

Summary

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Table of Contents

	<u>Page</u>
S.1 BACKGROUND	S-1
S.2 PURPOSE AND NEED	S-1
S.3 PROPOSED ACTION AND ALTERNATIVES	S-2
S.3.1 Potential New Sites	S-2
S.3.2 Potential Expansion Sites	S-3
S.3.3 Alternatives	S-3
S.3.4 Background on Construction and Operations of SPR Storage Sites	S-4
S.3.5 Potential New Sites and Associated Infrastructure	S-6
S.3.6 Potential Expansion Sites and Associated Infrastructure	S-7
S.4 ALTERNATIVES ELIMINATED FROM DETAILED STUDY.....	S-12
S.5 PUBLIC INVOLVEMENT	S-17
S.5.1 Scoping Comments	S-17
S.5.2 Public Review of Draft EIS.....	S-20
S.5.2.1 Major Issues Raised in Comments on Draft EIS	S-20
S.5.2.2 Major Changes to the Final EIS	S-22
S.6 ENVIRONMENTAL CONSEQUENCES	S-23
S.6.1 Environmental Risks and Public and Occupational Safety and Health.....	S-24
S.6.2 Land Use	S-25
S.6.3 Geology and Soils	S-27
S.6.4 Air Quality	S-28
S.6.5 Water Resources	S-28
S.6.6 Biological Resources.....	S-30
S.6.7 Socioeconomics	S-35
S.6.8 Cultural Resources	S-35
S.6.9 Noise	S-36
S.6.10 Environmental Justice	S-37
S.6.11 Comparison of Alternatives	S-37
S.7 CUMULATIVE IMPACTS.....	S-37

LIST OF TABLES

	<u>Page</u>
Table S.3.3-1: Alternatives	S-4
Table S.3.5-1: Key Elements of Proposed Action for Each Storage Site and Associated Infrastructure	S-7
Table S.6-1: Potential Resource Impacts by Alternative	S-23
Table S.6.6-1: Potential Acreage of Wetlands Affected by Alternatives with Three Expansion Sites	S-32
Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative	S-39
Table S.6.11-2: Differences in Potential Impacts for Alternatