ph.D. Ocean Engineering, M.S., Ocean Engineering, B.M.E., Mechanical Engineering<br>30 years of experience in ocean and civil engineering |
| Richard M. Stanwood, ICF Consulting<br>Land Use, Socioeconomics | M.S., Economics; B.A., Psychology<br>25 years of experience in socioeconomics, land use, environmental impact analysis, and NEPA documentation |
| Carter M. Teague, EEE Consulting, Inc.<br>Biological Resources, Water Resources, Wetlands | B.S., Natural Resources<br>8 years experience in water resource and biological studies and environmental permitting |
| Hova Woods, ICF Consulting<br>Environmental Justice, Public Involvement | M.P.A., Environmental Management; B.S., Finance<br>5 years of experience in NEPA environmental analyses, environmental regulatory analysis, and environmental management |
| Gary Yoshioka, ICF Consulting<br>Accidental Releases | Ph.D., Geography and Environmental Engineering;<br>J.D., Law; B.S., Mathematics<br>38 years of experience in environmental research, environmental regulatory analysis, and oil spill data analysis |

| Name, Firm, Project Function | Qualifications/Experience |
|---|---|
| Elizabeth Zelasko, ICF Consulting<br>Biological Resources | M.S.E.S., M.P.A. Environmental Policy and Natural Resource Management; B.S., Biology<br>3 years of experience in environmental analysis and documentation |
| Lianyang Zhang, ICF Consulting<br>Geology and Soils | Ph.D., Geotechnical Engineering; M.S., Civil and Environmental Engineering; B.S., Naval Architecture and Ocean Engineering<br>16 years of experience in geotechnical and geoenvironmental engineering, rock mechanics, and earthquake engineering |

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# Chapter 7. List of Agencies, Organizations, and People Receiving Copies of the Draft Environmental Impact Statement

This section lists the agencies, officials, and other interested parties who are receiving the draft EIS on the proposed expansion of the Strategic Petroleum Reserve.

On February 14, 2006, DOE mailed a postcard to 607 people and organizations on the project mailing list asking for a response from anyone who wanted to receive a copy of the draft EIS when it became available. The postcard indicated that paper copies of the draft EIS would be available in libraries and an electronic copy would be available on the project's website. DOE asked participants to return the postage-paid postcard after indicating one of the following choices:

- Do not mail me any materials;
- Mail me a CD-ROM of the complete draft EIS;
- Mail me a paper copy of the Summary of the draft EIS;
- Mail me a paper copy of the complete draft EIS; and
- Remove me from your mailing list.

When this document was issued, DOE filed copies of the draft EIS with EPA, who published a Notice of Availability of the draft EIS in the *Federal Register*. DOE also distributed paper copies of the draft EIS to federal agencies, key state agencies, elected officials, local libraries, and any other requesting parties. Additional summaries of the draft EIS were sent to the remaining interested parties. All recipients of the paper copies and the summaries also received a CD-ROM of the draft EIS unless they requested otherwise. The following sections list state and federal agencies, tribal entities, elected officials and other interested parties who received the draft EIS or summary. DOE will provide copies to other interested organizations or individuals on request.

## 7.1 FEDERAL AGENCIES

- Minerals Management Service
- National Ocean Service, Office of Ocean and Coastal Resource Management
- National Park Service
- NOAA Fisheries
- U.S. Army Corps of Engineers
- U.S. Coast Guard
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Forest Service

## 7.2 STATE AGENCIES

### 7.2.1 Louisiana

- Louisiana Department of Agriculture and Forestry
- Louisiana Department of Environmental Quality
- Louisiana Department of Health and Hospitals
- Louisiana Department of Natural Resources
- Louisiana Department of Transportation and Development

- Louisiana Department of Wildlife and Fisheries
- Louisiana Division of Historic Preservation
- Louisiana Oil Spill Coordinator's Office

### 7.2.2 Mississippi

- Grand Gulf Military Park
- Mississippi Department of Archives and History
- Mississippi Department of Environmental Quality
- Mississippi Department of Marine Resources
- Mississippi Department of Transportation
- Mississippi Department of Wildlife, Fisheries, and Parks
- Mississippi Development Authority

### 7.2.3 Texas

- Houston Galveston Area Council
- Railroad Commission of Texas
- Southeast Texas Regional Planning Commission
- Texas Association of Regional Councils
- Texas Commission on Environmental Quality
- Texas General Land Office
- Texas Health and Human Services Commission
- Texas Historical Commission
- Texas Parks and Wildlife Department
- Texas State Health Services
- Texas State Soil and Water Conservation Board
- Texas Water Development Board

## 7.3 TRIBAL GOVERNMENTS

- Chitimacha Tribe of Louisiana
- Point au Chien Tribe
- Quapaw Tribal Business Committee

## 7.4 COUNTY AND LOCAL GOVERNMENT

### 7.4.1 Louisiana

- Calcasieu Parish Office of Homeland Security and Emergency Preparedness
- Calcasieu Parish Planning and Development
- Cameron Parish Health Services
- Cameron Parish Office of Emergency Preparedness
- Greater Lafourche Port Commission
- Iberville Parish Office of Emergency Preparedness
- Iberville Parish Parks and Recreation
- Iberville Parish Permit and Inspection Department
- Iberville Parish Planning Commission
- Lafourche Parish Department of Coastal, Energy, and Environment
- Lafourche Parish Department of Public Works
- Lafourche Parish Emergency Preparedness Office

- Lafourche Parish Parks, Recreation, and Public Facilities
- Terrebonne Parish Consolidated Government
- Terrebonne Parish Economic Development Authority
- West Baton Rouge Office of Planning and Zoning

### 7.4.2 Mississippi

- Claiborne County Administration
- Claiborne County Emergency Coordinator
- Claiborne County Planning Department
- Hattiesburg Public Services Department
- Hattiesburg Urban Development Department
- Jackson County Chamber of Commerce
- Jackson County Emergency Communications District
- Jackson County Planning Department
- Lincoln County Chamber of Commerce
- Lincoln County Emergency Coordinator
- The Area Development Partnership

### 7.4.3 Texas

- Brazoria County Emergency Management
- Brazoria County Parks Department
- Galveston County Office of Emergency Management
- Galveston County Public Information Office
- Jefferson County Emergency Management Office
- Jefferson County Environmental Control

## 7.5 ELECTED OFFICIALS

### 7.5.1 Congressional Committees

#### 7.5.1.1 Senate

- Committee on Appropriations
  - Subcommittee on Energy and Water Development
- Committee on the Budget
- Committee on Energy and Natural Resources

#### 7.5.1.2 House of Representatives

- Committee on Appropriations
  - Subcommittee on Energy and Water Development
- Committee on the Budget
- Committee on Energy and Commerce
  - Subcommittee on Energy and Air Quality

## 7.5.2 Louisiana

### 7.5.2.1 Federal

- Representative Richard Baker, 6th District, LA
- Representative Charles W. Boustany, Jr., 7th District, LA
- Senator Mary Landrieu, LA
- Representative Charlie Melancon, 3rd District, LA
- Senator David Vitter, LA

### 7.5.2.2 State

- Governor Kathleen Babineaux Blanco, LA
- Representative Damon J. Baldone, Louisiana State House of Representatives
- Senator Joel Chiasson, Louisiana State Senate
- Representative Carla Blanchard Dartez, Louisiana State House of Representatives
- Representative Gordon Dove, Sr., Louisiana State House of Representatives
- Senator Reggie P. Dupre, Jr., Louisiana State Senate
- Representative Mickey Frith, Louisiana State House of Representatives
- Senator D.A. Gautreaux, Louisiana State Senate
- Representative Karen Gaudet St. Germain, Louisiana State House of Representatives
- Senator Robert Marrionneaux, Louisiana State Senate
- Representative Loulan J. Pitre, Jr., Louisiana State House of Representatives
- Representative Roy J. Quezaire Jr., Louisiana State House of Representatives
- Senator Gerald J. Thuennisen, Louisiana State Senate
- Representative Warren J. Triche, Jr., Louisiana State House of Representatives

### 7.5.2.3 Local

- Curtis Anderson, Council, District V, West Baton Rouge Parish, LA
- Donnis Bell, Sr., Constable, Ward 6, Calcasieu Parish, LA
- Ralph Bergeron, City Council, District 3, Port Allen, LA
- James Bernauer, Mayor, Patterson, LA
- Riley Berthelot, Jr., President, West Baton Rouge Parish, LA
- Roland Bertrand, Constable, Ward 2, Calcasieu Parish, LA
- Sheila Bourdreaux, Council Clerk, Lafourche Parish, LA
- Carroll P. Bourgeois, Mayor, Addis, LA
- Herman Bourgeois, Mayor, Gramercy, LA
- Joey Bouziga, Mayor, Golden Meadow, LA
- Nolan J. Broussard, Constable, Ward 1, Cameron Parish, LA
- Orgy Broussard, Constable, Ward 8, Calcasieu Parish, LA
- Huey Brown, Council, District VI, West Baton Rouge Parish, LA
- Maurice A. Brown, Mayor, White Castle, LA
- Charles Caillouet, Mayor, Thibodaux, LA
- Brent Callais, Council, District 8, Lafourche Parish, LA
- Harlan Cashiola, Council, District VII , West Baton Rouge Parish, LA
- Richard Champagne, Mayor, Lockport, LA
- Michael Chauffe, Mayor, Grosse Tete, LA
- Gwen S. Constance, Constable, Ward 6, Cameron Parish, LA
- Hilda Curry, Mayor, New Iberia, LA
- Jeff Duhon, Constable, Ward 7, Calcasieu Parish, LA

- Daniel J. East, Constable, Ward 2, Cameron Parish, LA
- Tommy Eschete, City Council Administrator, Thibodaux, LA
- Rayward Fremin, Jr., Council, District 3, Iberia Parish, LA
- George Grace, Mayor, St. Gabriel, LA
- Mark A. Gulotta, Mayor, Plaquemine, LA
- Emmet Hardaway, Mayor of Berwick, LA
- Raymond Harris, Jr., Mayor, Franklin, LA
- Melvin Holden, Mayor, Baton Rouge, LA
- Earnestine Horn, Policy Jury Administrator, Cameron Parish, LA
- Johnny Johnson, City Council, District 4, Port Allen, LA
- Larry Johnson, Council, District VIII, West Baton Rouge Parish, LA
- Jeff “Petit” Kershaw, Council, District II, West Baton Rouge Parish, LA
- Ray Helen Lawrence, City Council, District 1, Port Allen, LA
- Dantin Leblanc, Council, District IV, West Baton Rouge Parish, LA
- Derek A. Lewis, Mayor, Port Allen, LA
- Daniel Lorraine, Council, District 9, Lafourche Parish, LA
- R.J. Loupe, Jr., Mayor Pro-tem, Port Allen, LA
- Michael Matherne, Council Chairman, Lafourche Parish, LA
- Tim Matte, Mayor, Morgan City, LA
- Hal McMillin, Police Juror, District 14, Calcasieu Parish, LA
- S. Mark McMurry, Parish Administrator, Calcasieu Parish, LA
- Brandon Mellieon, City Inspector, Plaquemine, LA
- Louis Michiels, Sr., Constable, Ward 1, Calcasieu Parish, LA
- Nicholas P. Migliacio, Council, District 9, Iberville Parish, LA
- Randal Mouch, Council, District I, West Baton Rouge Parish, LA
- Betty Nelson, Council, District VIII, West Baton Rouge Parish, LA
- Joey Normand, Mayor, Brusly, LA
- J. Mitchell Ourso, Jr., President, Council, Iberville Parish, LA
- Troas Poche, Mayor, Lutcher, LA
- Charlotte Randolph, President, Lafourche Parish, LA
- Hugh Riviere, City Council, District 2, Port Allen, LA
- Randy Roach, Mayor, Lake Charles, LA
- Nolton Saltzman, Constable, Ward 3, Cameron Parish, LA
- Don Schwab, Council President, Terrebonne Parish, LA
- Randy Sexton, Council, District 11, Iberville Parish, LA
- Arnold L. Smith, Constable, Ward 5, Calcasieu Parish, LA
- John P. Stephenson, Constable, Ward 4, Cameron Parish, LA
- Leroy Sullivan, Mayor, Donaldsville, LA
- Wayne Thibodeaux, Council, District 2, Terrebonne Parish, LA
- Steve Trahan, President, Police Jury Cameron Parish, LA
- Tim Trahan, Constable, Ward 5, Cameron Parish, LA
- Keith Washington, Sr., Council, District III, West Baton Rouge Parish, LA

### 7.5.3 Mississippi

#### 7.5.3.1 Federal

- Senator Thad Cochran, MS
- Senator Trent Lott, MS
- Representative Charles W. “Chip” Pickering, Jr., 3rd District, MS
- Representative Gene Taylor, 4th District, MS

- Representative Bennie Thompson, 2nd District, MS
- Representative Roger Wicker, 1st District, MS

#### 7.5.3.2 State

- Governor Haley Barbour, MS
- Representative Billy Broomfield, Mississippi State House of Representatives
- Secretary Eric Clark, Mississippi Secretary of State
- Representative Daniel D. Guice Jr., Mississippi State House of Representatives
- Representative Frank Hamilton, Mississippi State House of Representatives
- Representative Gregory L. Holloway, Sr., Mississippi State House of Representatives
- Representative Robert L. Johnson III, Mississippi State House of Representatives
- Senator Thomas E. King, Jr., Mississippi State Senate
- Senator Ezell Lee, Mississippi State Senate
- Representative America Middleton, Mississippi State House of Representatives
- Senator T.O. Moffat, Mississippi State Senate
- Senator J. Edward Morgan, Mississippi State Senate
- Senator Lynn Posey, Mississippi State Senate
- Representative John O. Read, Mississippi State House of Representatives
- Senator Thomas E. Robertson, Mississippi State Senate
- Representative J. Shaun Walley, Mississippi State House of Representatives
- Representative Carmel Wells-Smith, Mississippi State House of Representatives
- Representative Henry B. Zuber III, Mississippi State House of Representatives

#### 7.5.3.3 Local

- Seren Ainsworth, Mayor, Ocean Springs, MS
- John Anderson, Board of Supervisors, Perry County, MS
- Amelda Arnold, Mayor, Port Gibson, MS
- Matthew J. Avara, Mayor, Pascagoula, MS
- Manly Barton, President, Board of Supervisors, Jackson County, MS
- Xavier Bishop, Mayor, Moss Point, MS
- Bobby Bolton, Board of Supervisors, Perry County, MS
- William Brooks, Mayor, Leakesville, MS
- Tim Broussard, Board of Supervisors, District 3, Jackson County, MS
- Allen Burks, Board of Supervisors, Claiborne County, MS
- Linda Carroll, Assessor/Collector, Perry County, MS
- Martha Clark, Circuit Court Clerk, Perry County, MS
- William Cooley, Board of Supervisors, Perry County, MS
- Johnny L. DuPree, Mayor, Hattiesburg, MS
- Albert Garner, Mayor, New Augusta, MS
- Prentiss Garner, Board of Supervisors, Perry County, MS
- Mott Headley, Jr., Claiborne County MS Board of Supervisors
- Carlos Herring, Sheriff , Perry County, MS
- James Johnston, Board of Supervisors, Claiborne County, MS
- Martha Lott, Board of Supervisors, Claiborne County, MS
- Doug Moak, Board of Supervisors, Lincoln County, MS
- Pete Pope, Mayor, Gautier, MS
- L.D. Ready, Alderman, Richton, MS
- Leon Small, Mayor, Beaumont, MS
- John Thompson, Board of Supervisors, Perry County, MS

- Tim Waldrup, Mayor, Ellisville, MS
- Gary Walker, Board of Supervisors, Lincoln County, MS
- Vickie Walters, Chancery Court Clerk, Perry County, MS
- Gregory Warr, Mayor, Gulfport, MS
- Bobby Watts, Board of Supervisors, Lincoln County, MS
- Michael Wells, Board of Supervisors, Claiborne County, MS
- Jimmy White, Mayor, Richton, MS
- Nolan Williamson, Board of Supervisors, Lincoln County, MS
- Jerry Wilson, Board of Supervisors, Lincoln County, MS

### 7.5.4 Texas

#### 7.5.4.1 Federal

- Senator Kay Bailey Hutchison, TX
- Senator John Cornyn, TX
- Representative Ron Paul, 14th District, TX
- Representative Ted Poe, 2nd District, TX

#### 7.5.4.2 State

- Representative Alma A. Allen, Texas State House of Representatives
- Representative Kevin Bailey, Texas State House of Representatives
- Representative Dwayne Bohac, Texas State House of Representatives
- Representative Dennis Bonnen, Texas State House of Representatives
- Representative William Callegari, Texas State House of Representatives
- Representative Garnet F. Coleman, Texas State House of Representatives
- Representative Joel Crabb, Texas State House of Representatives
- Representative John E. Davis, Texas State House of Representatives
- Representative Glenda Dawson, Texas State House of Representatives
- Representative Joe D. Deshotel, Texas State House of Representatives
- Representative Harold V. Dulton, Texas State House of Representatives
- Representative Alma Edwards, Texas State House of Representatives
- Representative Gary Elkins, Texas State House of Representatives
- Senator Rodney G. Ellis, Texas State Senate
- Representative Jessica C. Ferrar, Texas State House of Representatives
- Senator Mario Gallegos, Texas State Senate
- Representative Peggy Hamric, Texas State House of Representatives
- Representative Scott Hochberg, Texas State House of Representatives
- Senator Mike Jackson, Texas State Senate
- Senator Kyle Janek, Texas State Senate
- Senator Jon Lindsay, Texas State Senate
- Representative Joseph Nixon, Texas State House of Representatives
- Representative Rick Noriega, Texas State House of Representatives
- Governor Rick Perry, TX
- Representative Debbie Riddle, Texas State House of Representatives
- Representative Wayne Smith, Texas State House of Representatives
- Representative Robert Talton, Texas State House of Representatives
- Representative Senfronia P. Thompson, Texas State House of Representatives
- Representative Sylvester Turner, Texas State House of Representatives
- Representative Corbin Van Arsdale, Texas State House of Representatives

- Representative Hubert Vo, Texas State House of Representatives
- Senator John Whitmore, Texas State Senate
- Senator Thomas Williams, Texas State Senate
- Representative Martha Wong, Texas State House of Representatives
- Representative Beverly Woolley, Texas State House of Representatives

#### 7.5.4.3 Local

- Jerry Adkins, Mayor, Clute, TX
- Everette Alfred, Commissioner, Precinct 4, Jefferson County, TX
- Eddie Arnold, Commissioner, Precinct 1, Jefferson County, TX
- Mark Domingue, Commissioner, Precinct 2, Jefferson County, TX
- Charles Fancy, Mayor, China, TX
- Alfred S. Gerson, Judge, Jefferson County, TX
- Guy N. Goodson, Mayor, Beaumont, TX
- Carl R. Griffith, Jr., Judge, Jefferson County, TX
- Waymon D. Hallmark, Commissioner, Precinct 3, Jefferson County, TX
- Bruce Halstead, Mayor, Liberty, TX
- Mark Huddleson, Commissioner, Precinct 1, Chambers County, TX
- Guy Jackson, Mayor, Anahuac, TX
- Tanya Lowrance, Secretary to Commissioner, Precinct 1, Chambers County, TX
- Calvin Mundinger, Mayor, Baytown, TX
- James Nevil, Mayor, Quintana, TX
- Oscar Ortiz, Mayor, Port Arthur, TX
- Dude Payne, Commissioner, Precinct 1, Brazoria County, TX
- Jim Phillips, Mayor, Freeport, TX
- Shane Pirtle, Mayor, Lake Jackson, TX
- L.M. Sebasta, Jr., Mayor, Angleton, TX
- Larry Stanley, Brazoria County Texas Commissioner
- John Willy, Judge, Brazoria County, TX

## 7.6 ORGANIZATIONS AND INDUSTRY

- Argonne National Laboratory
- Bayou Preservation Organization
- Coalition to Restore Coastal Louisiana
- Continental Shelf Associates, Inc.
- Dominion Transmission, Inc.
- Dow Chemical Company
- Earthwave Society
- Flynt and Associates
- Gulf Restoration Network
- Houston Wilderness
- Iberia Industrial Development Foundation
- Ineos Olefins and Polymers, USA
- International Chemical Workers Union
- Lake Charles American Press
- Marine Advisory Service
- Mississippi State Audubon Society
- Parsons Brinckerhoff
- Pinto Energy Partners, L.P.

- Save the Pascagoula
- Sierra Club
- South Mississippi Electric Power Association
- T. Baker Smith, Inc. Environmental Services
- Terrebonne Parish Economic Development Authority
- Texas A&M University, Oil Spill Control Technologies
- Wetland Habitat Alliance of Texas
- Wildlife Rescue and Rehabilitation

## 7.7 MEDIA

- KBTV-TV, NBC, Beaumont, TX
- KTMD-TV, Telemundo Network Group LLC, Houston, TX,
- Lake Charles American Press
- The Daily Comet/Daily Courier
- The Pasadena Citizen
- The Vicksburg Post
- WVLA-TV, NBC, Baton Rouge, LA

## 7.8 OTHER

- Ms. Jorene Aycock
- Mr. Charles Bellam
- Mr. Billy S. Broome
- Ms. Opal Moreau Broussard
- Mr. Charles Bush
- Ms. Bertha Cassingham
- Ms. Dorthy Cole
- Mr. Benny C. Crawford
- Mr. Carlton Dufrechou
- Mr. Nate Ellis
- Mr. Rome Emmons
- Mr. Bobbie Hawkins
- Mr. T.L. Howell
- Frank and Ann Jones
- Mr. Tom Landrum
- Mr. Dennis Mahaffey
- Mr. Jeff May
- Mr. Randall P. Montgomery
- Dr. James A. Nicholson
- Mr. Julius Ridgeway
- Mr. W.J. Rhodes
- Mr. B. Sachau
- Mr. Sanford
- Mr. V.L. Scott
- Ms. Wilma Subra
- Dr. Robert Thoms
- Mr. Neill Wood
- Ms. Peggy Wood
- Joey and Gloria Wyatt

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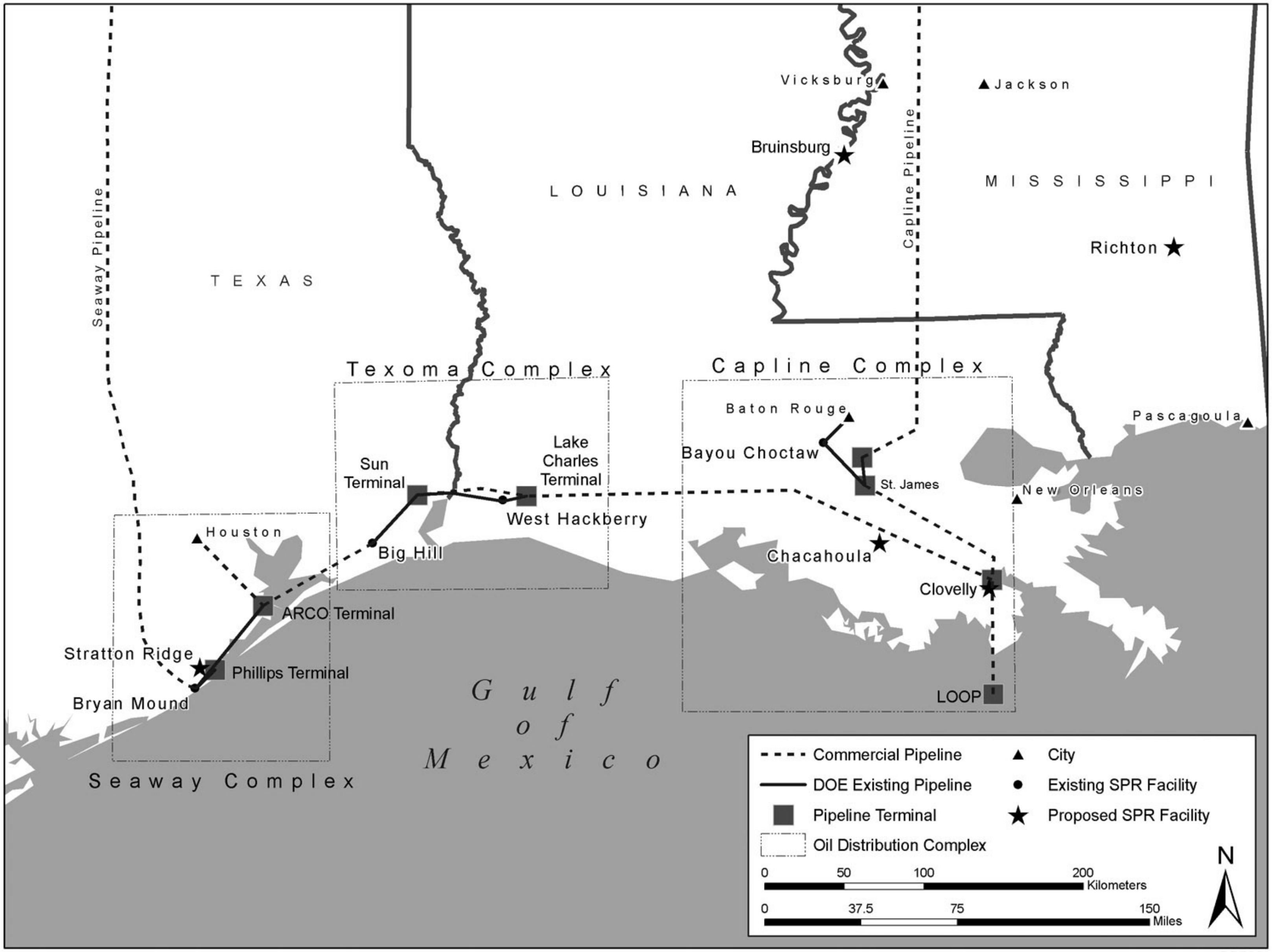
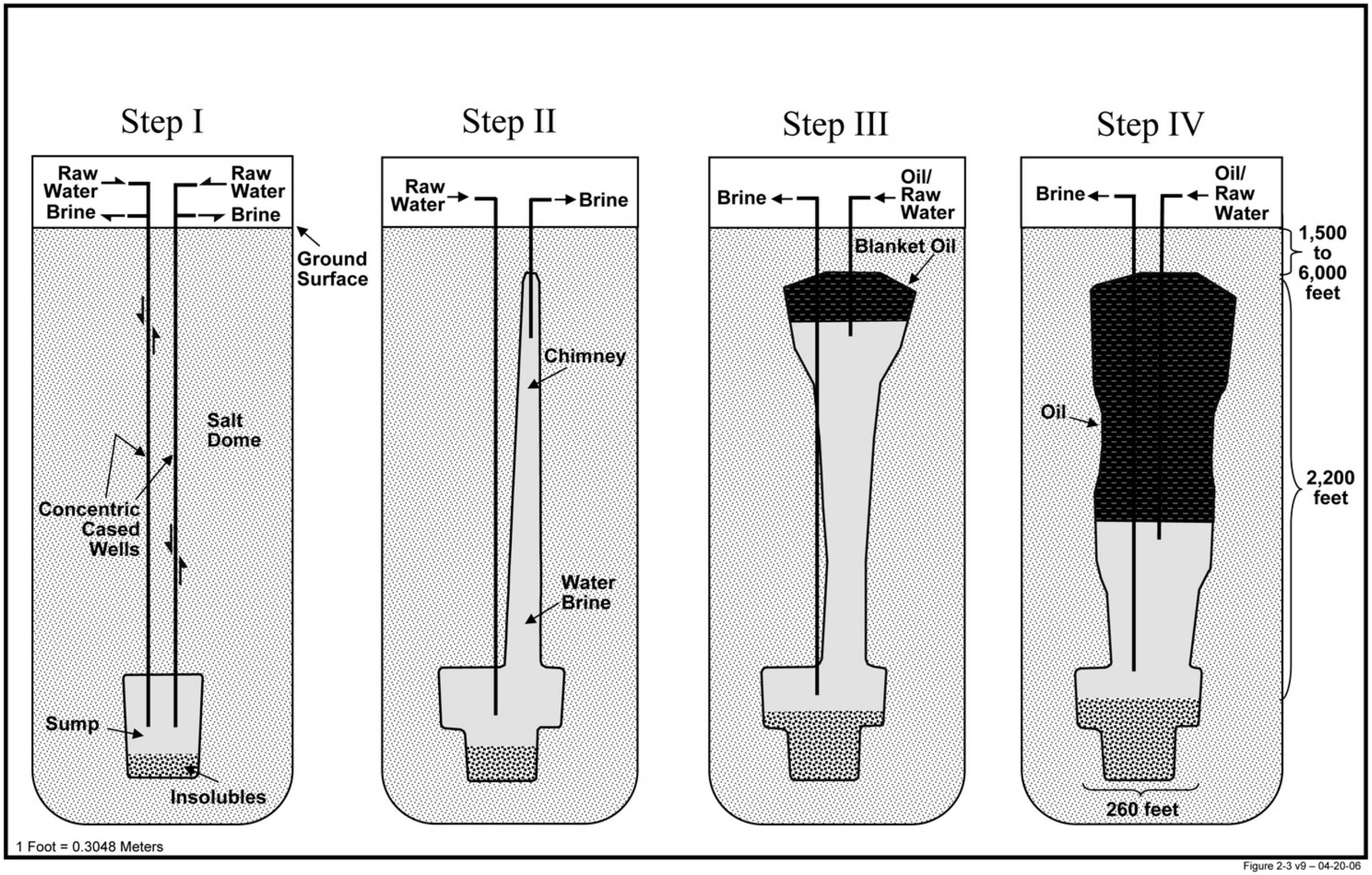
**Figure 2.2.2-1: Existing and Proposed SPR Facility Locations and Crude Oil Distribution Complexes**




ICF20060411DBP001

**Figure 2.3-1: Cavern Creation in Construction of a Typical SPR Cavern**




1 foot = 0.3048 Meters

**Figure 2.3-2: Filling a Typical SPR Storage Site**

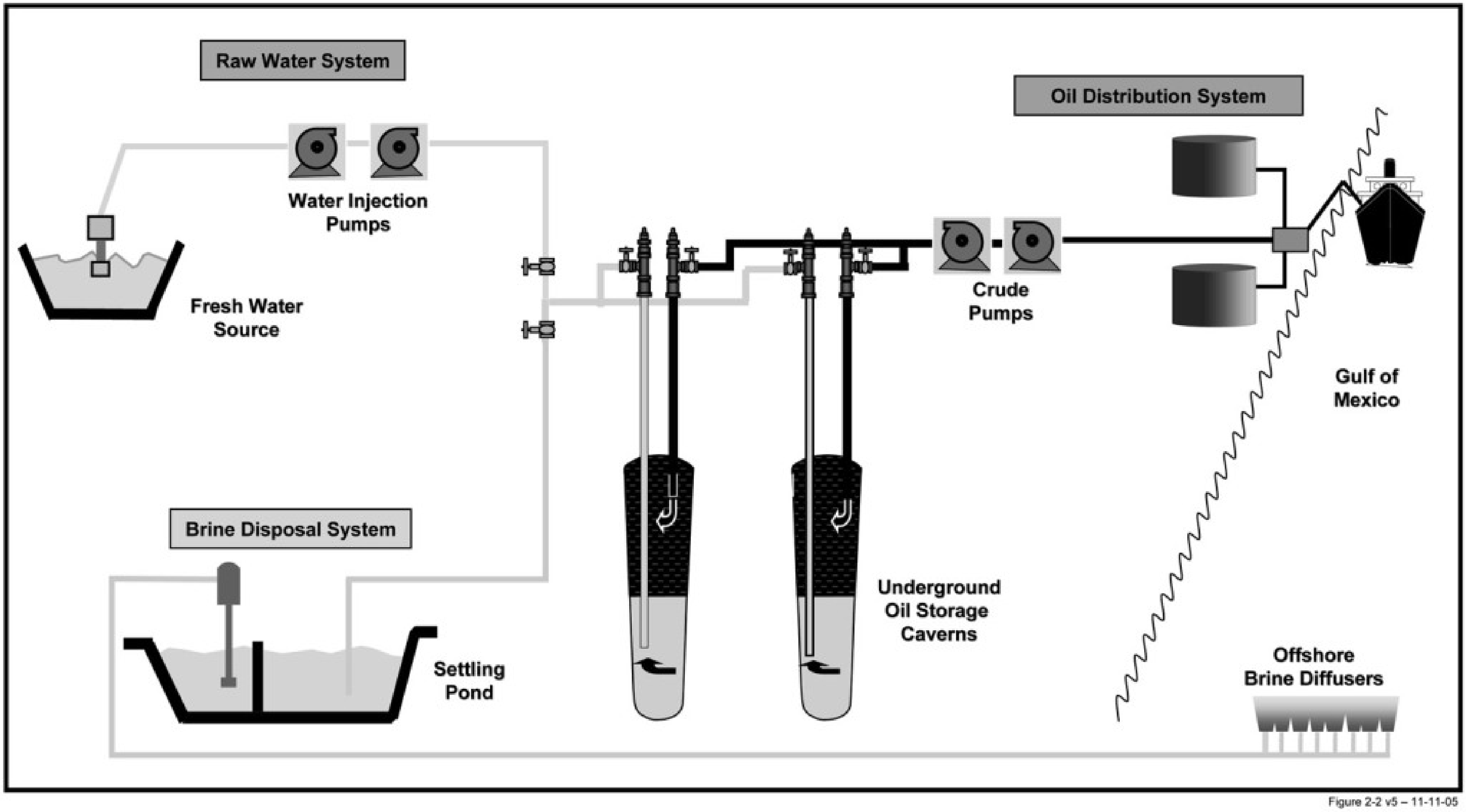


**Figure 2.3.2-1: RWI Typical Structure**

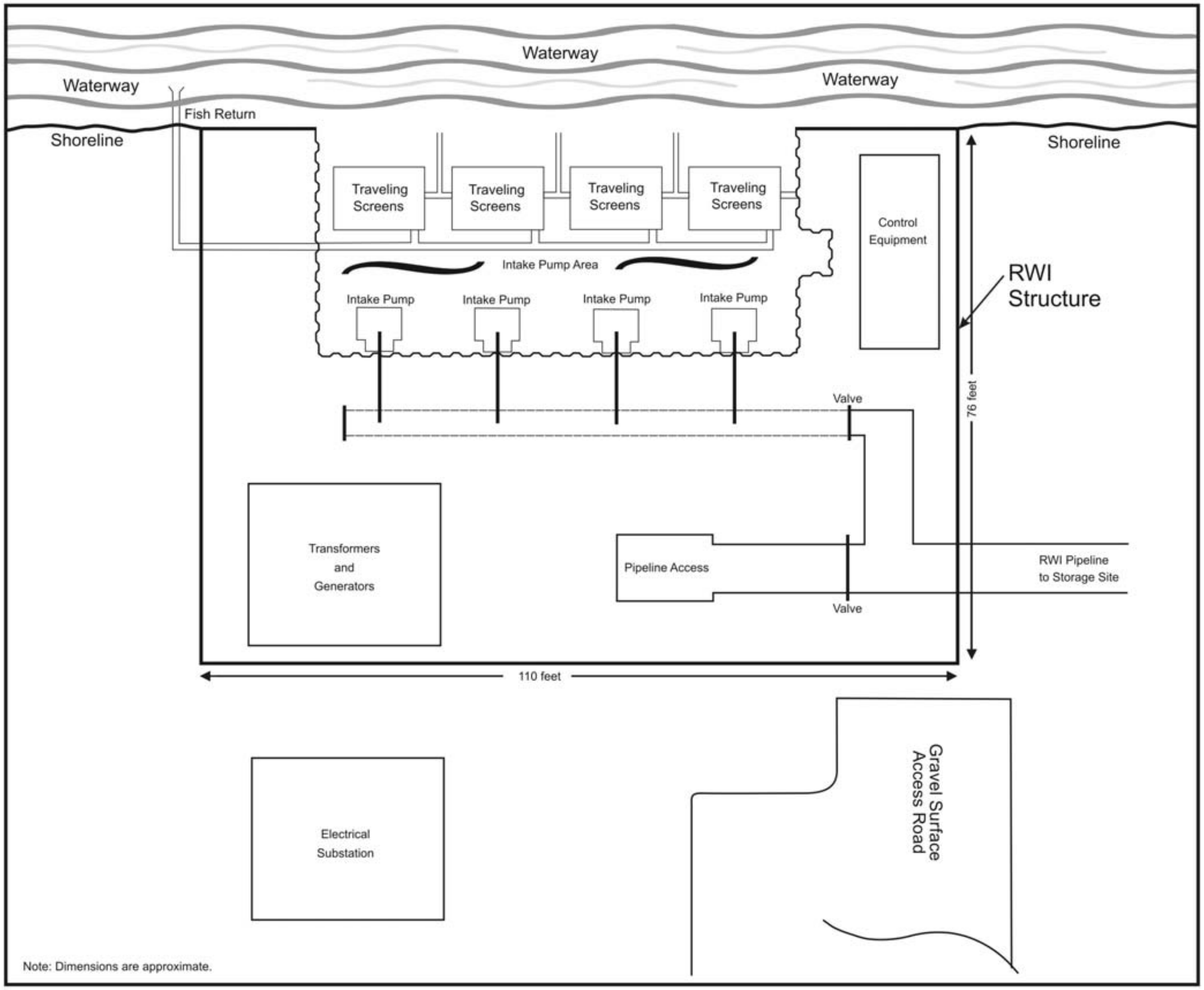


**Figure 2.3.9-1: Uplands and Wetlands Pipeline ROW Requirements for a Single Pipeline**

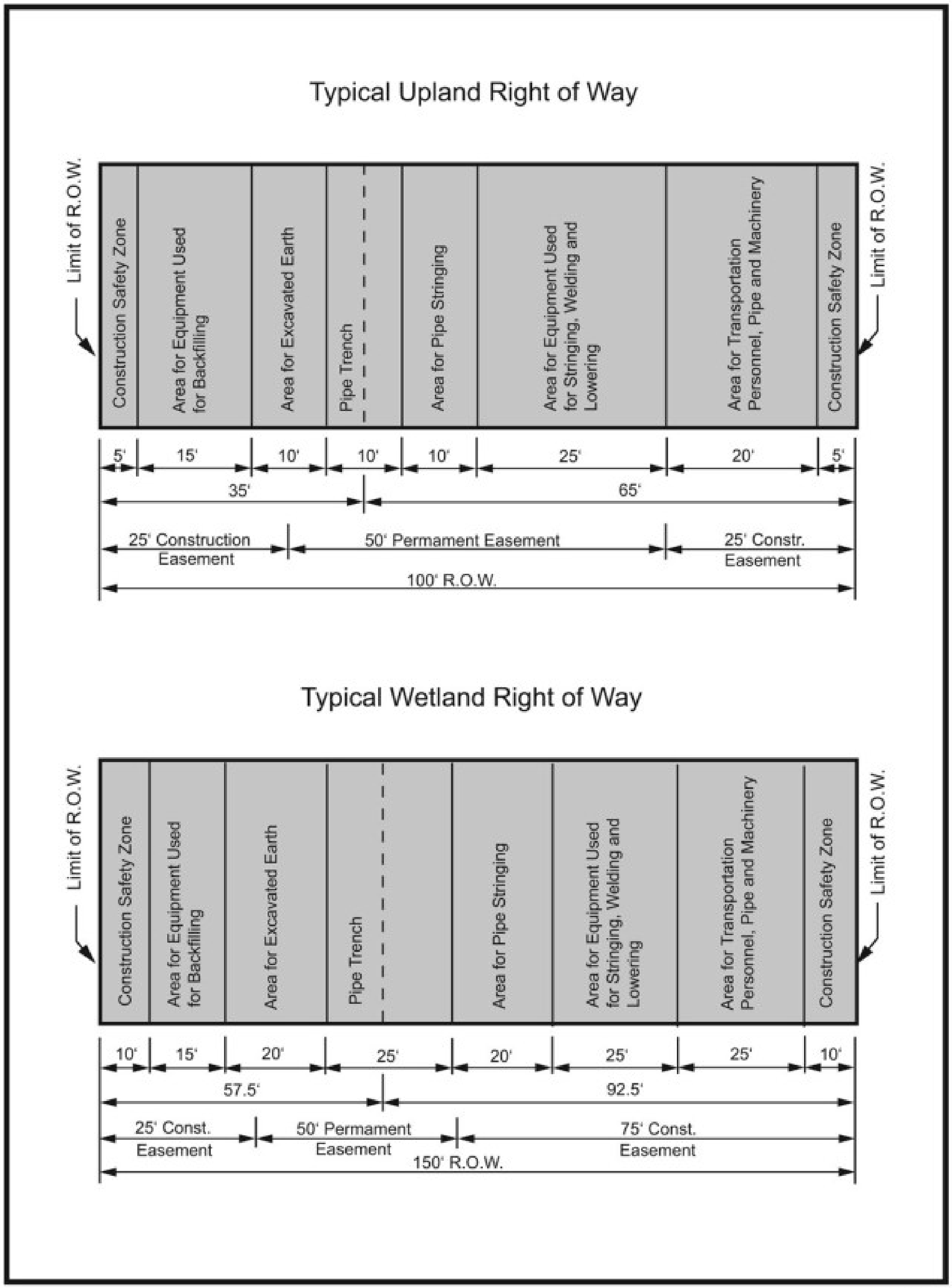
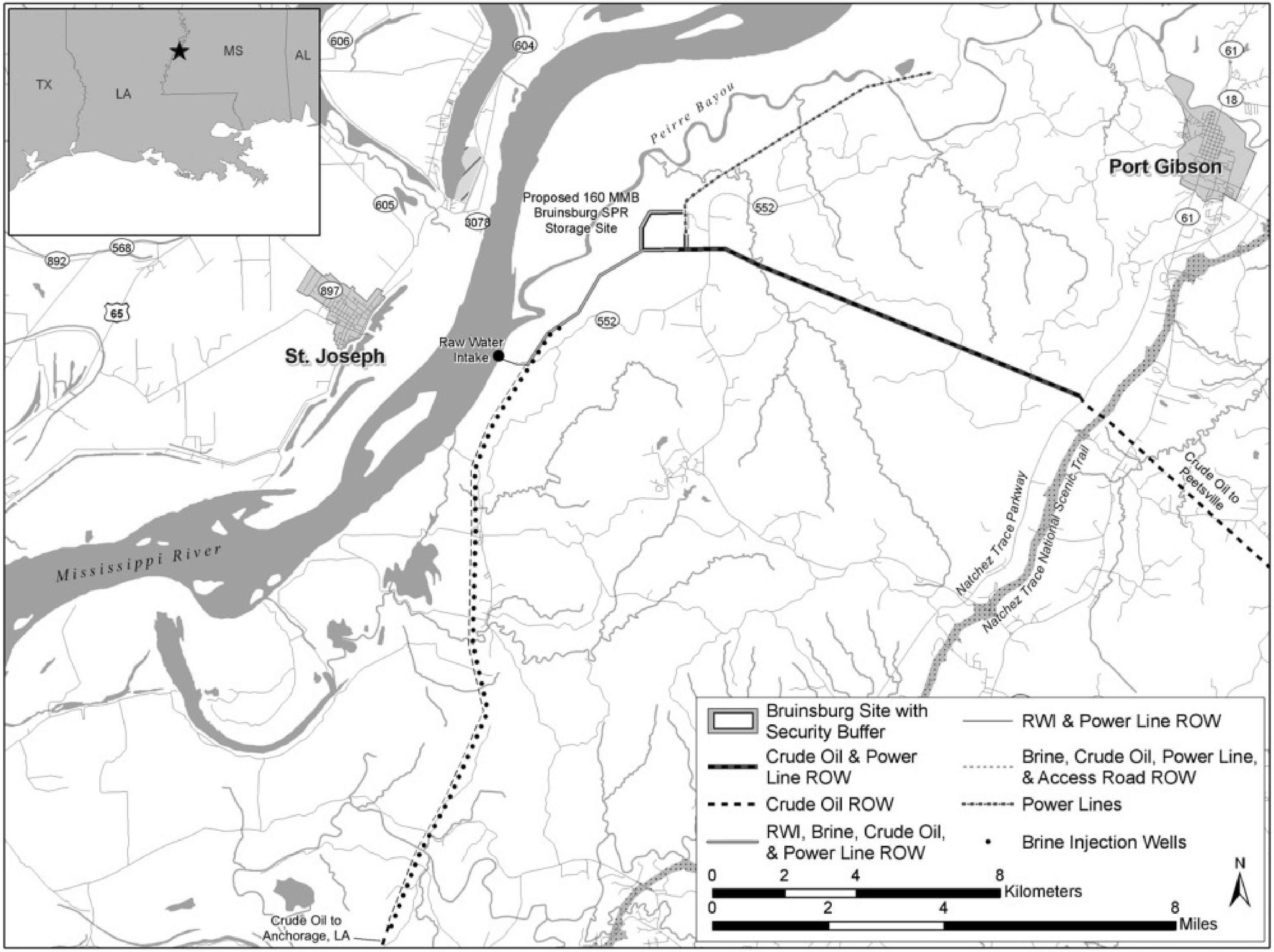


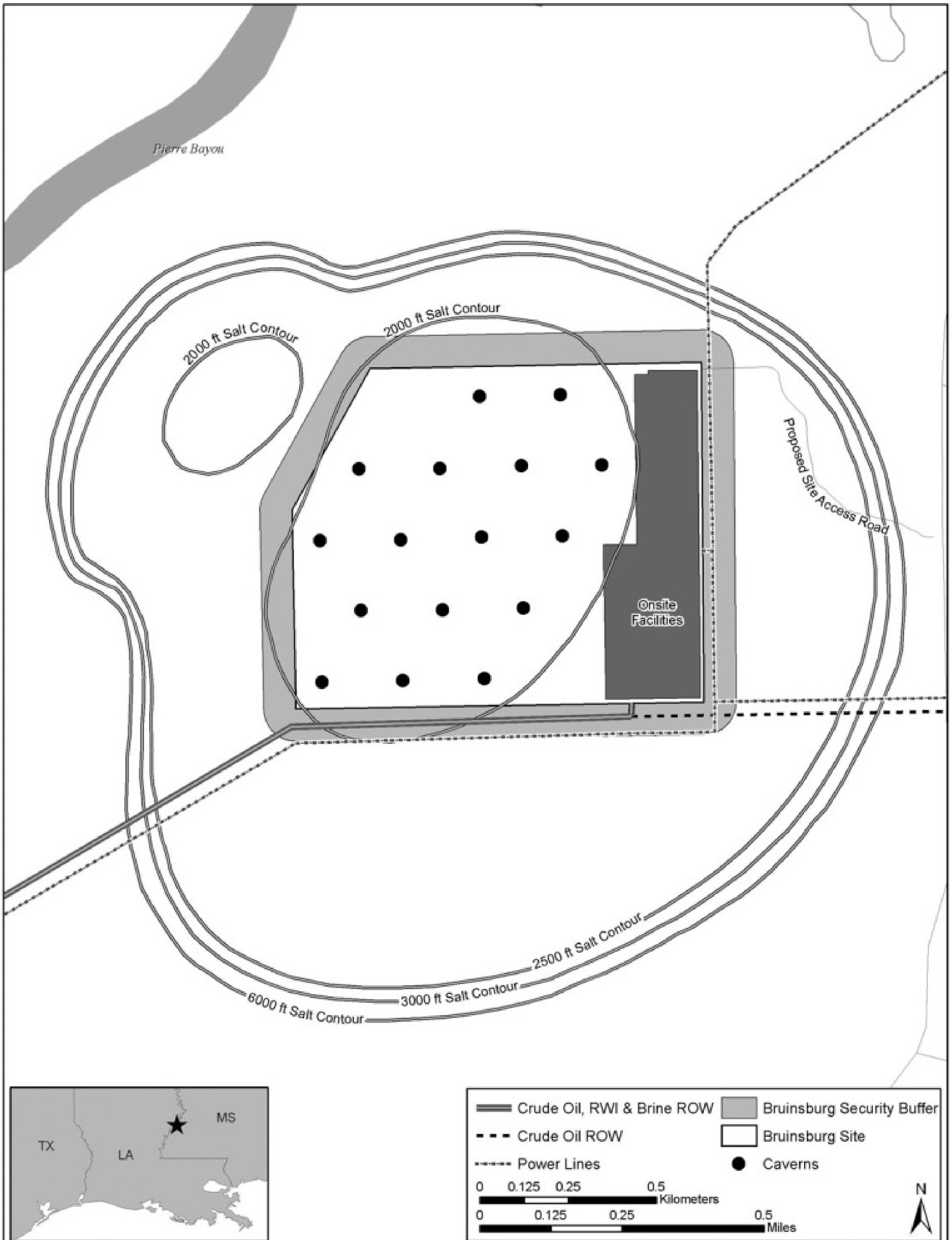

Figure 2-6 v2
10-14-05

**Figure 2.4.1-1: Location of Proposed Bruinsburg Storage Site**




ICF20060509DBP006

**Figure 2.4.1-2: Proposed Layout of Bruinsburg Storage Site**




ICF20060510DBP009

**Figure 2.4.1-3: Proposed Pipelines for Bruinsburg 160 MMB Storage Site**

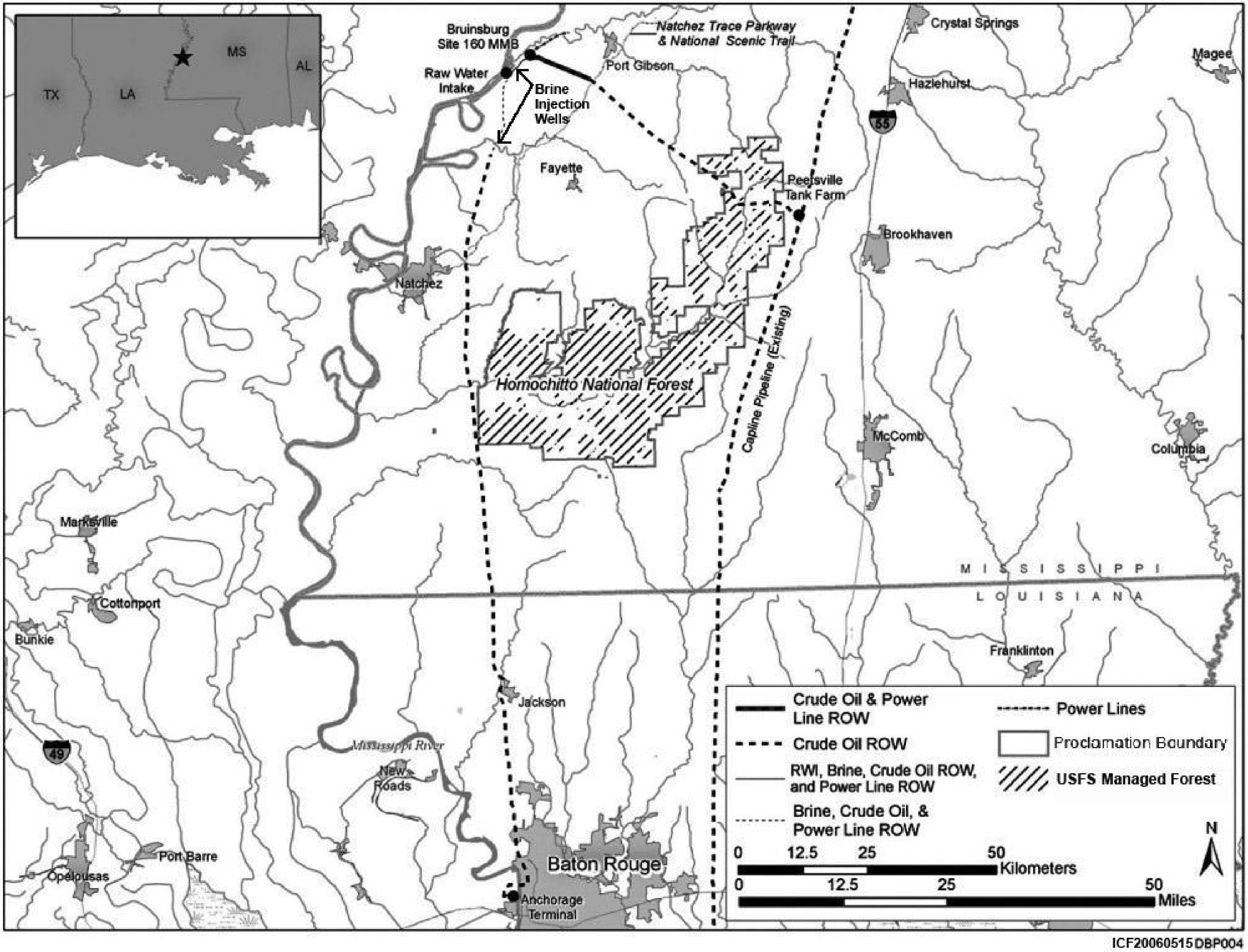


**Figure 2.4.1-4: Proposed Layout of Peetsville Tank Farm**

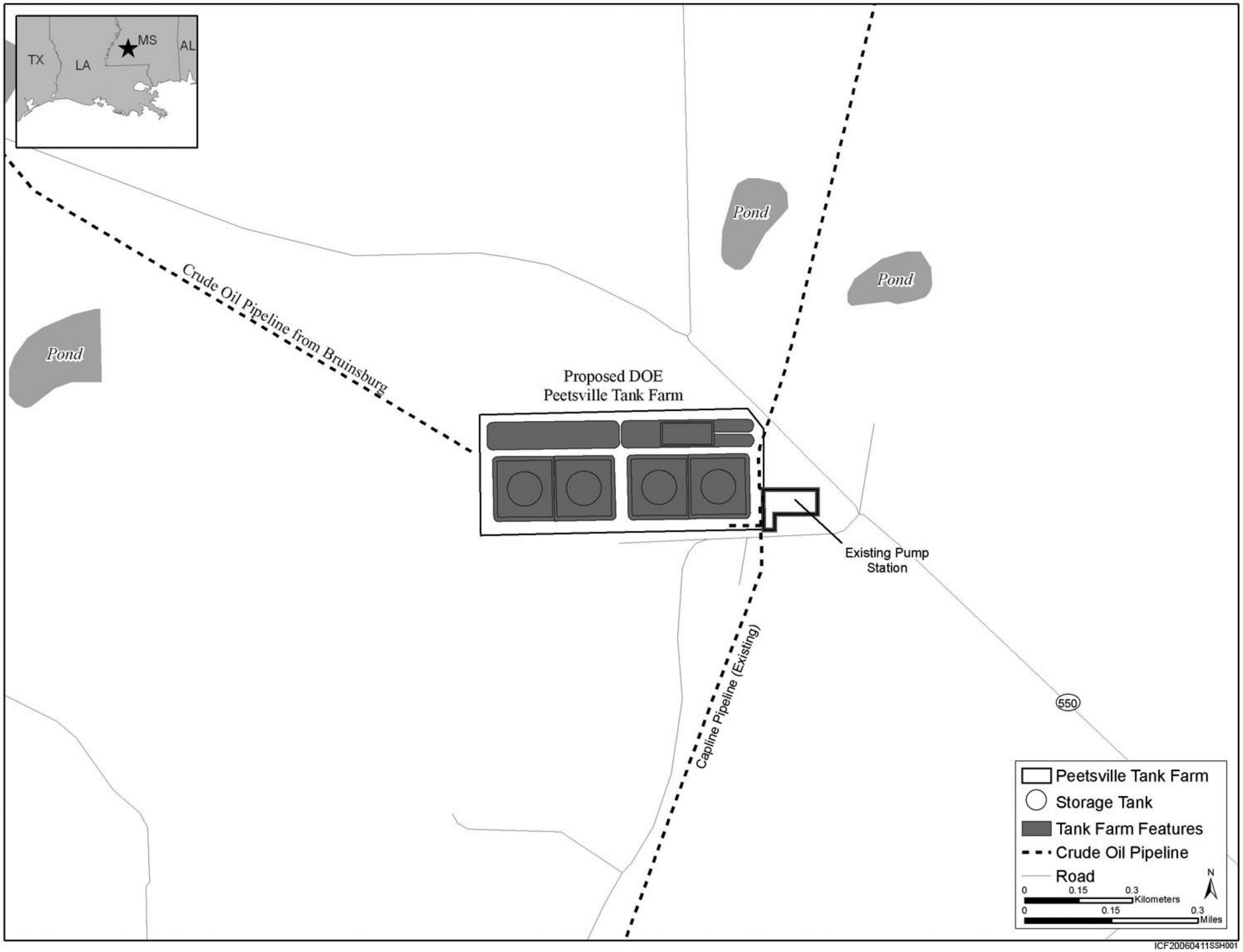
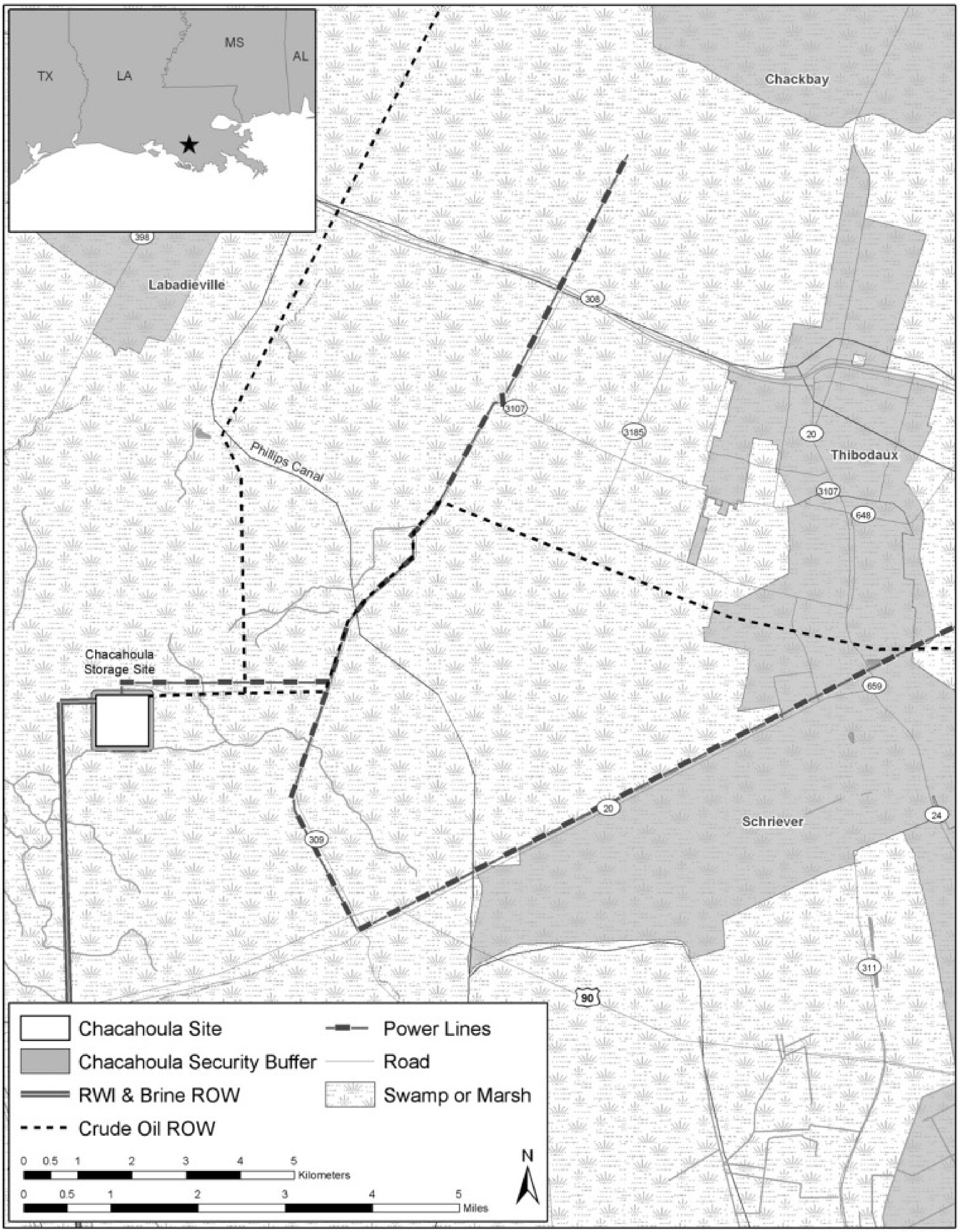


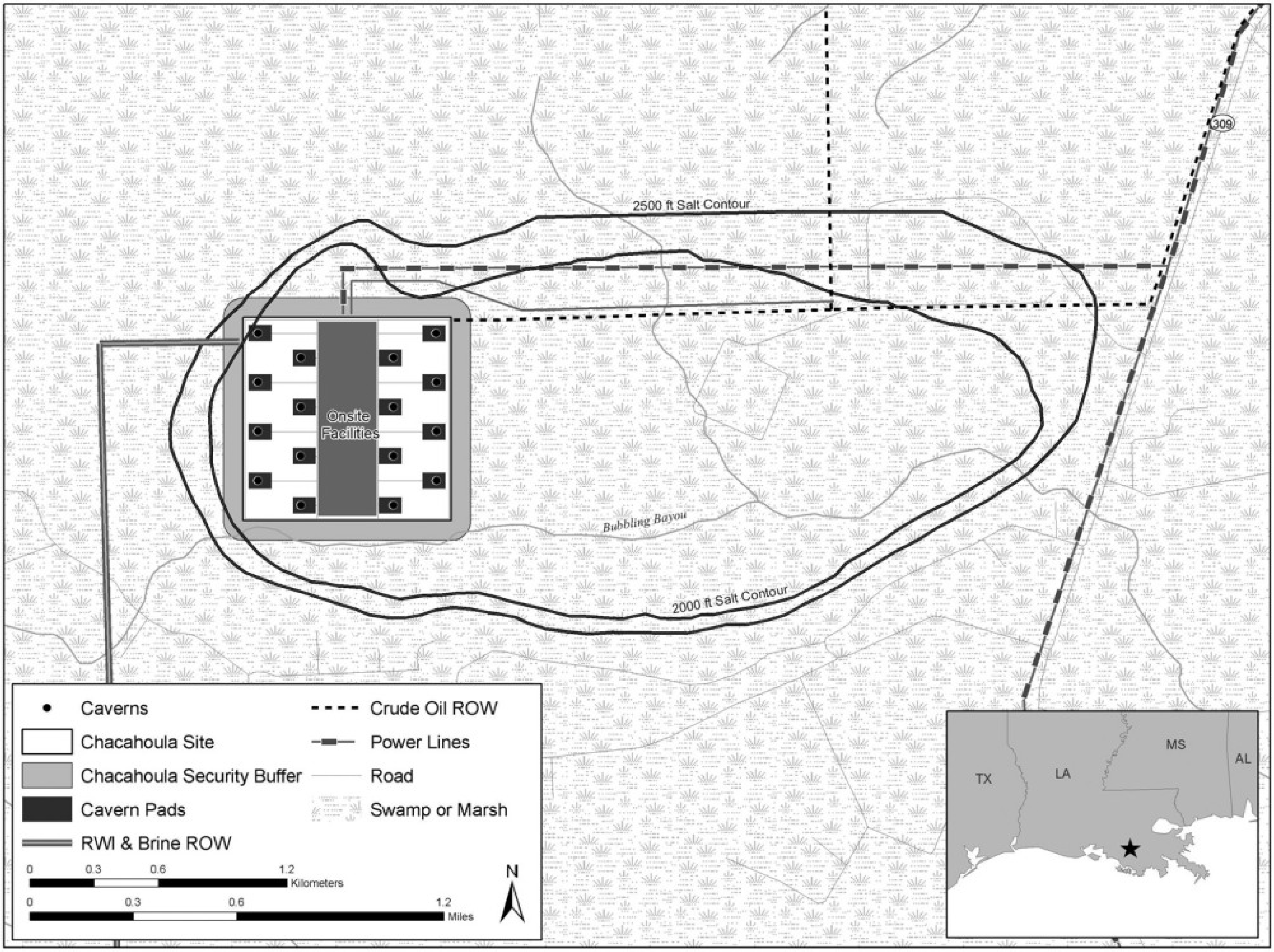
**Figure 2.4.1-5: Proposed Layout of Anchorage Tank Farm**

**Figure 2.4.2-1:  Location of Proposed Chacahoula Storage Site**



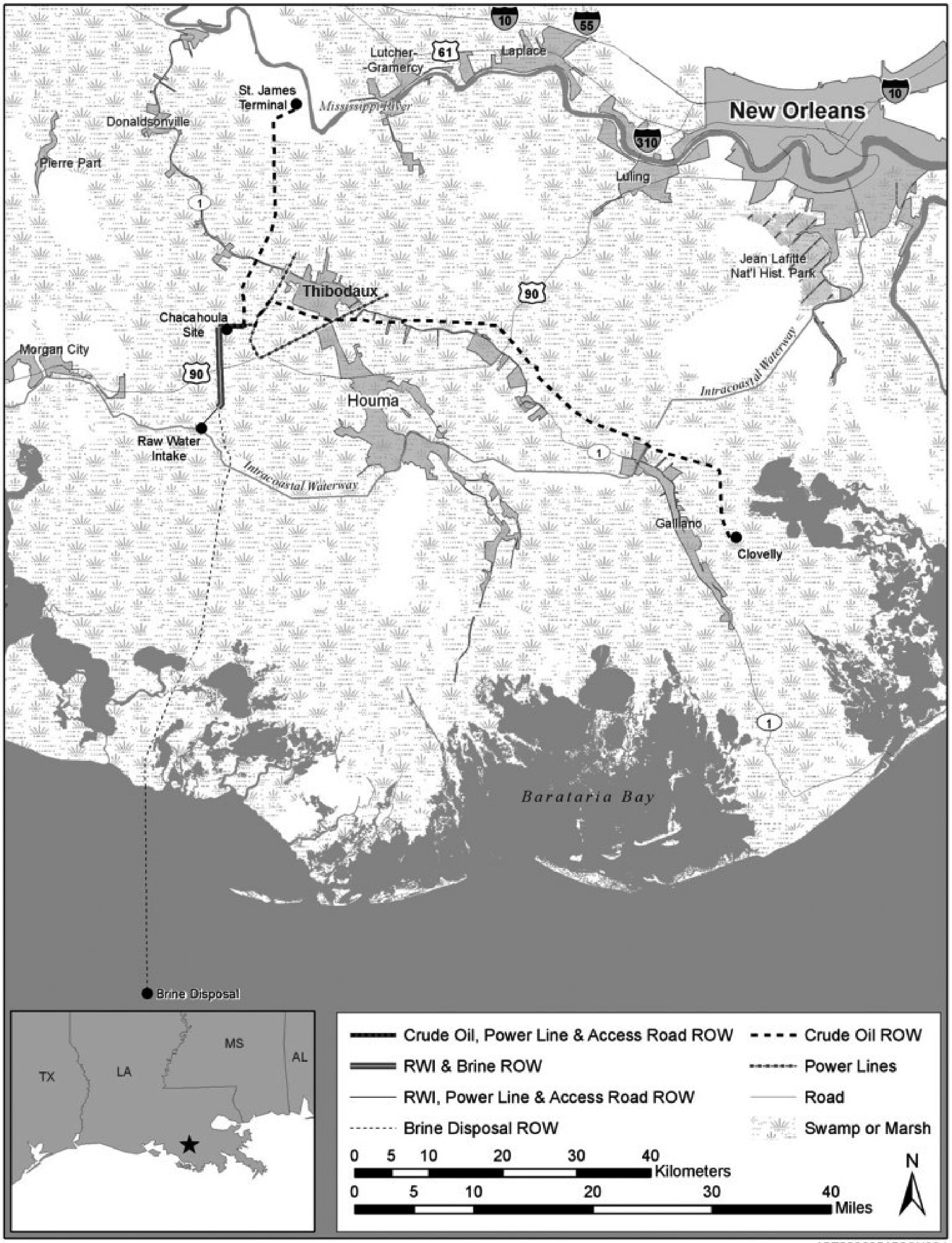

ICF20060509SSH013

**Figure 2.4.2-2: Proposed Layout of Chacahoula Storage Site**



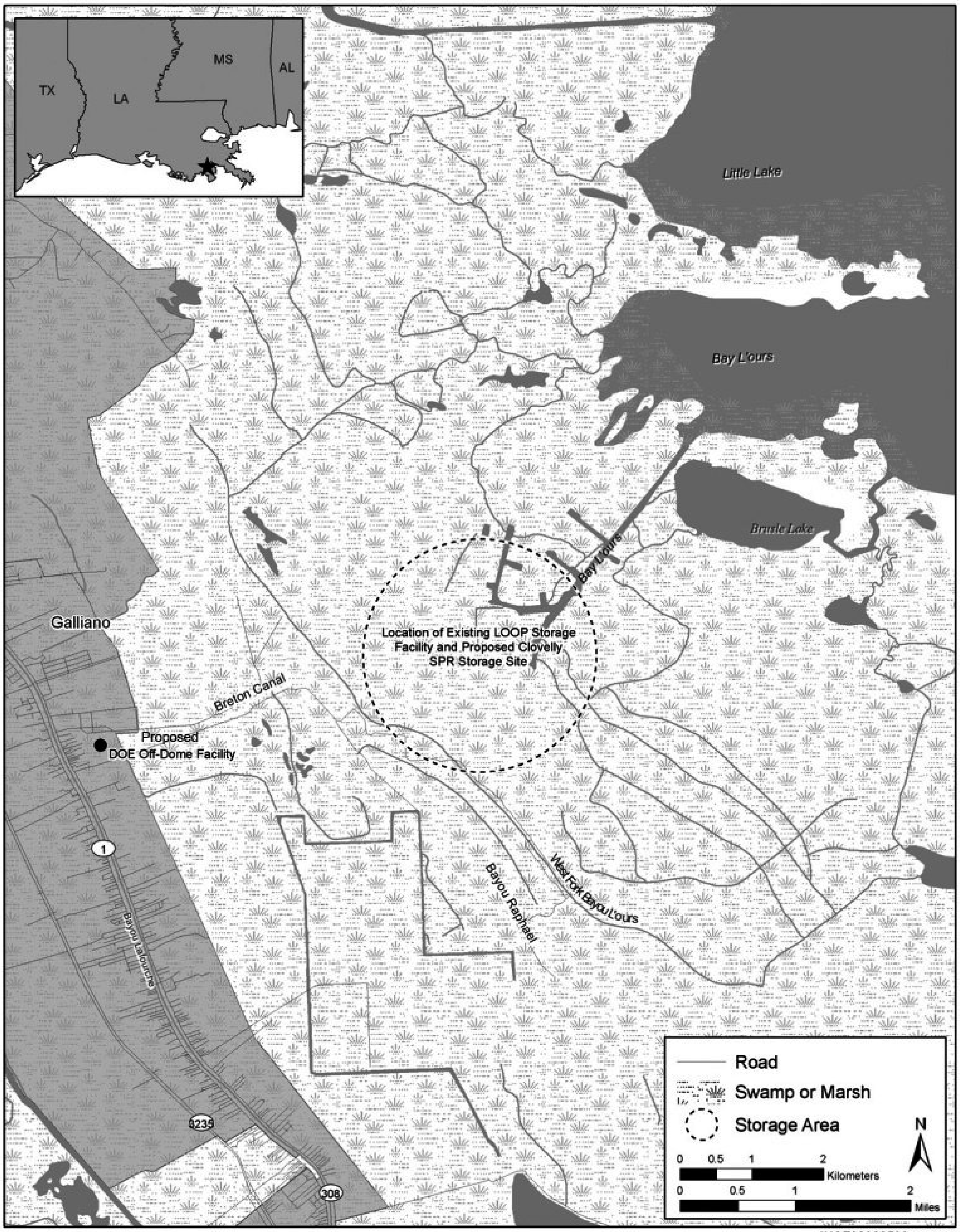

ICF20060510SSH003

**Figure 2.4.2-3: Proposed Pipelines for Chacahoula Storage Site**



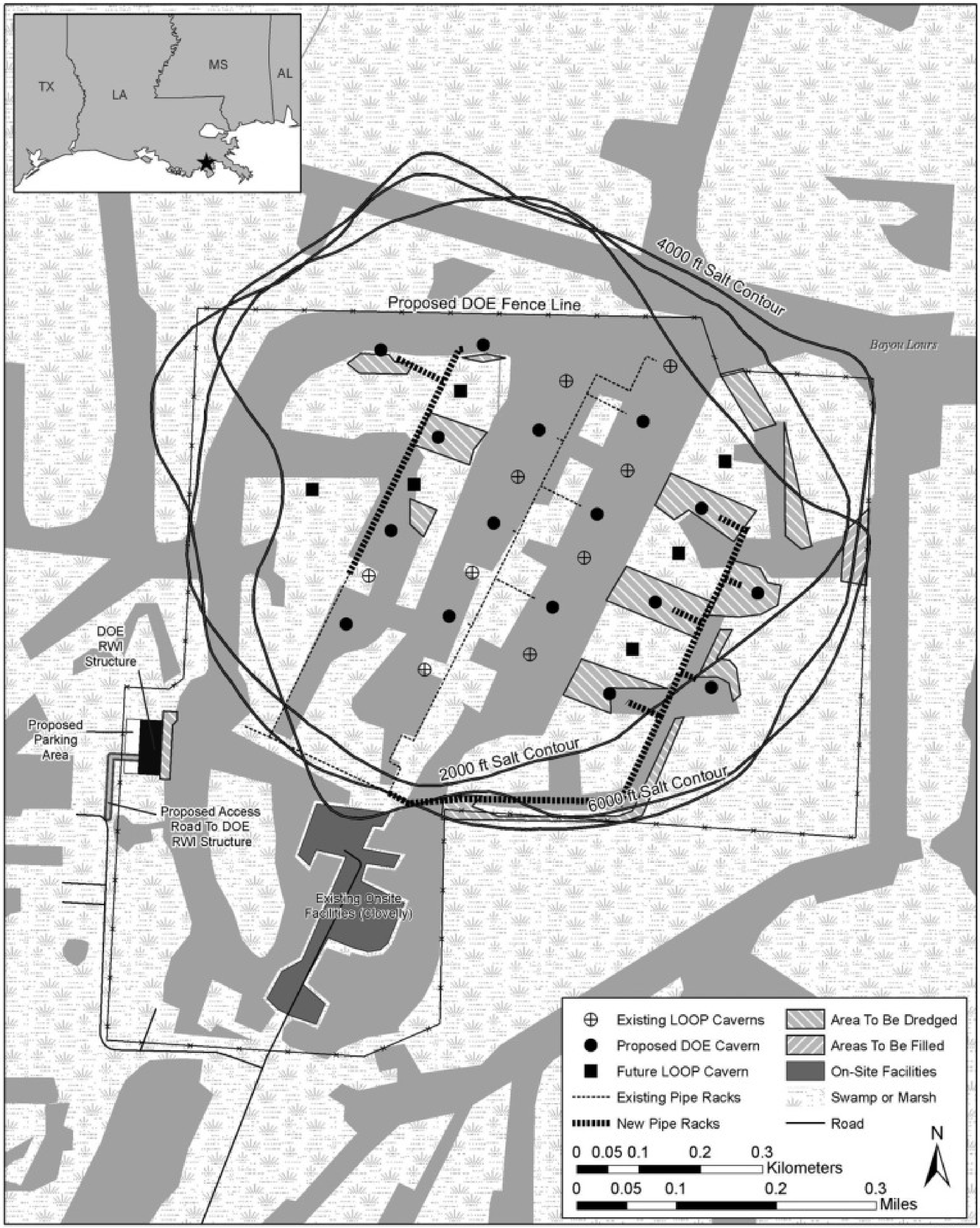

ICF20060515SSH004

**Figure 2.4.3-1: Location of Proposed Clovelly 120 MMB Storage Site**




IUCF20060509SSH007

**Figure 2.4.3-2: Proposed Layout of Clovelly 120 MMB Storage Site**




ICF20060510SSH001

**Figure 2.4.3-3: Proposed Layout of DOE Off-Dome Facilities**

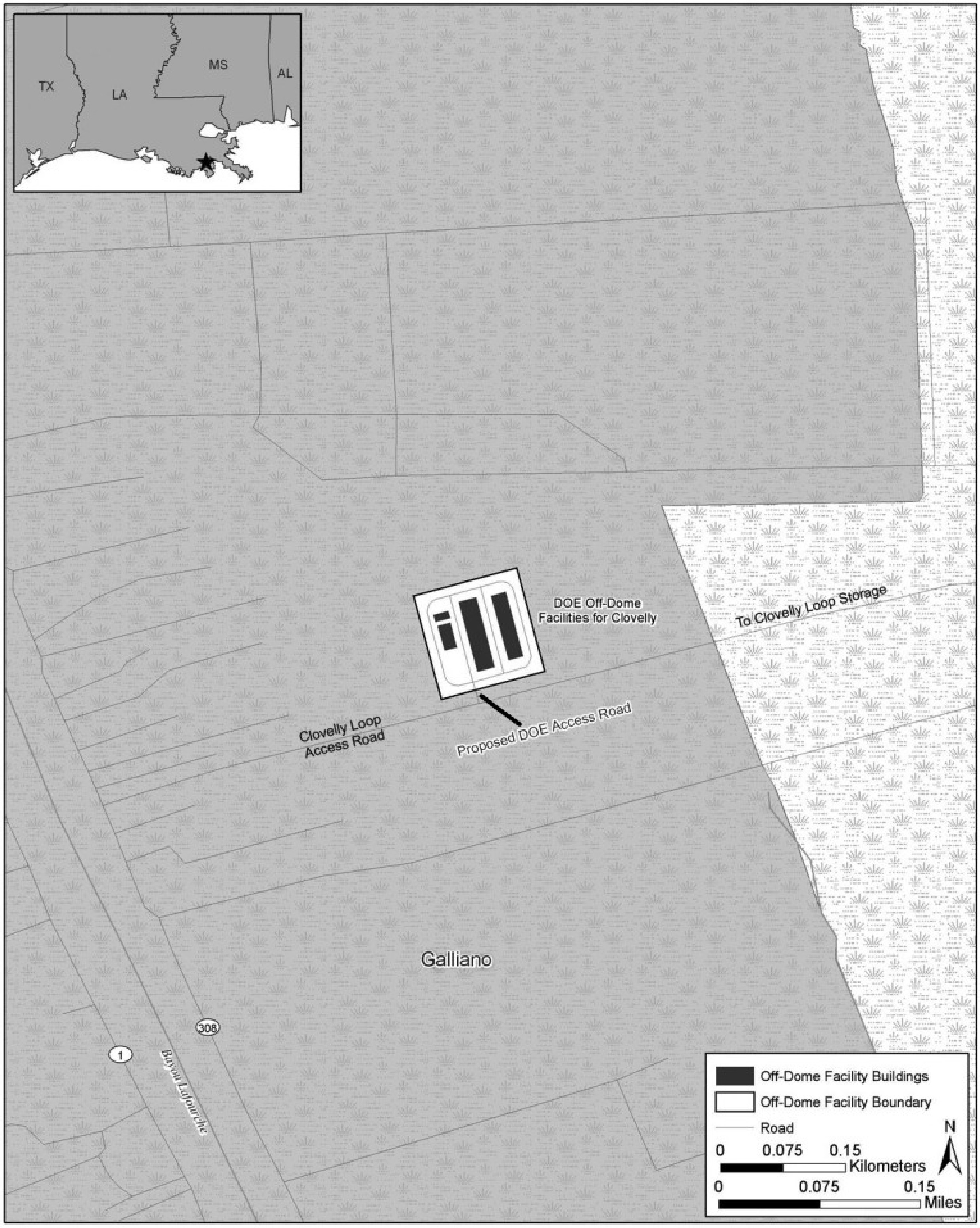



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**Figure 2.4.4-1: Layout of Clovelly 80 or 90 MMB Storage Site**

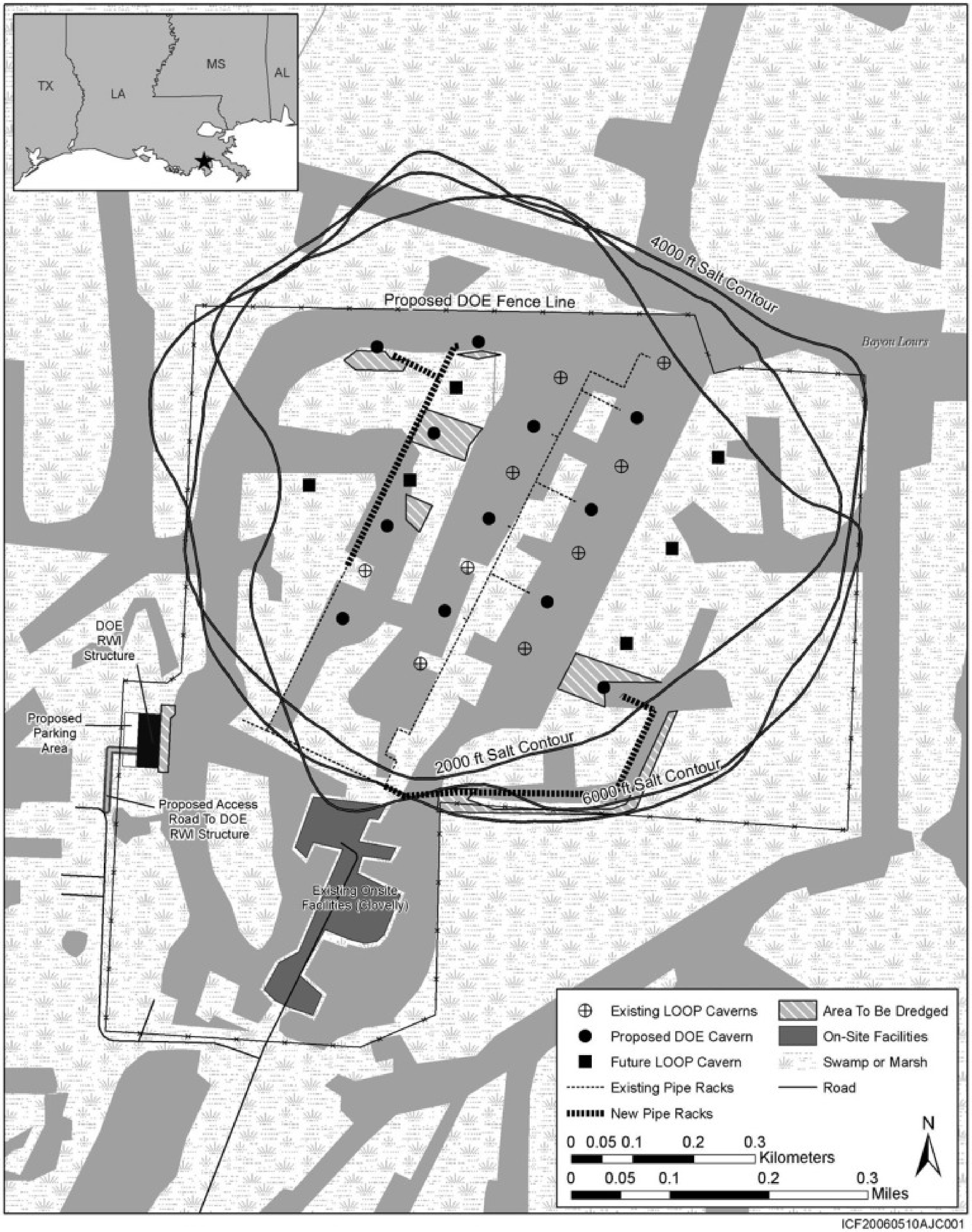


**Figure 2.4.4-2: Location of Proposed Bruinsburg 80 MMB Storage Site**

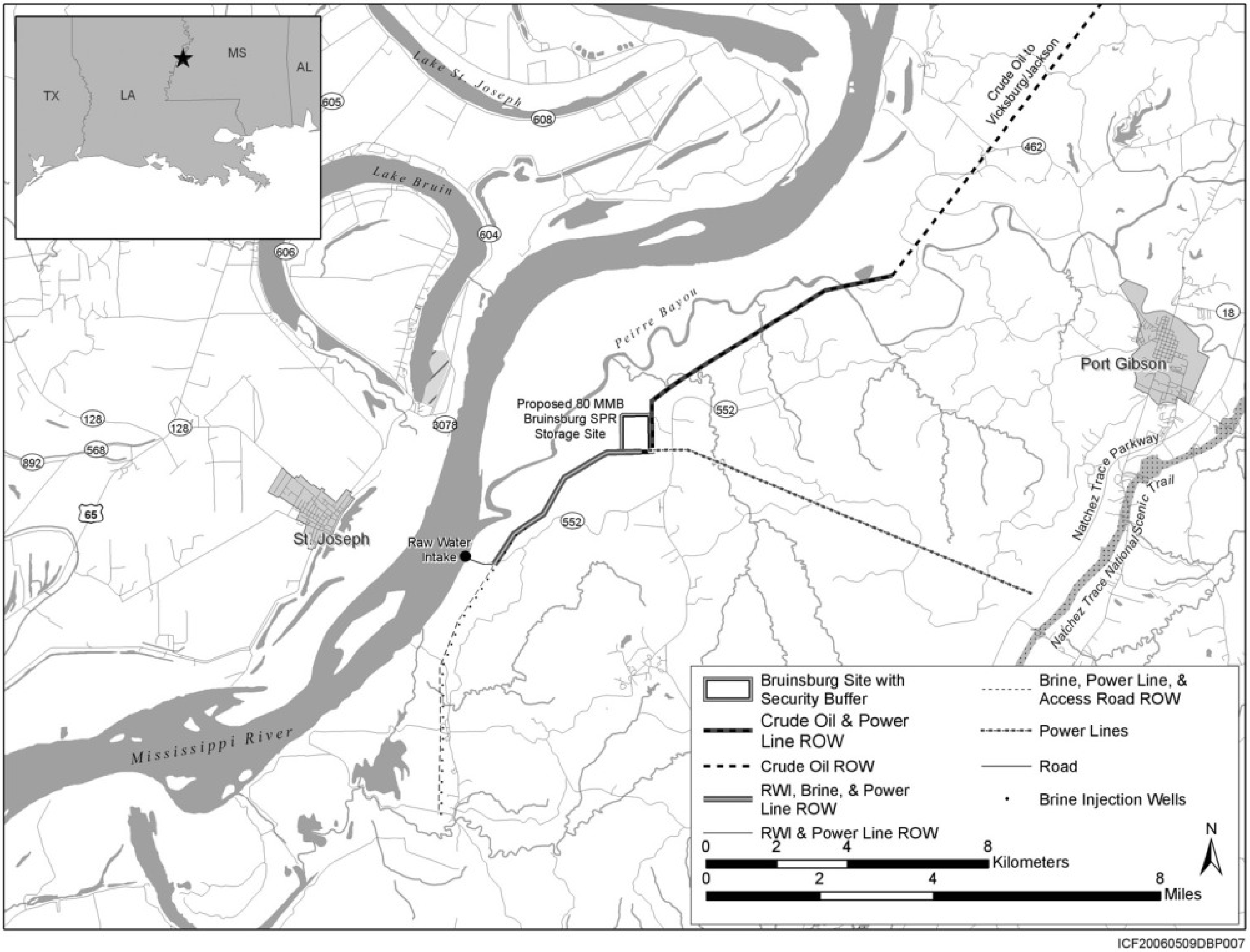
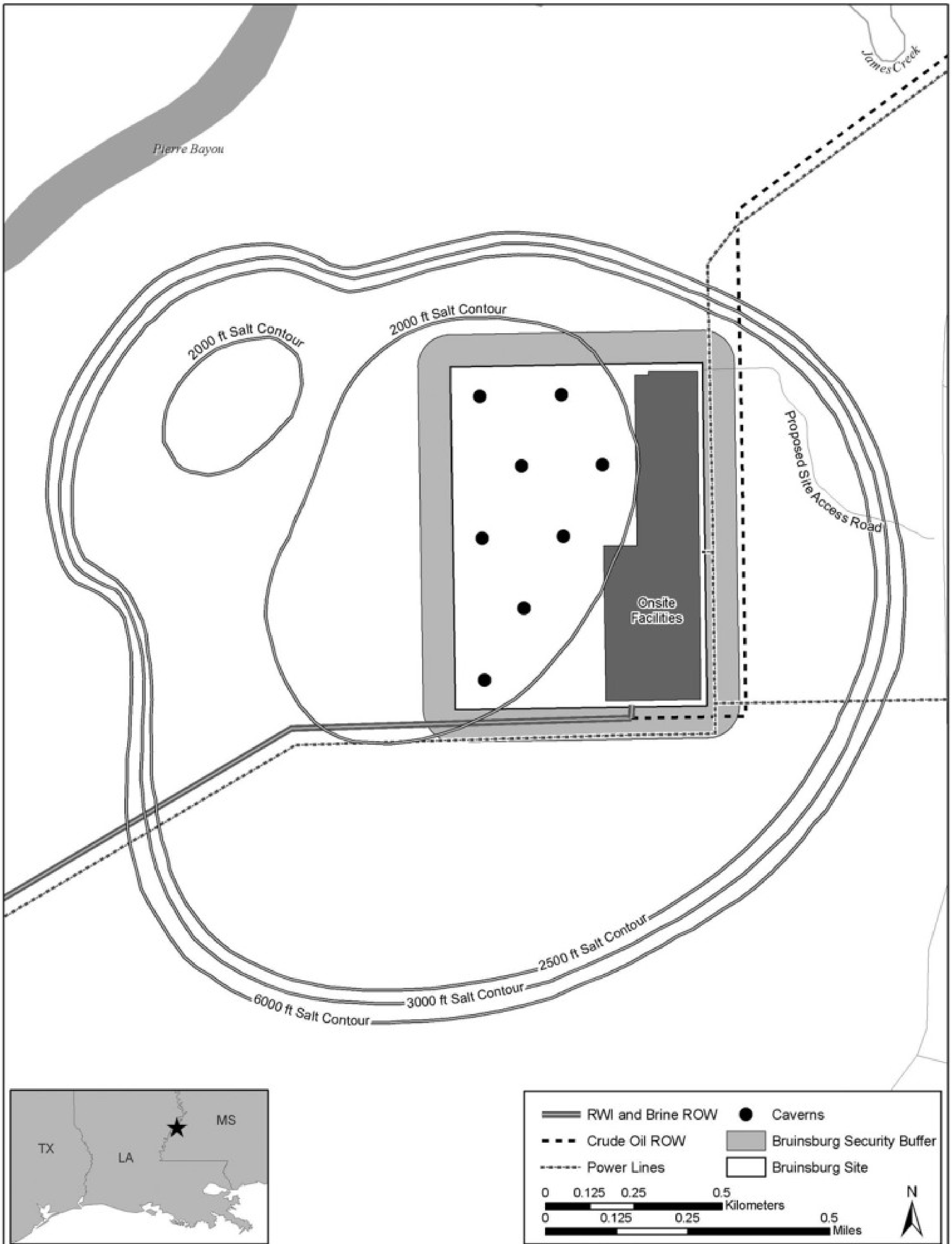
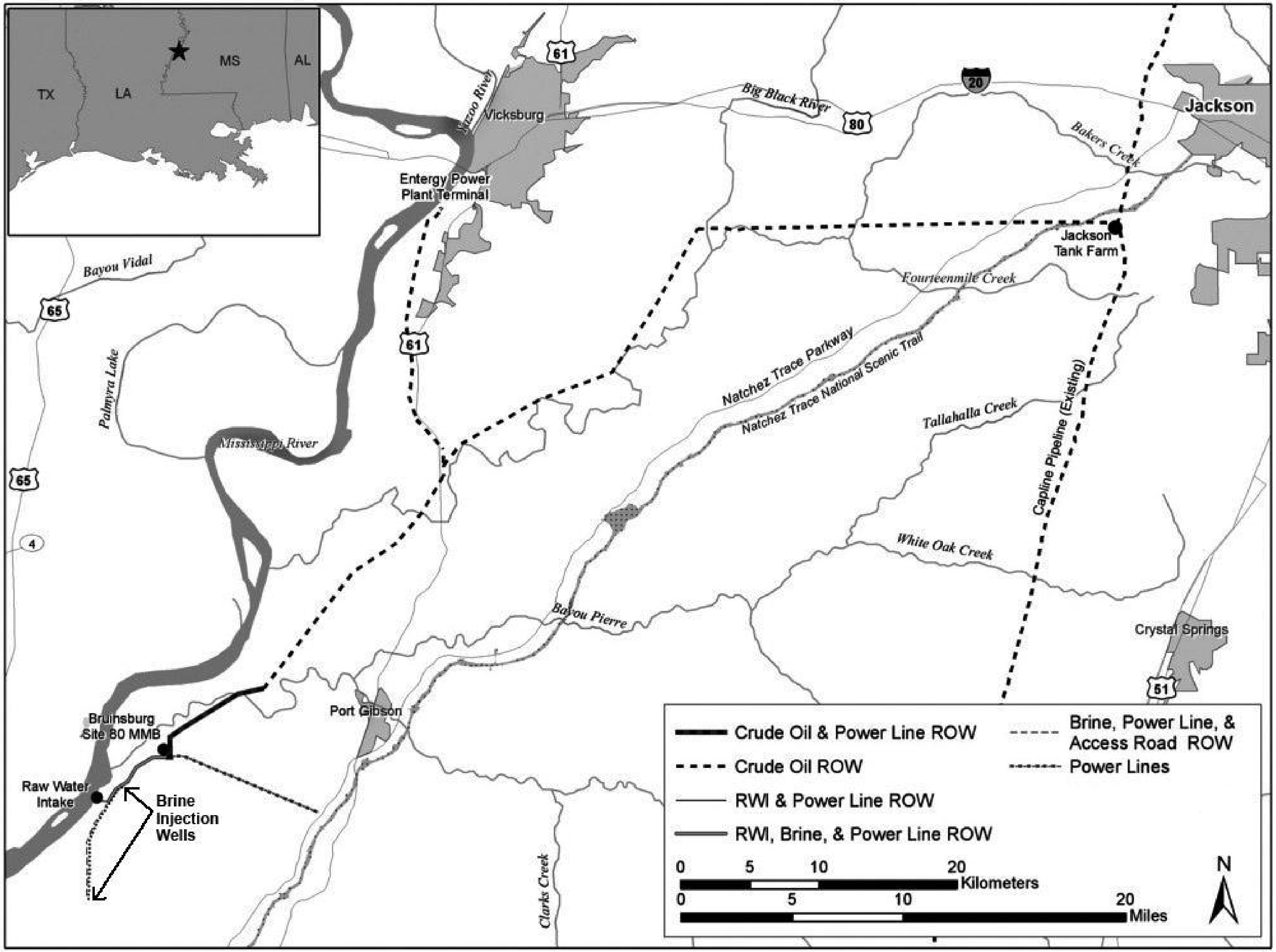


**Figure 2.4.4-3: Proposed Layout for Bruinsburg 80 MMB Storage Site**




ICF20060510DBP008

**Figure 2.4.4-4: Proposed Pipelines for the Bruinsburg 80 MMB Storage Site**




ICF20060515DBP005

**Figure 2.4.4-5: Proposed Layout of Jackson Tank Farm**

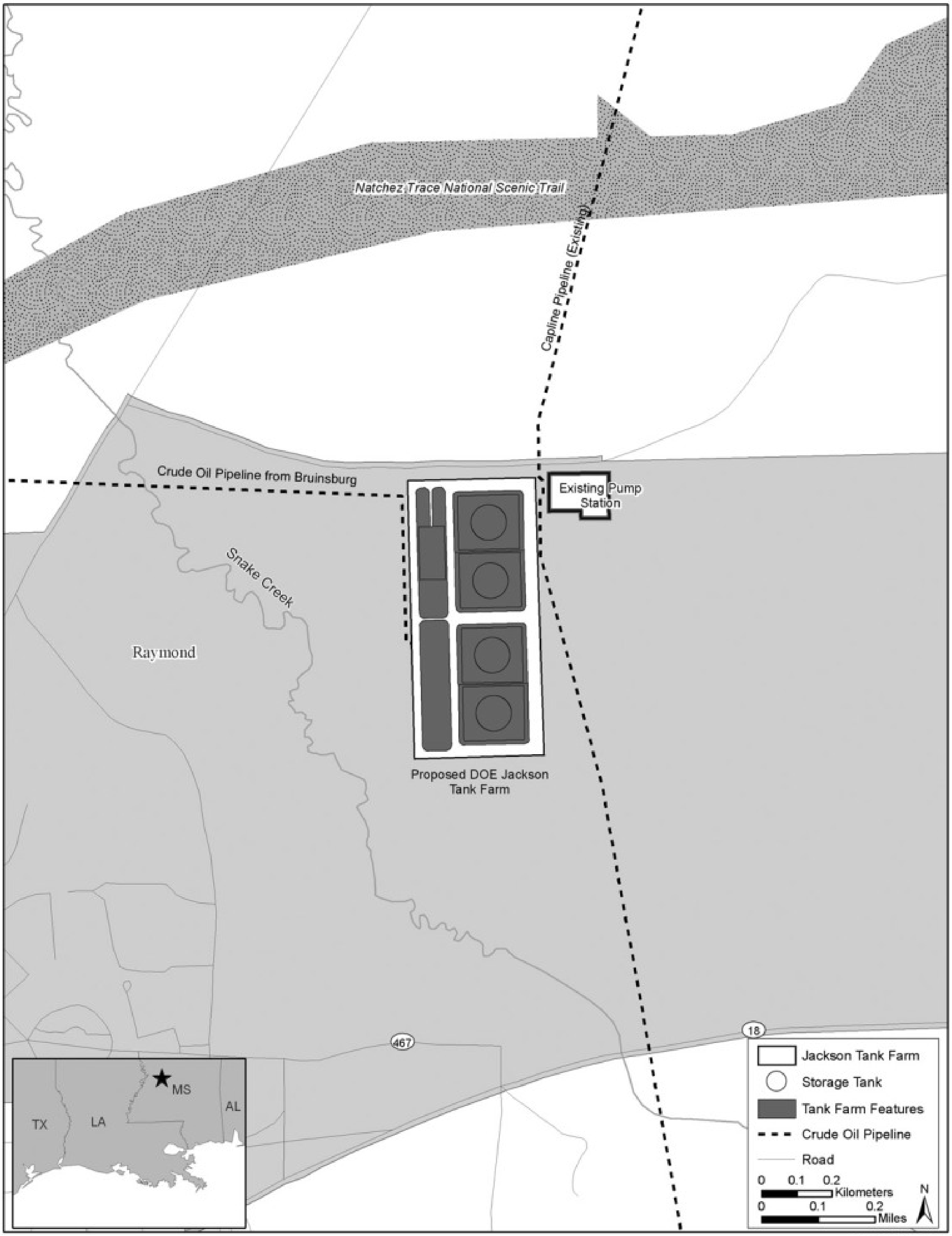


**Figure 2.4.5-1: Location of Proposed Richton Storage Site**

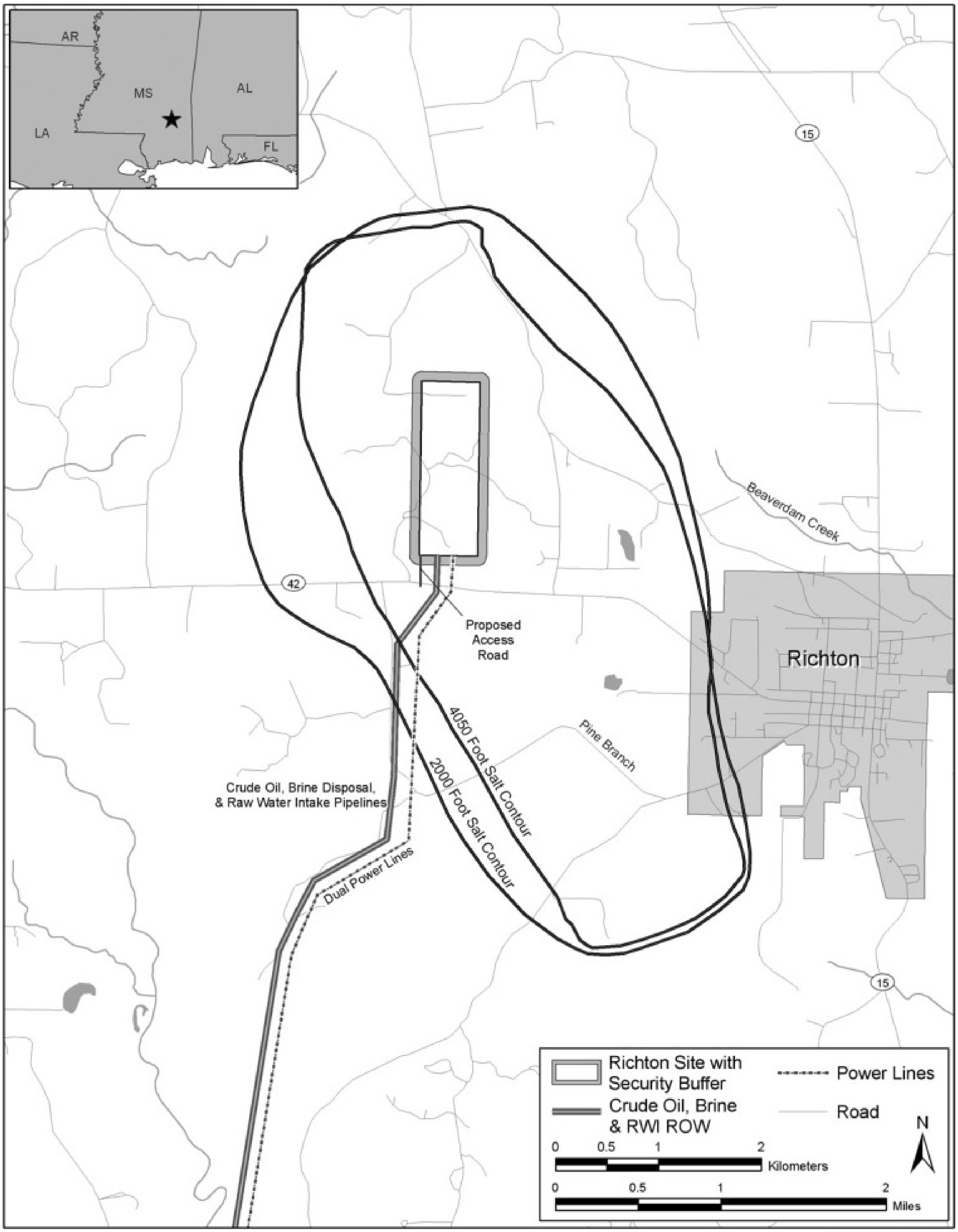



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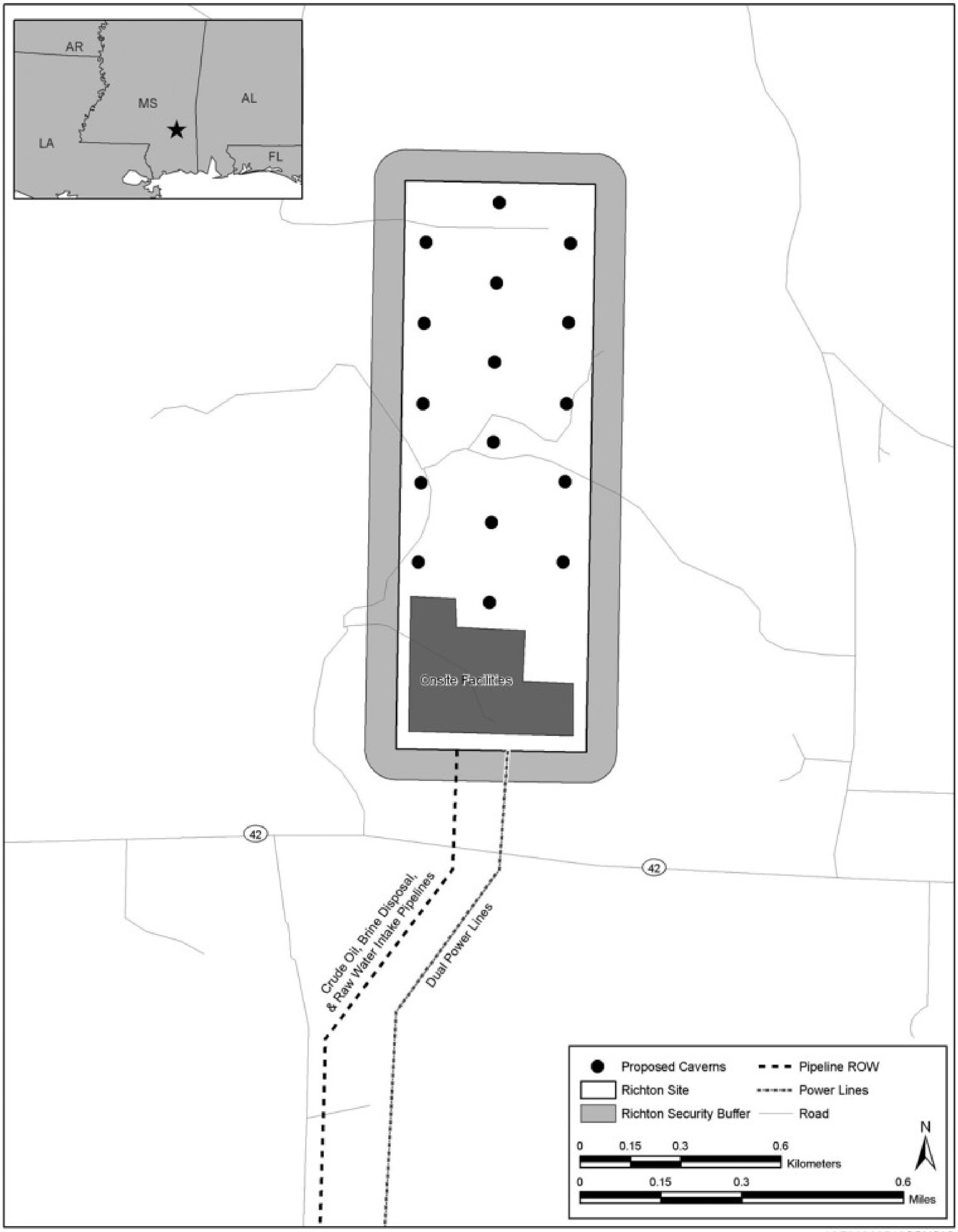
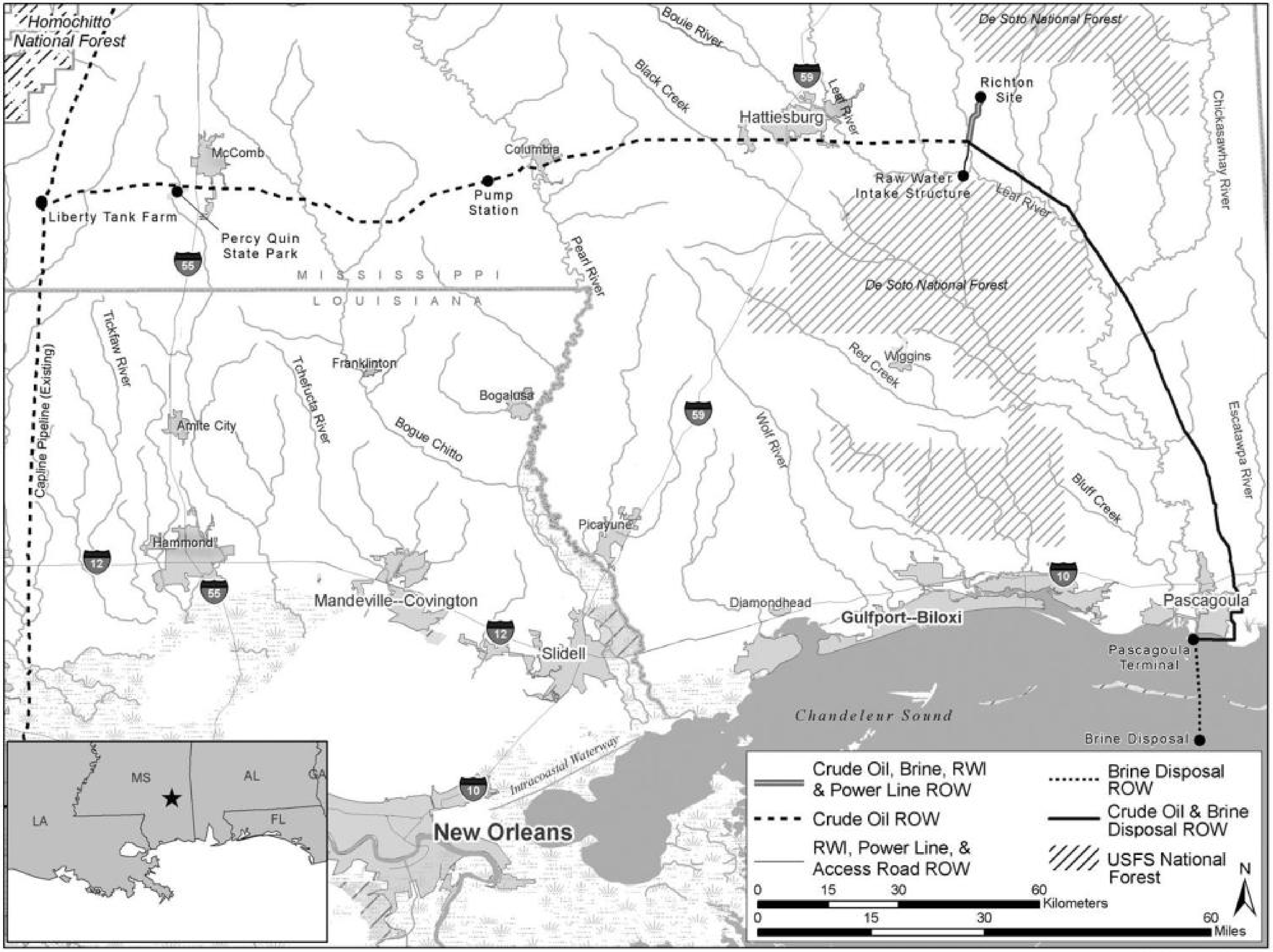
**Figure 2.4.5-2: Proposed Layout of Richton Storage Site**



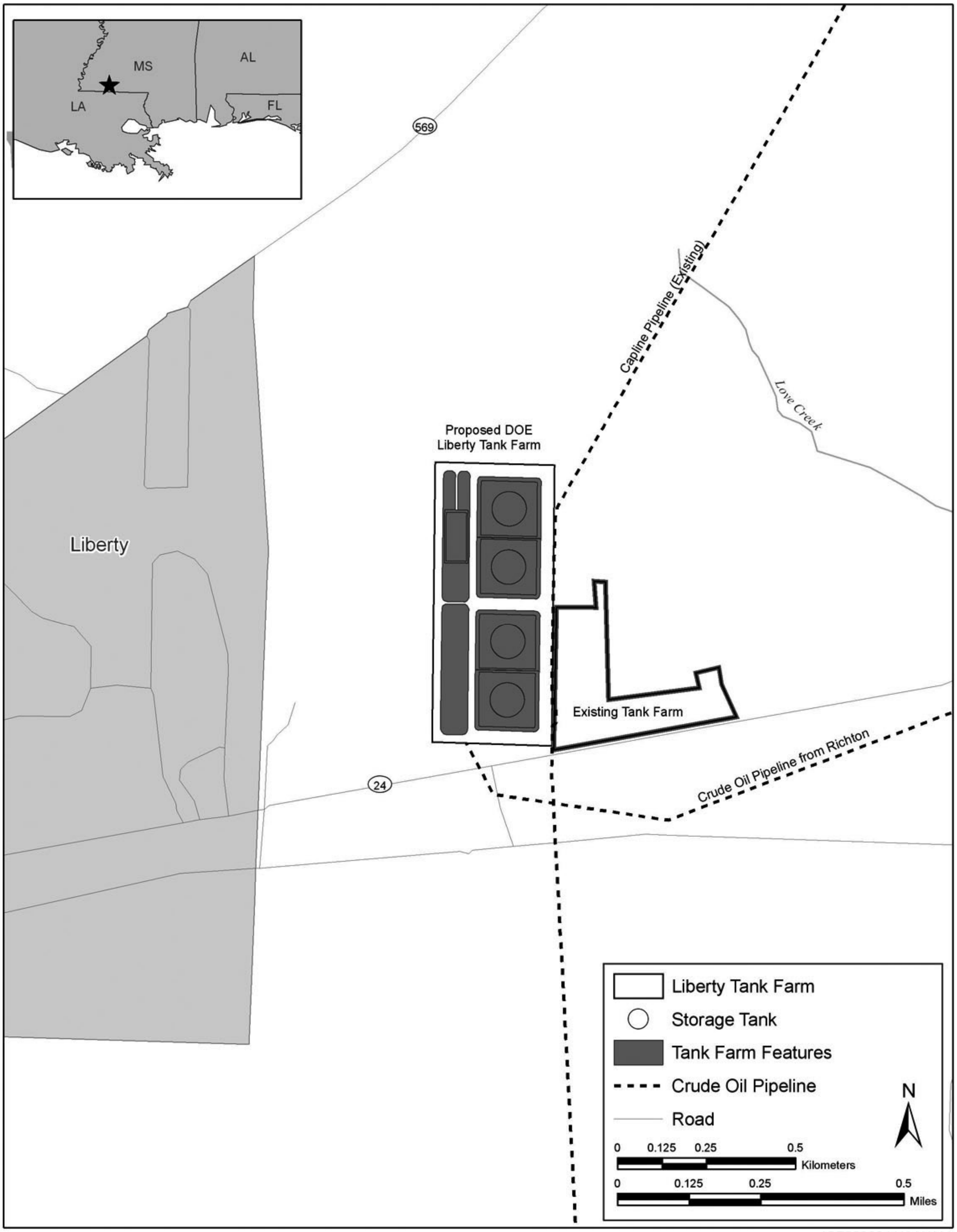

ICF20060510SSH013

**Figure 2.4.5-3: Proposed Pipelines for Richton Storage Site**



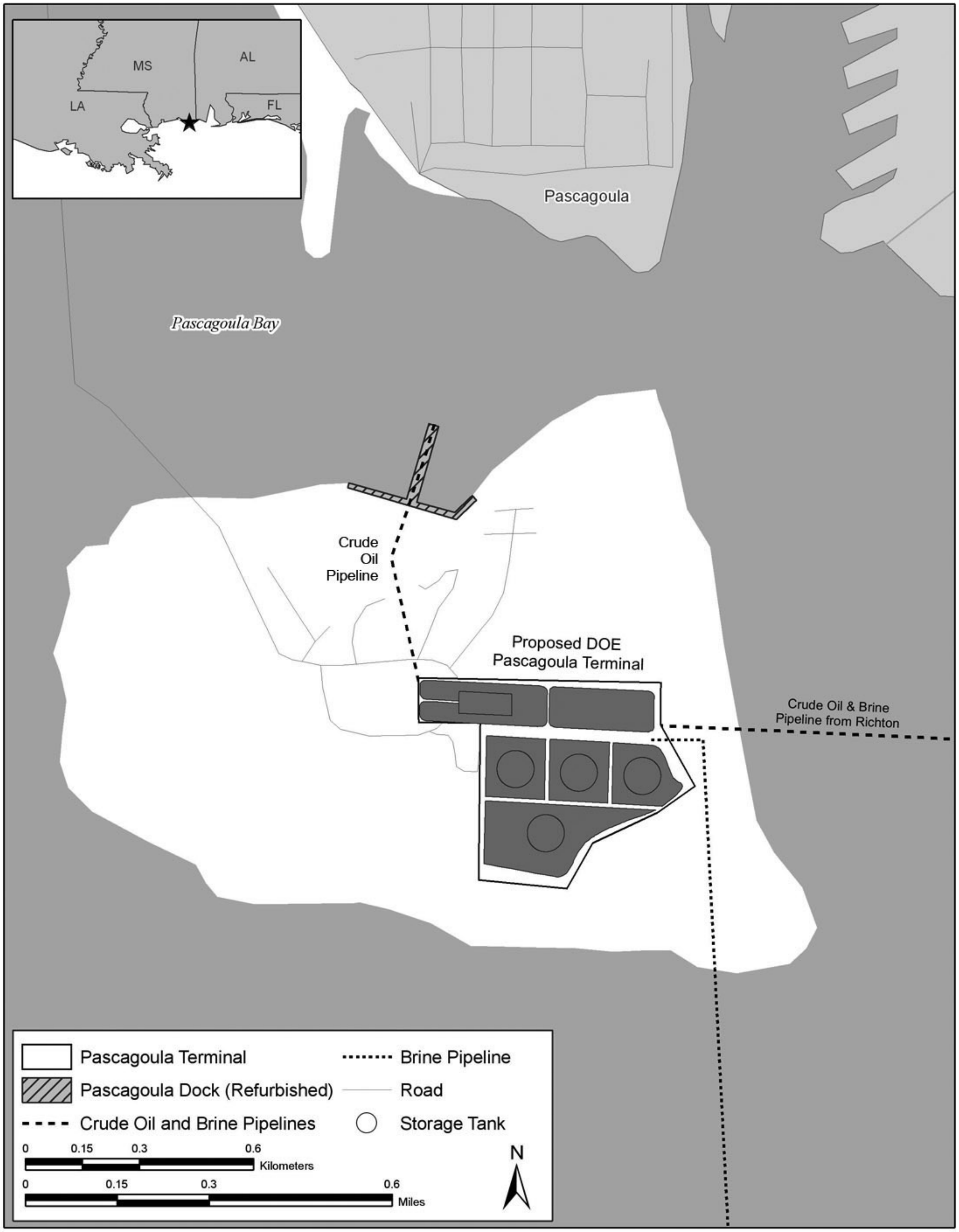

ICF20060515SSH012

**Figure 2.4.5-4: Proposed Layout of the Liberty Tank Farm**



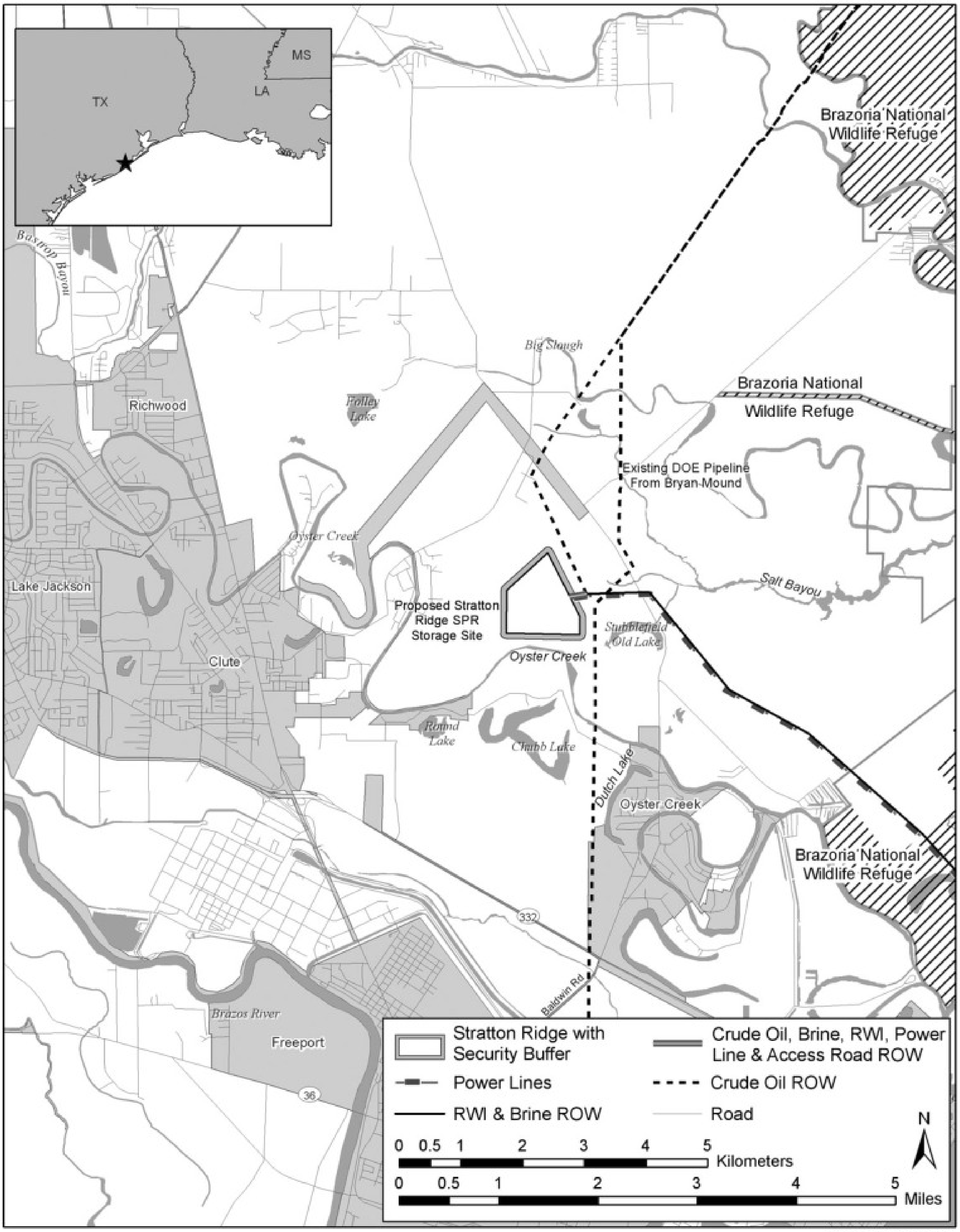

ICF20060411SSH002

**Figure 2.4.5-5: Proposed Layout of the Pascagoula Terminal**



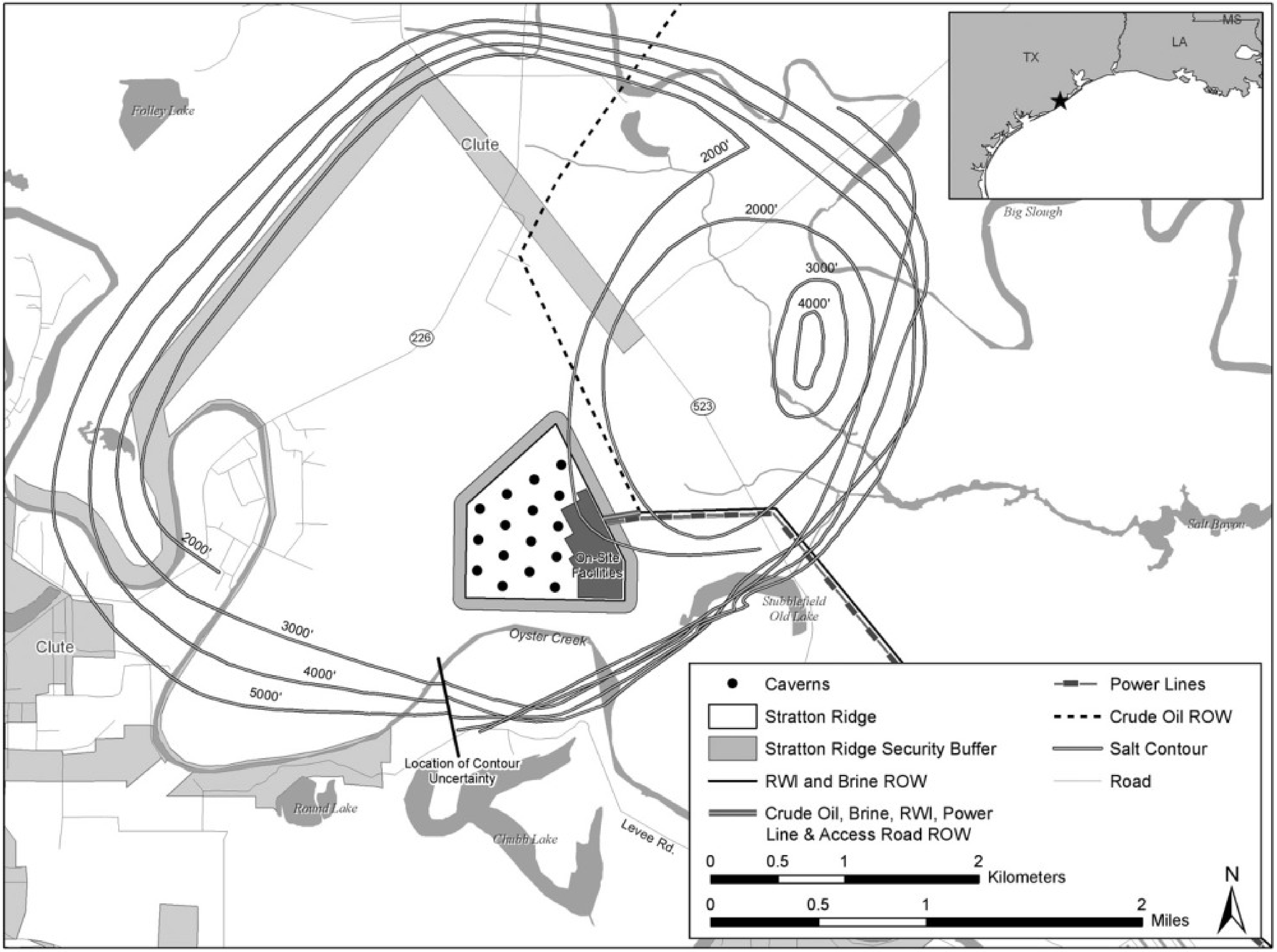

ICF20060411SSH001

**Figure 2.4.6-1: Location of Proposed Stratton Ridge Storage Site**



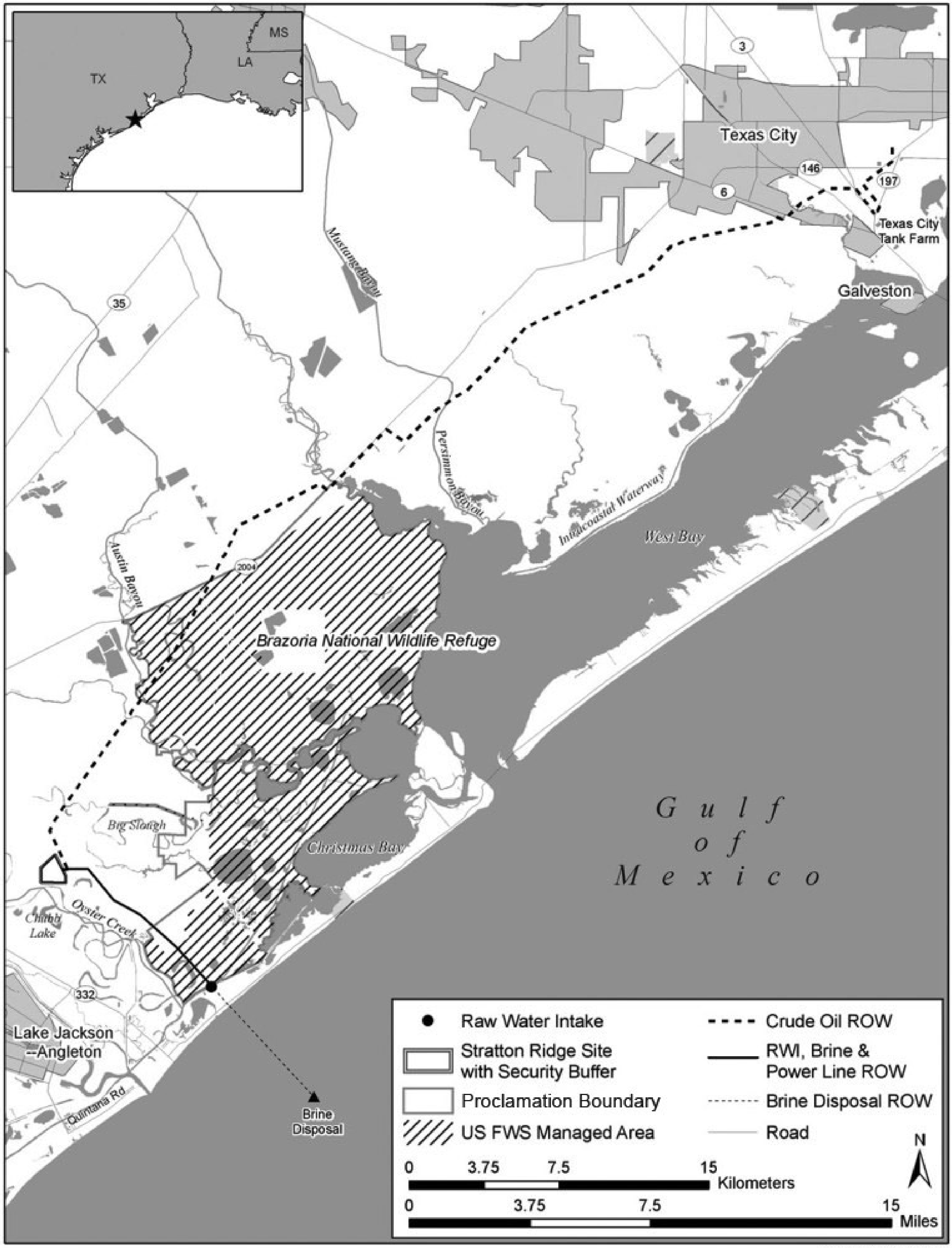

ICF20060215DBP001

**Figure 2.4.6-2: Proposed Layout for Stratton Ridge Storage Site**



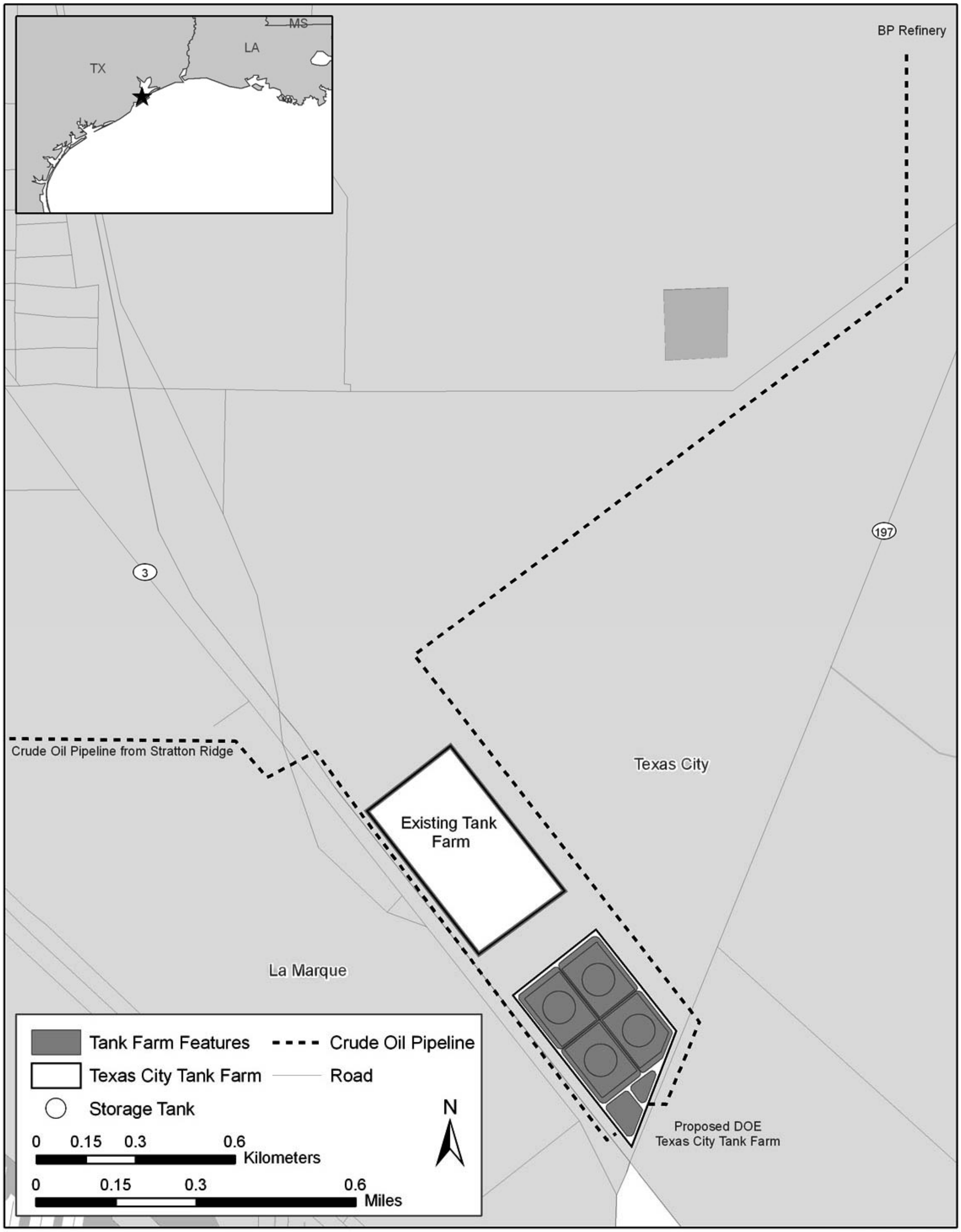

ICF20060509DBP003

**Figure 2.4.6-3: Proposed Pipelines for Stratton Ridge Storage Site**




ICF20060504DBP002

**Figure 2.4.6-4: Proposed Layout of Texas City Tank Farm**




ICF20060412SSH003

**Figure 2.5.1-1: Location of Proposed Bayou Choctaw Expansion Site**

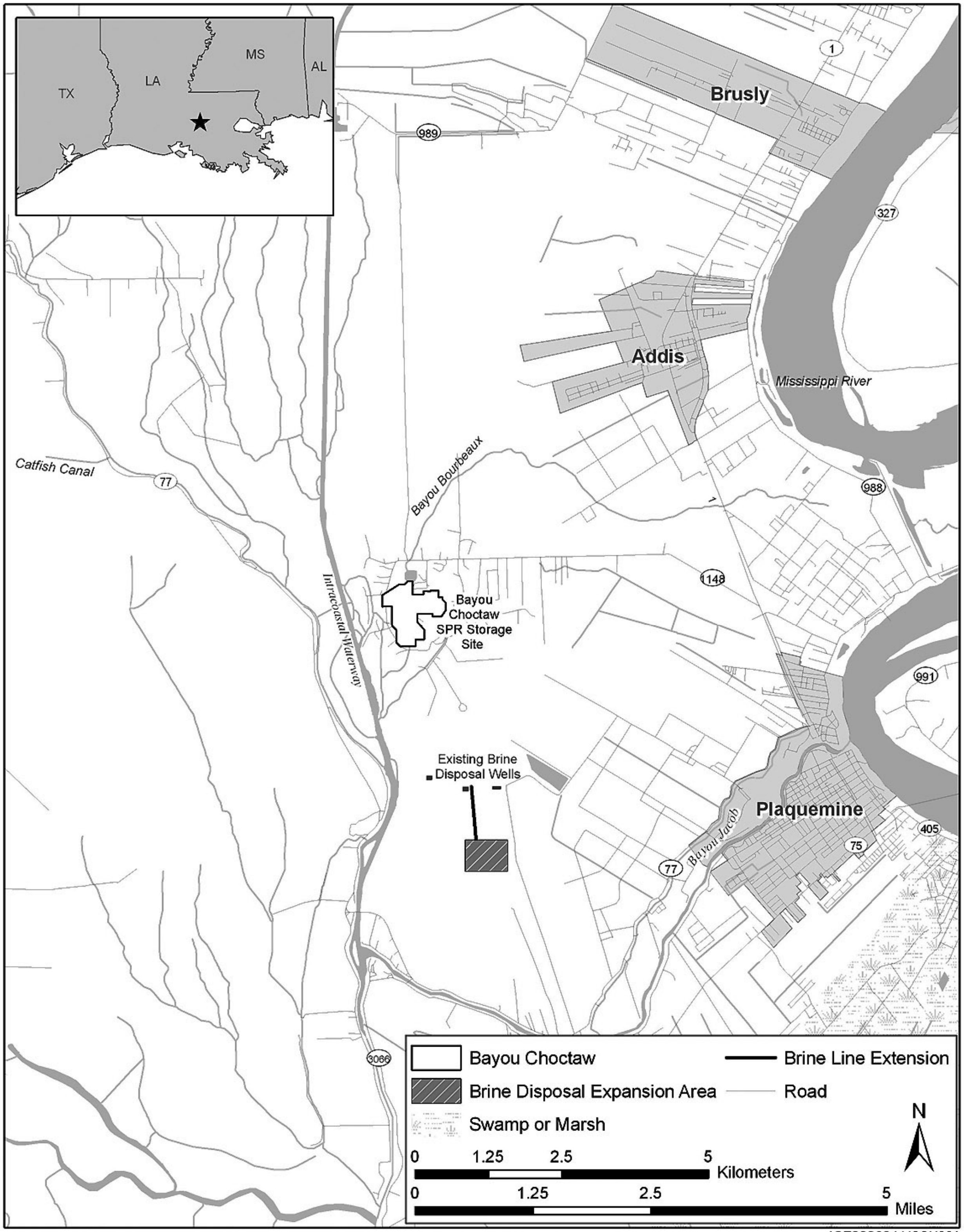



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**Figure 2.5.1-2:  Layout and Proposed Expansion for Bayou Choctaw Storage Site**

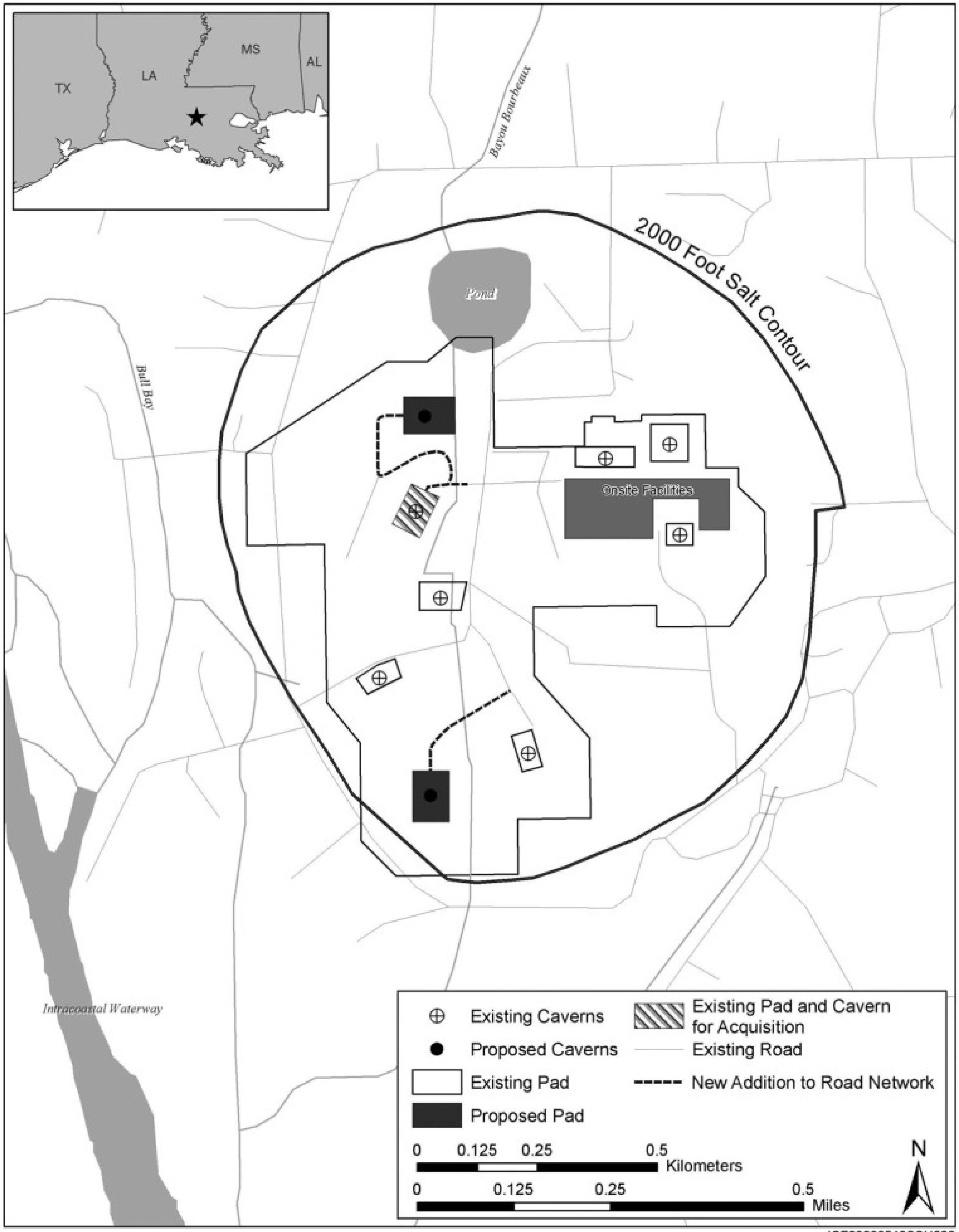


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**Figure 2.5.2-1: Location and Pipelines of Proposed Big Hill Expansion Site**

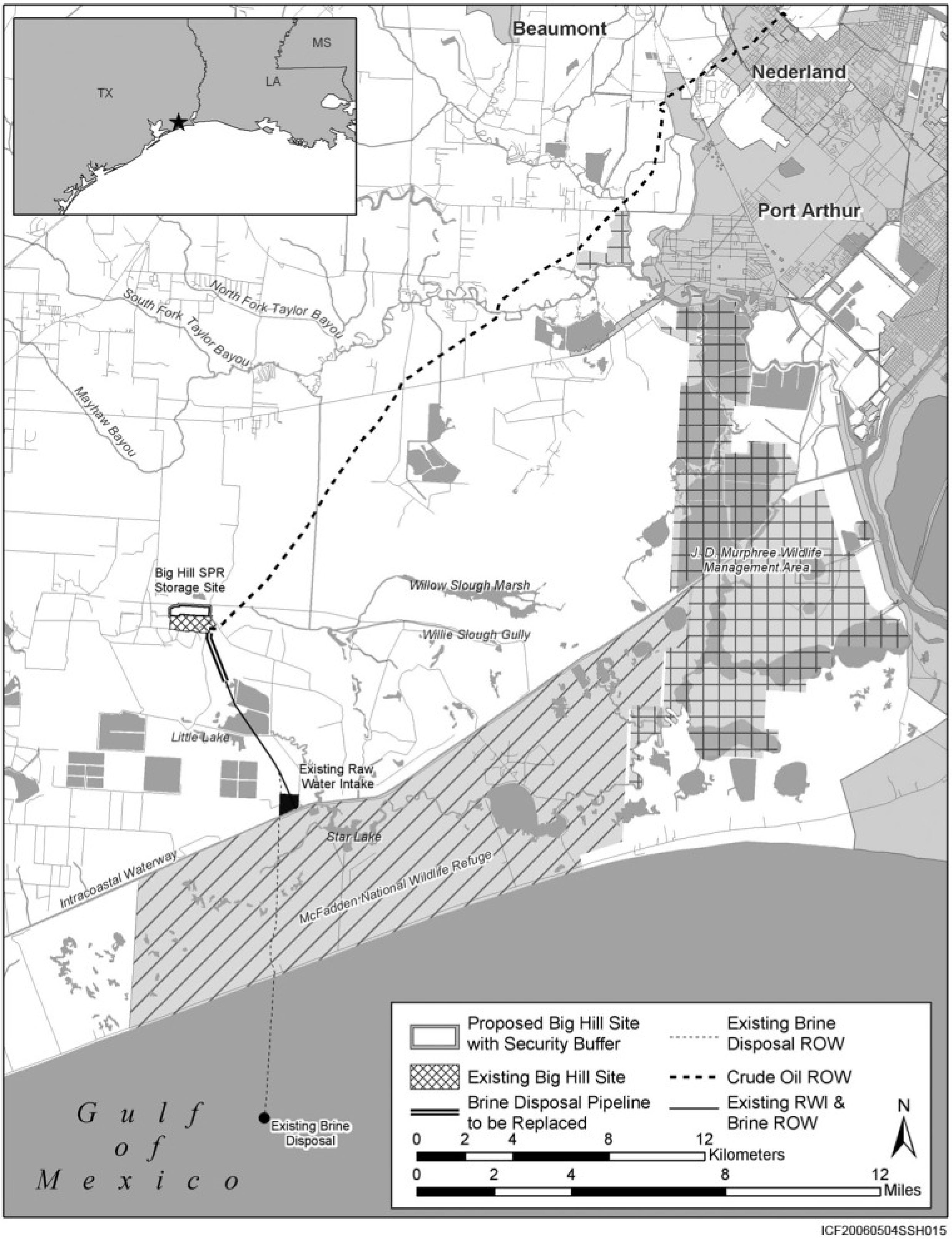


**Figure 2.5.2-2: Layout and Proposed Expansion for Big Hill Storage Site**

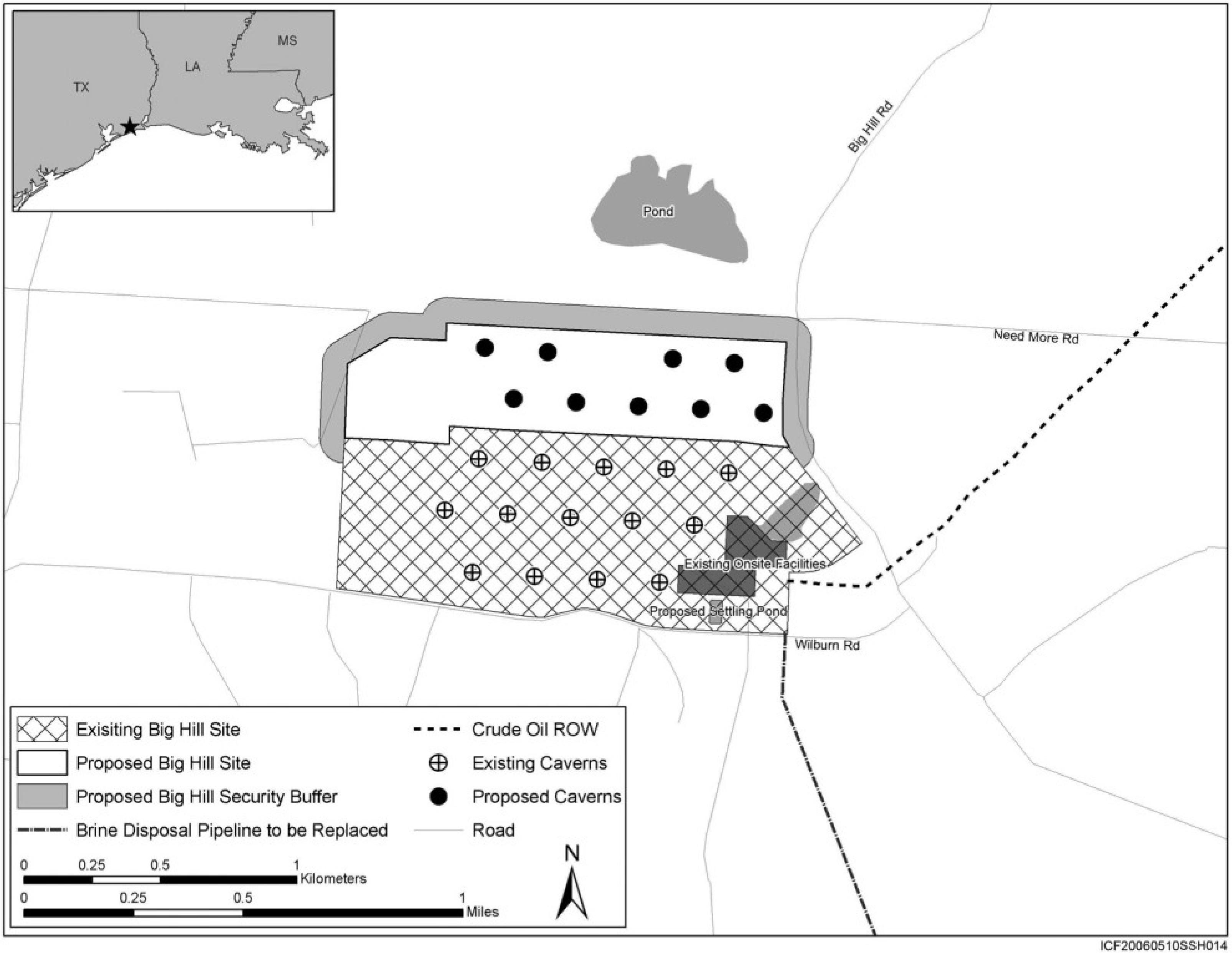
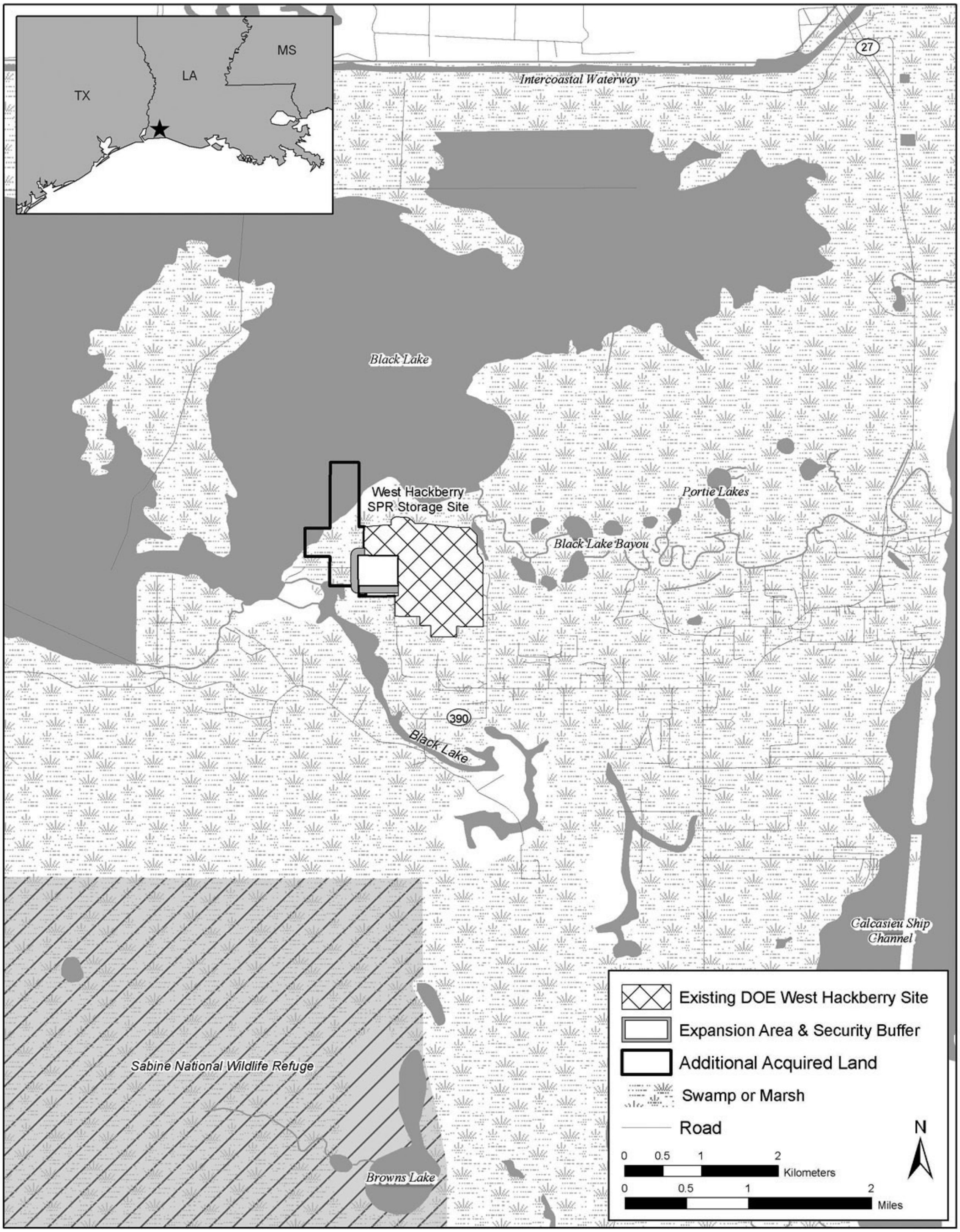


**Figure 2.5.3-1: Location of Proposed West Hackberry Expansion Site**




ICF20060411SSH010

**Figure 2.5.3-2: Layout and Proposed Expansion of West Hackberry Storage Site**

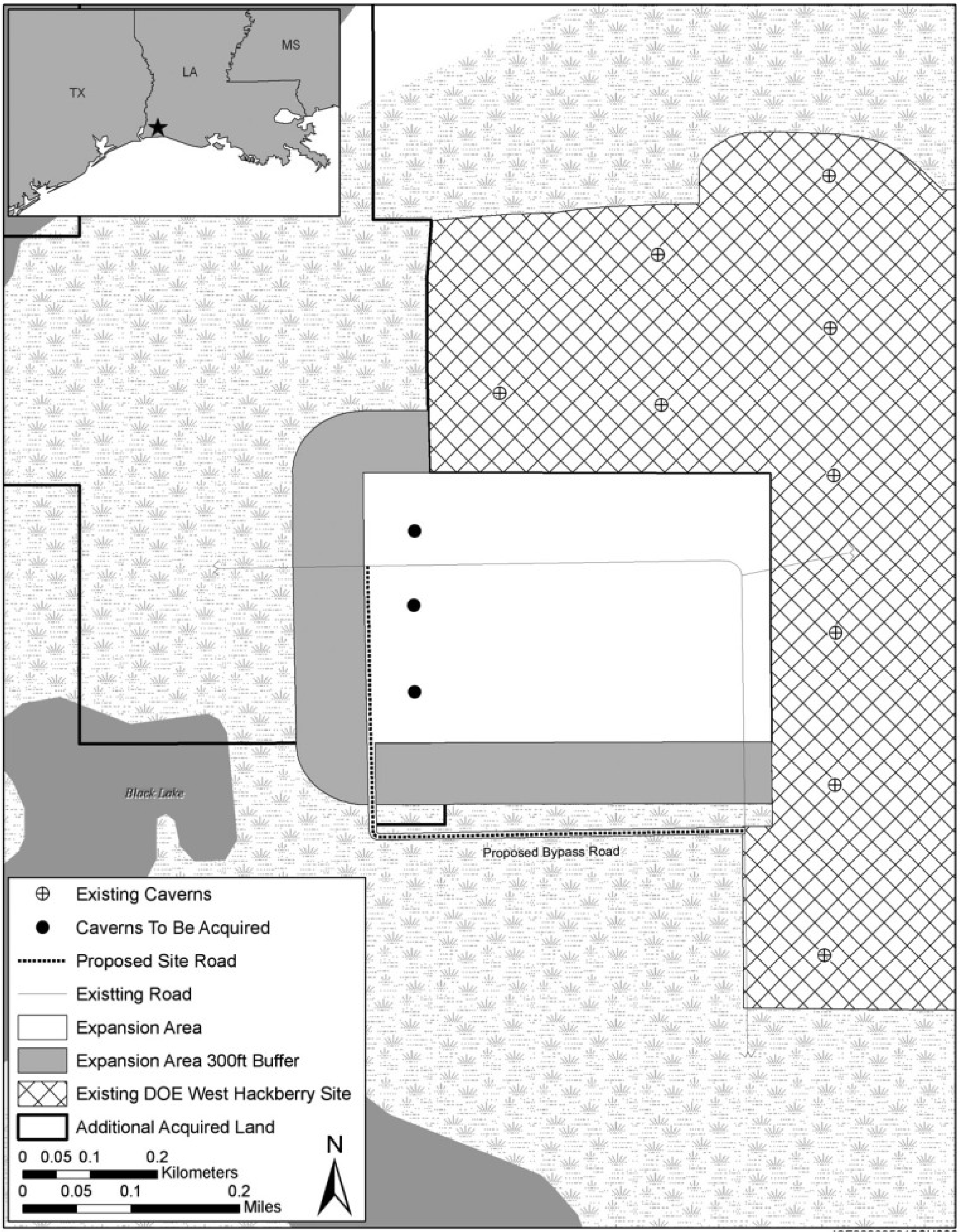
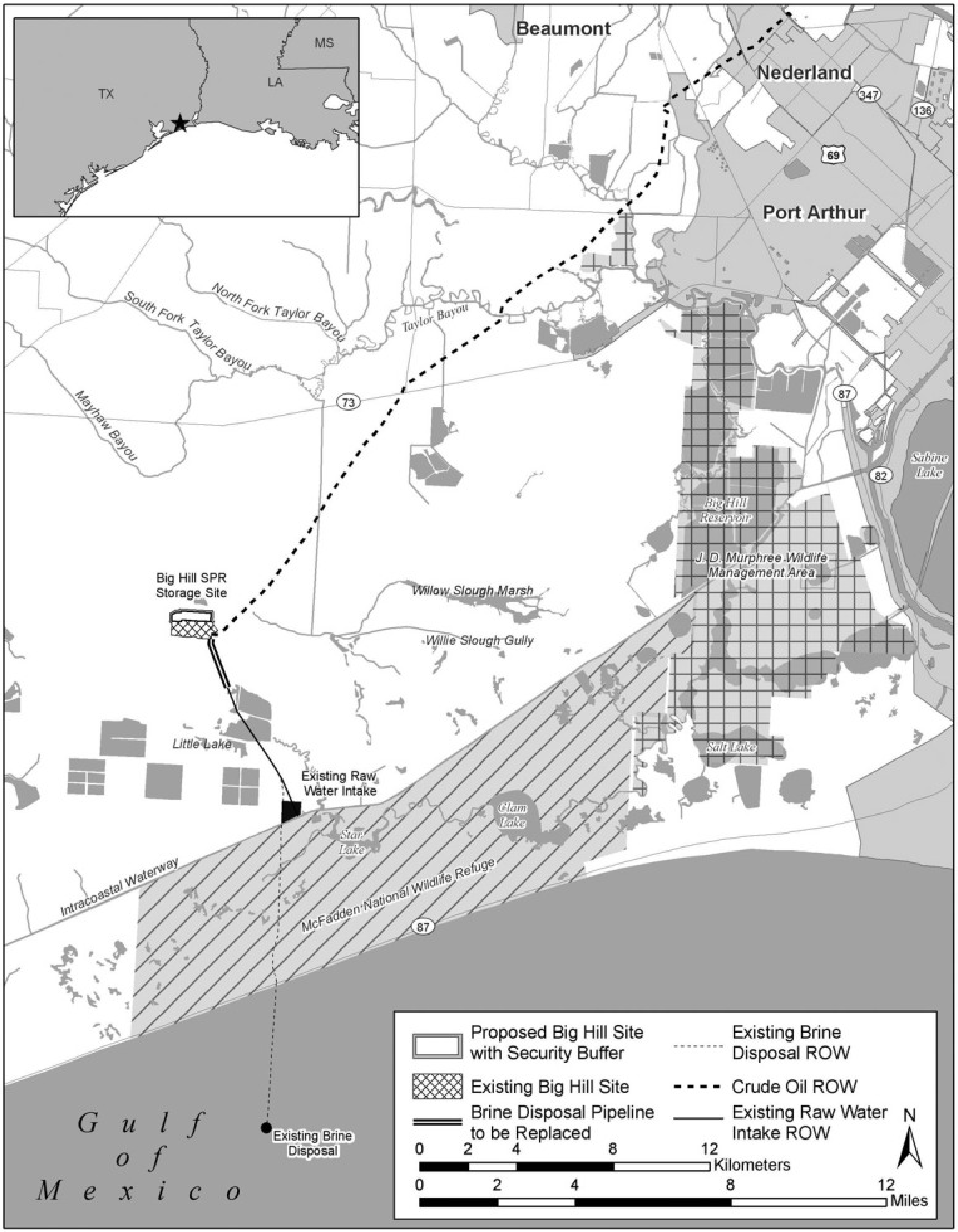
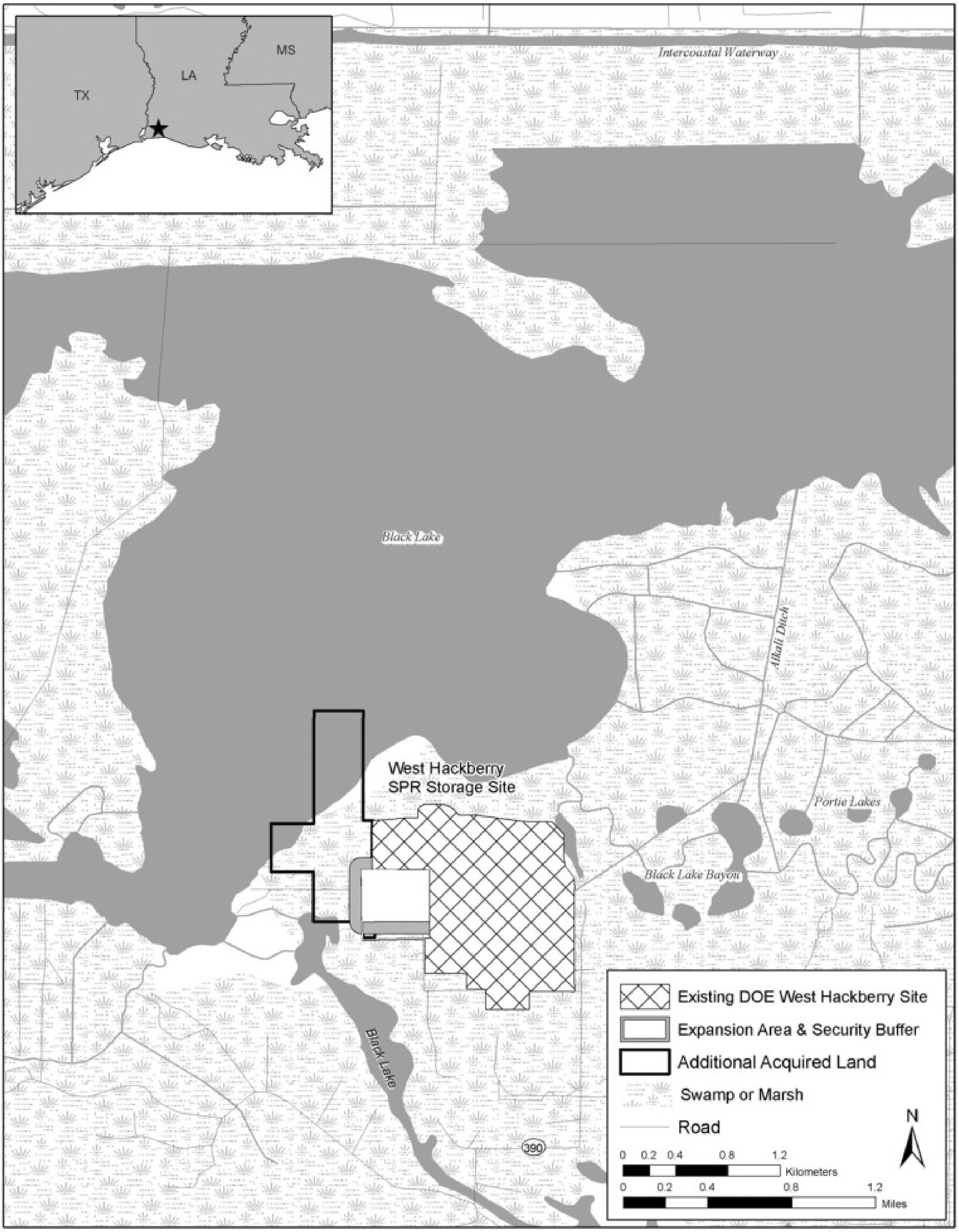


**Figure 3.6.10-1: Regional Surface Water Map for Big Hill Site**




ICF20060516SSH001

**Figure 3.6.11-1: Regional Surface Water Map for West Hackberry Site**




ICF20060516SSH005

**Figure 3.6.3-1: Regional Surface Water Map for Bruinsburg Site**

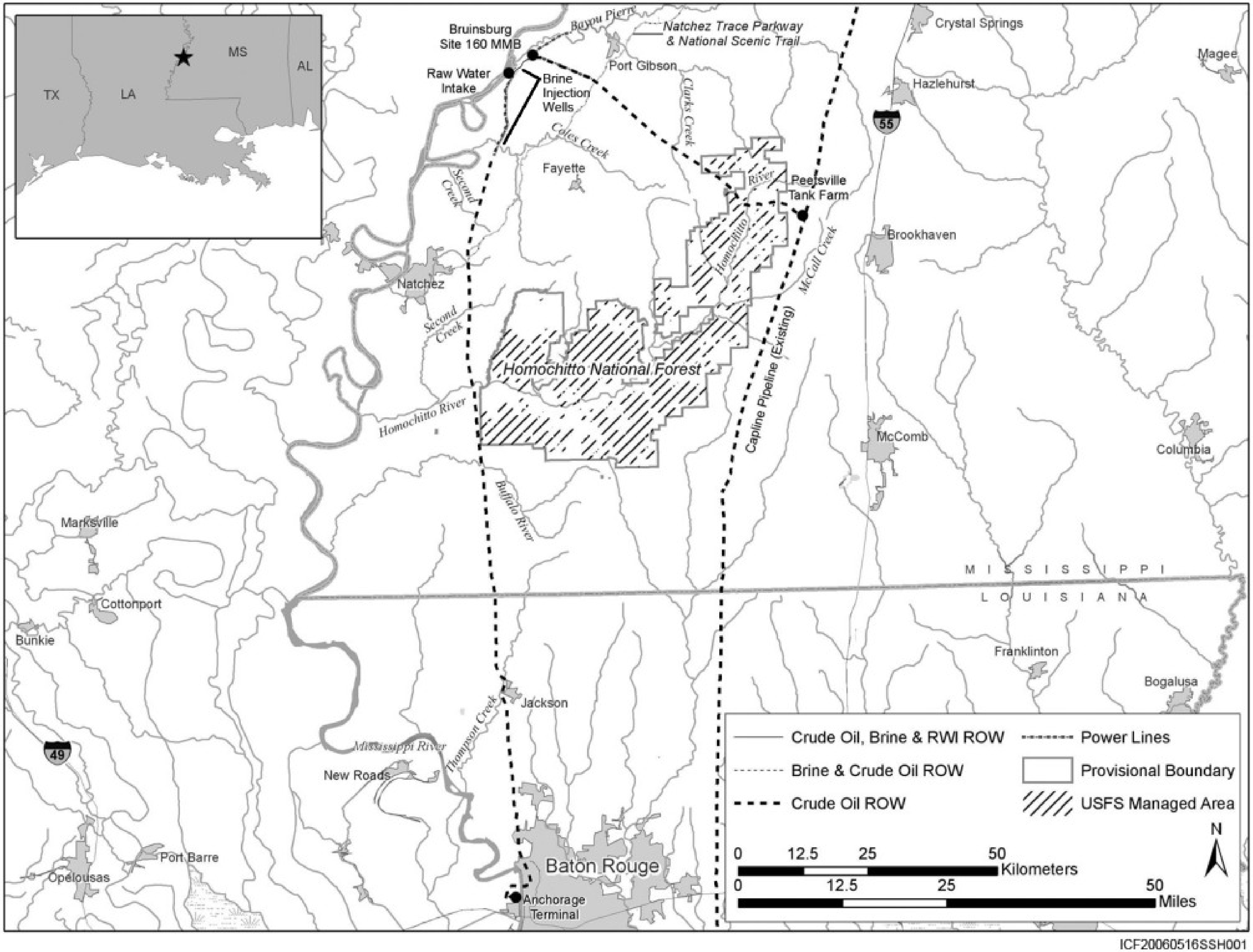


**Figure 3.6.4-1: Regional Surface Water Map for Chacahoula Site**

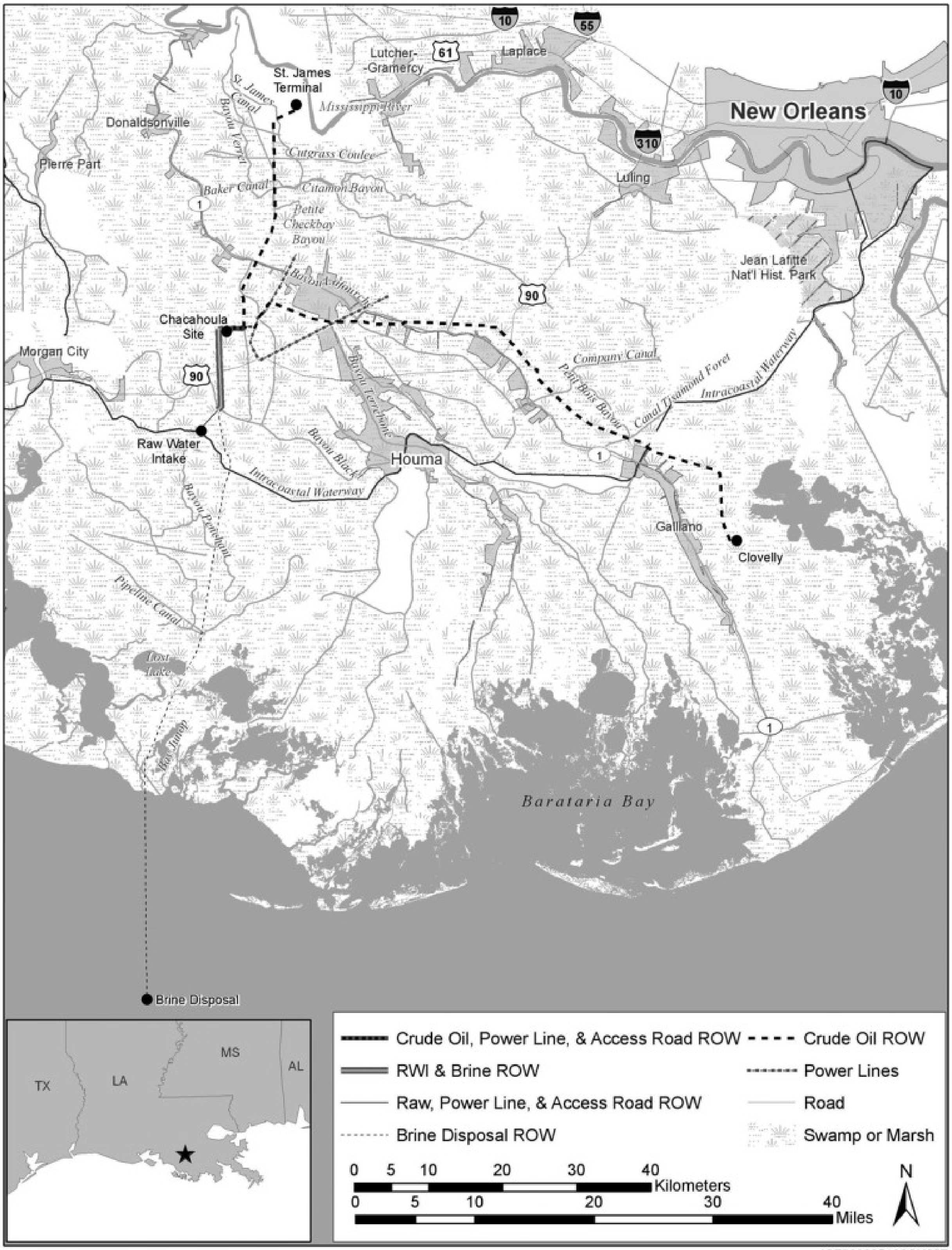
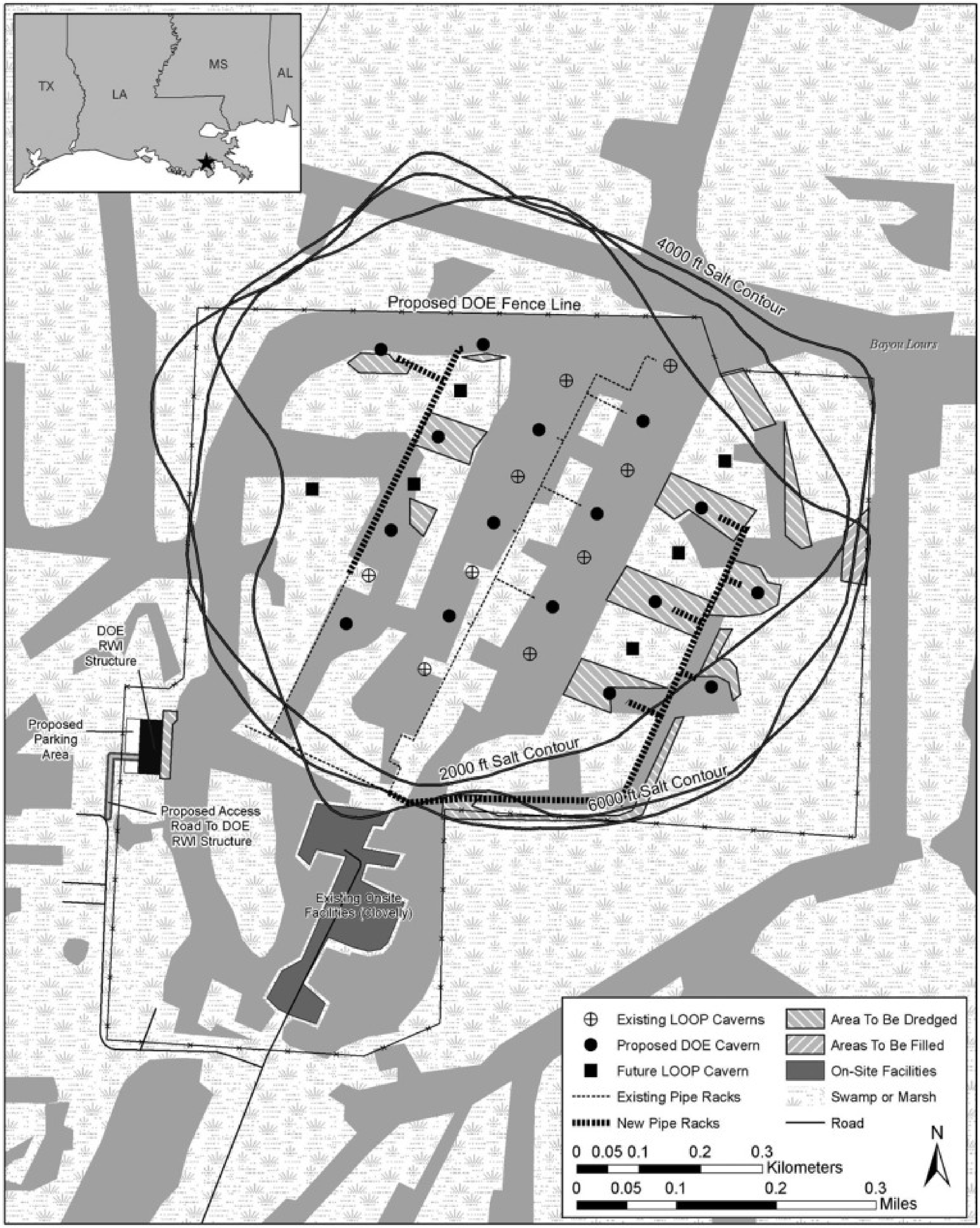
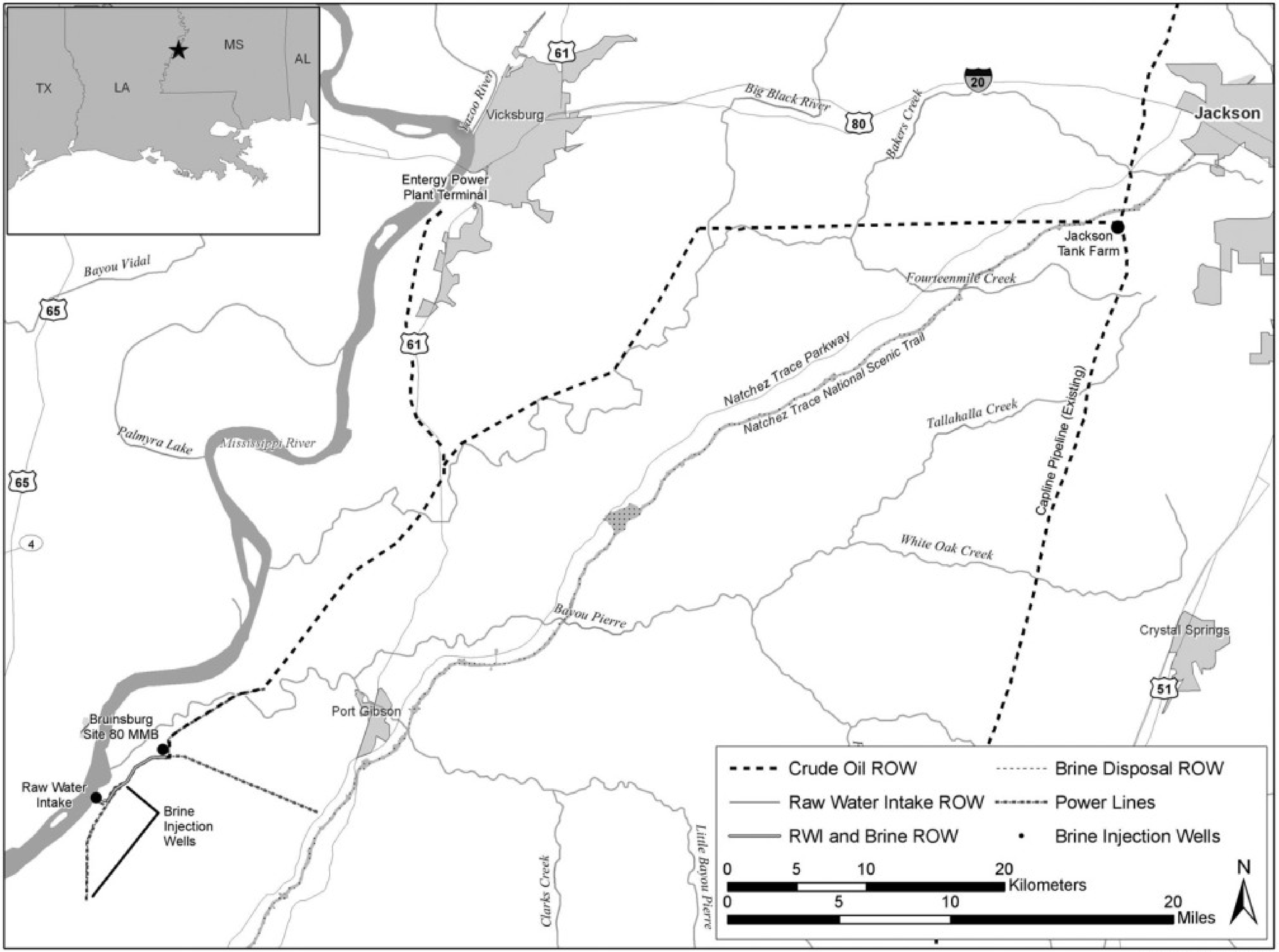


**Figure 3.6.5-1: Local Surface Water Map for Clovelly Site**



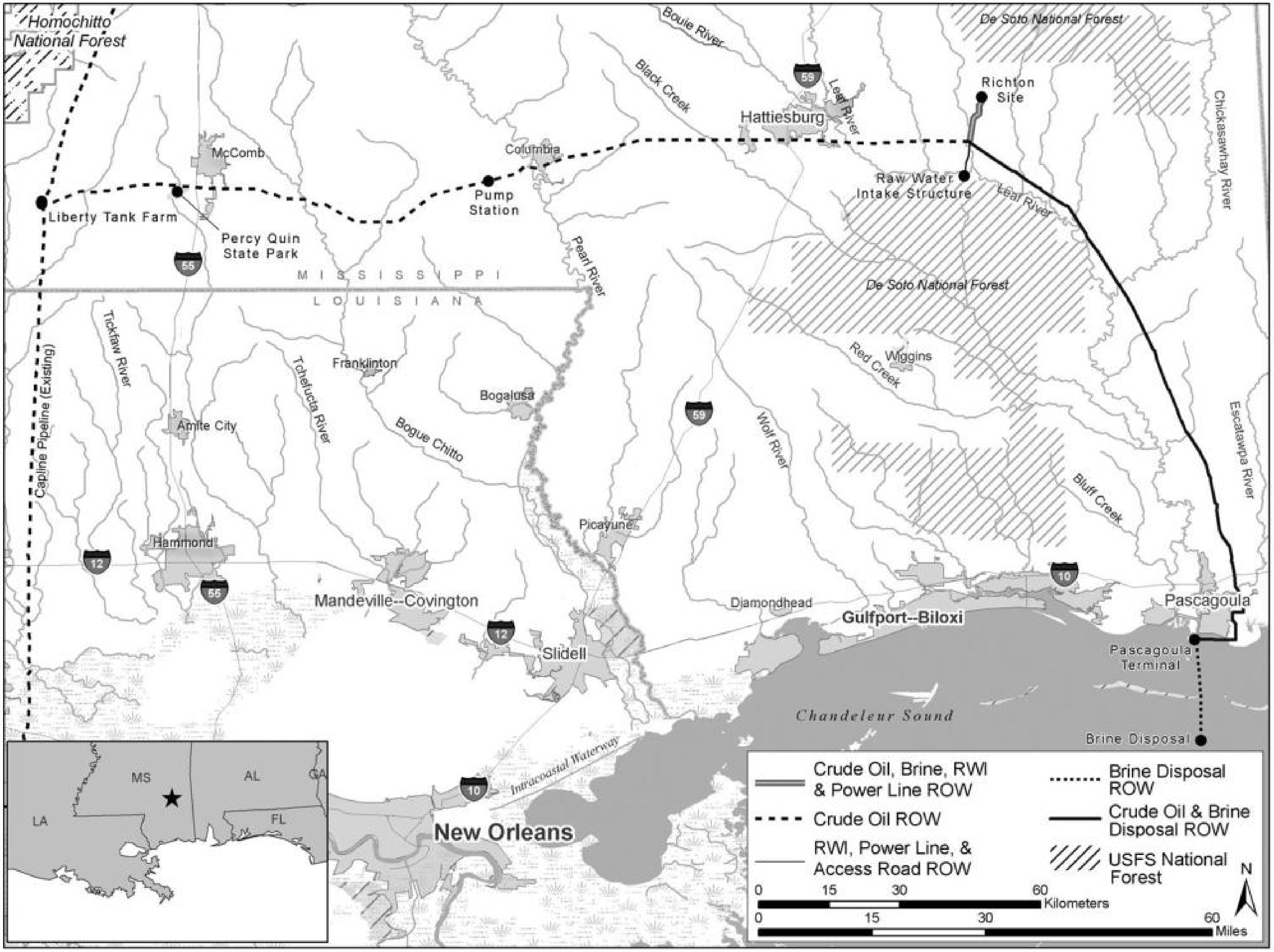

ICF20060516SSH002

**Figure 3.6.6-1: Regional Surface Water Map for Clovelly-Bruinsburg Sites**




ICF20060516SSH002

**Figure 3.6.7-1: Regional Surface Water Map for Richton Site**




ICF20060515SSH012

**Figure 3.6.7-2: Local Surface Water Map for Richton Site**

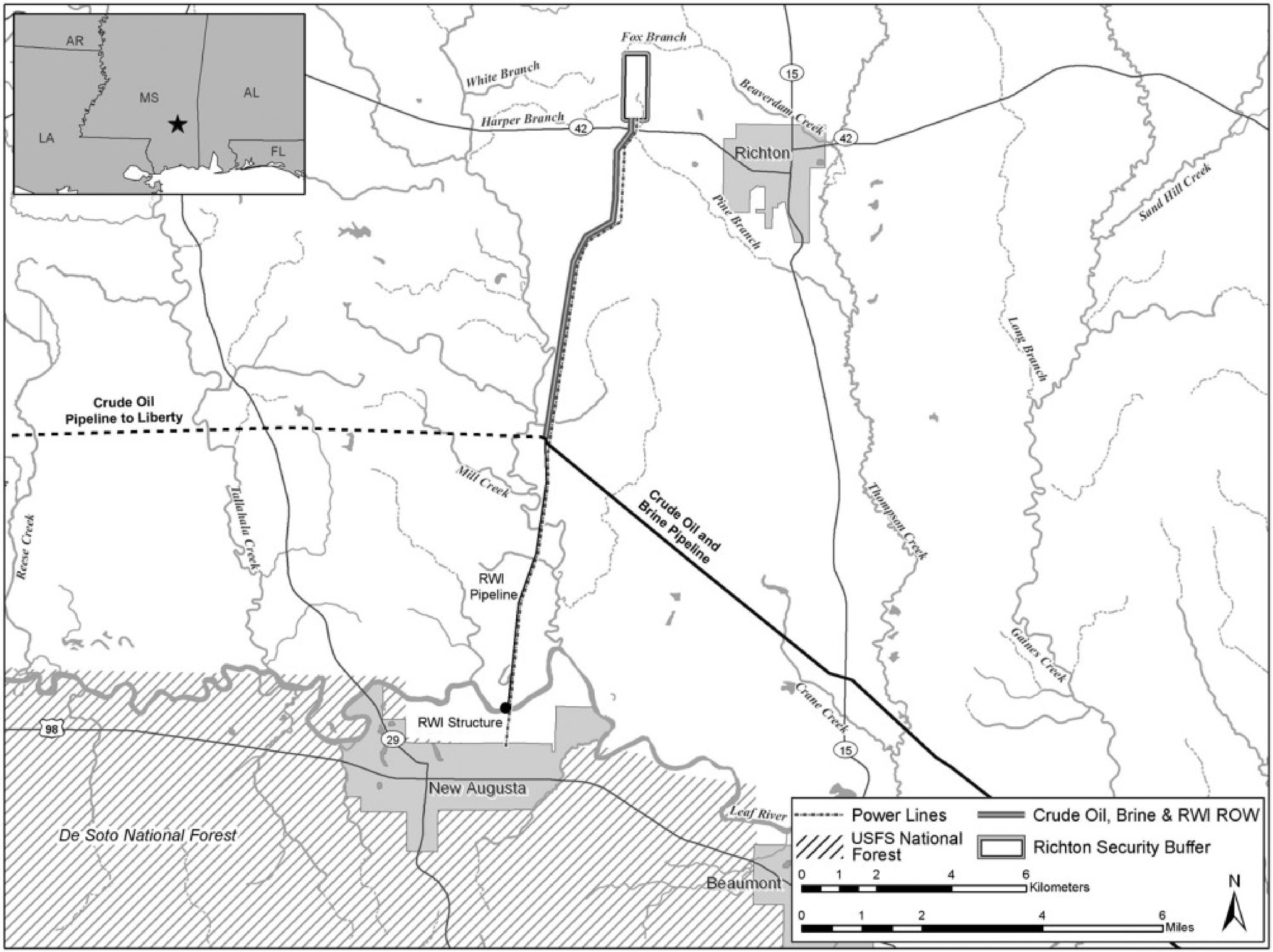
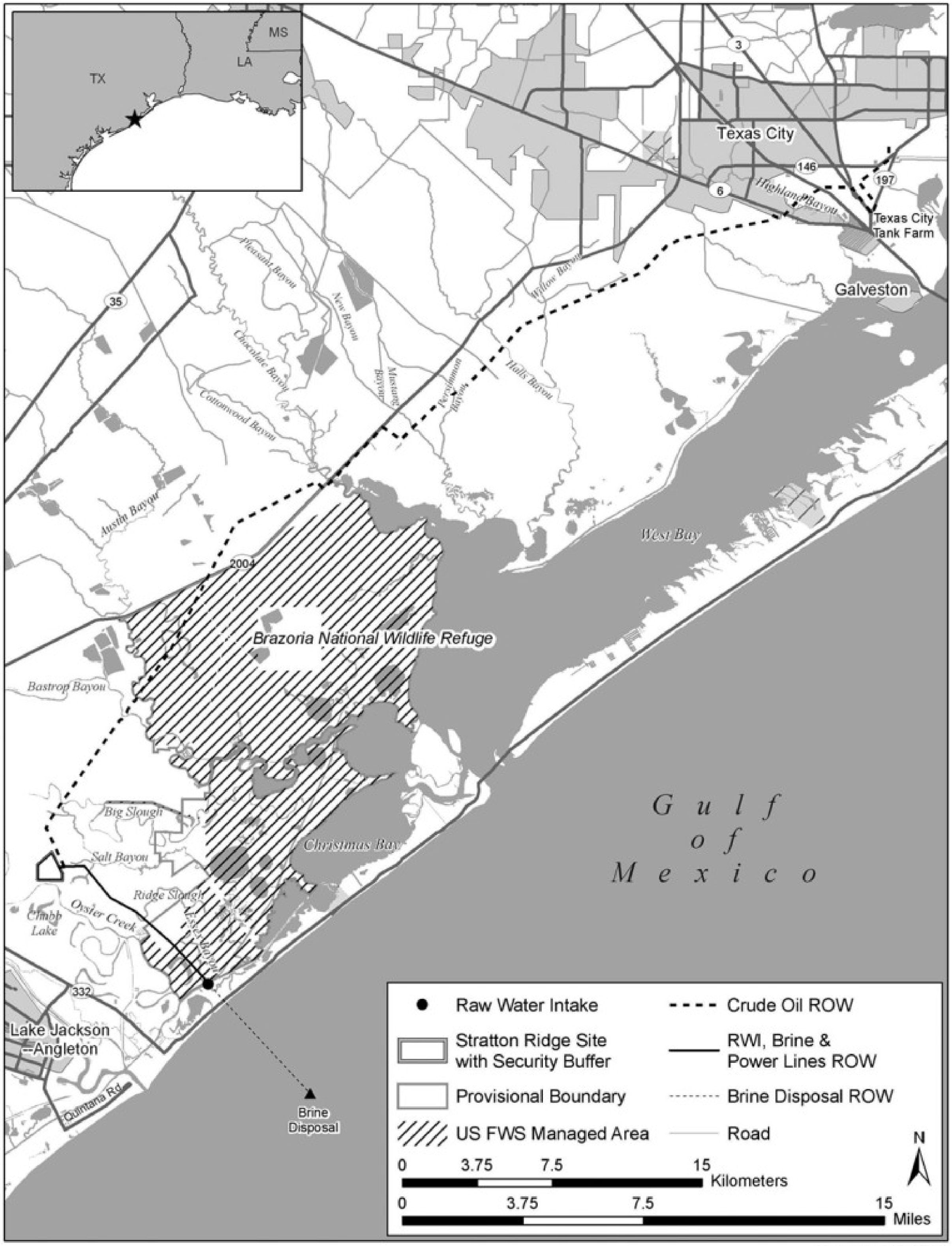
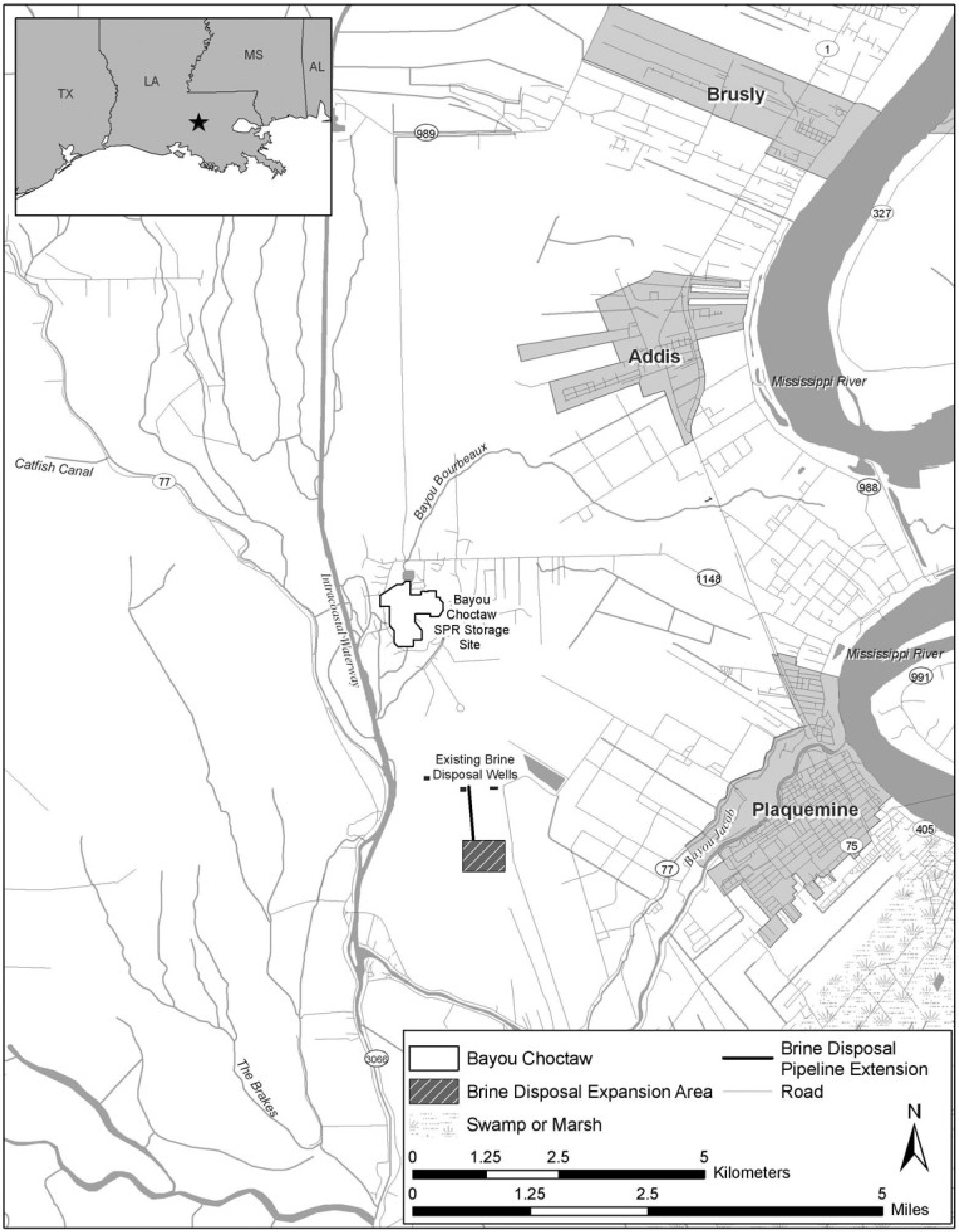


**Figure 3.6.8-1: Regional Surface Water Map for Stratton Ridge Site**




ICF20060516SSH003

**Figure 3.6.9-1: Local Surface Water Map for Bayou Choctaw Site**




ICF20060516SSH001

**Figure 3.9.3-1: Cultural Resources in Vicinity of Bruinsburg 160 MMB Facility**

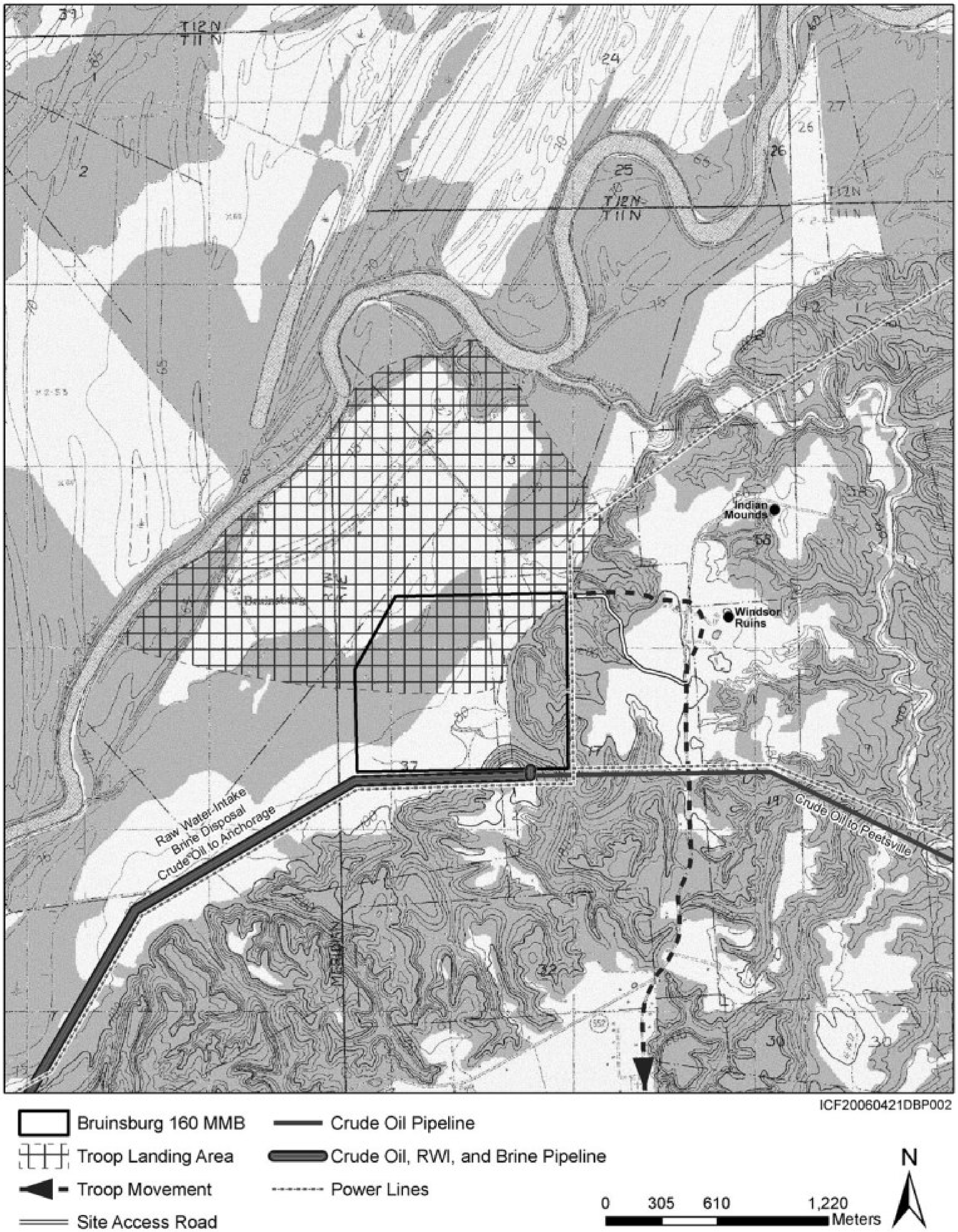
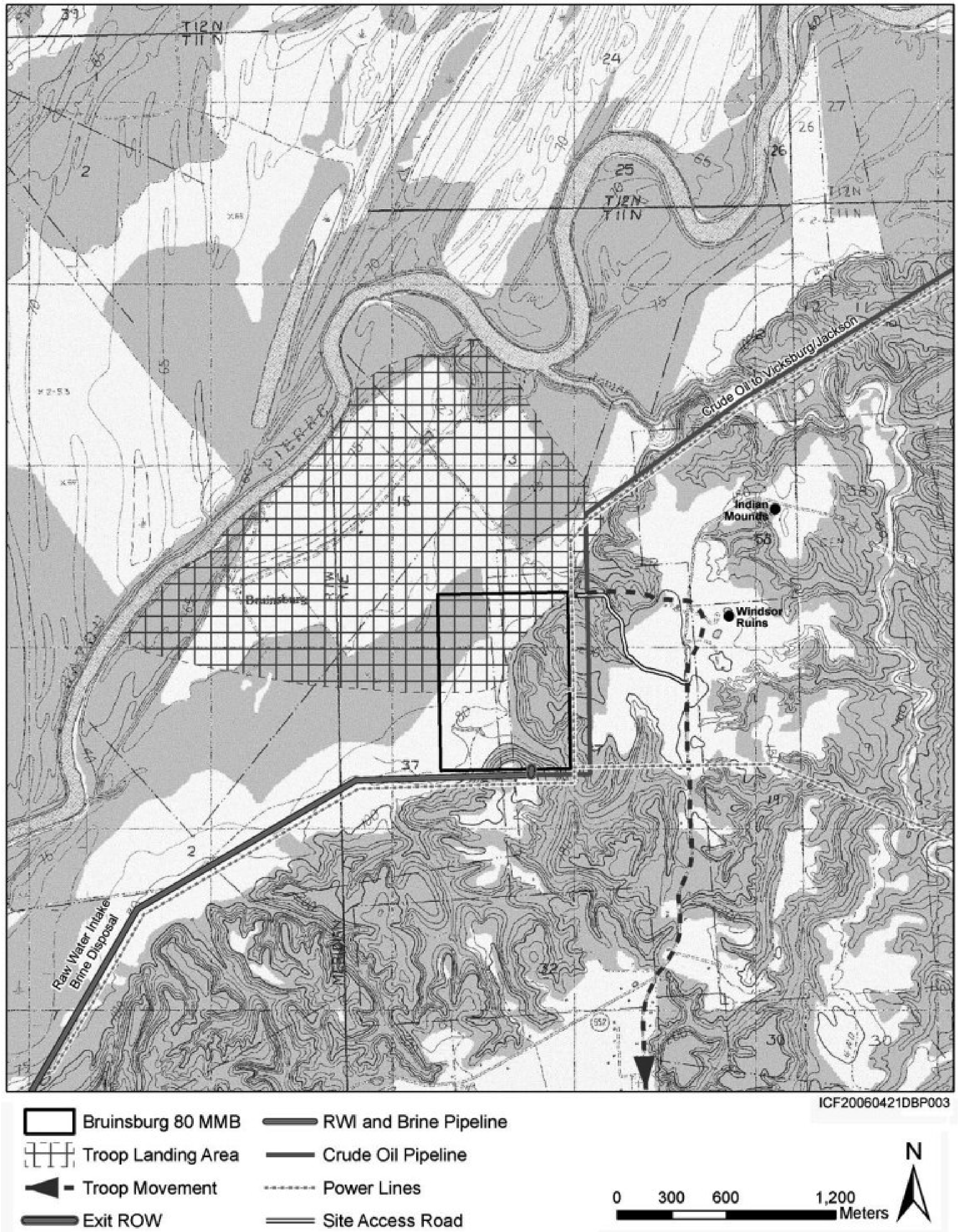


**Figure 3.9.6-1: Cultural Resources in Vicinity of the Bruinsburg 80 MMB Facility Proposed for the Clovelly-Bruinsburg Combination**



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INDEX

## Summary

## Chapter 1. Purpose and Need for Action

## Chapter 2. Proposed Action and Alternatives

## Chapter 3. Affected Environment and Potential Impacts

### 3.1 Introduction



### 3.2 Environmental Risks and Public and Occupational Safety and Health

## 3.3 Land Use

## 3.4 Geology and Soils



## 3.5 Air Quality

## 3.6 Water Resources

## 3.7 Biological Resources

### 3.8 Socioeconomics



### 3.9 Cultural Resources

### 3.10 Noise



### 3.11 Environmental Justice

## Chapter 4.  Cumulative Impacts

## Chapter 5. Irreversible and Irretrievable Commitment of Resources



## Chapter 6. List of Preparers



## Chapter 7. List of Agencies, Organizations, and People Receiving Copies of the Draft Environmental Impact Statement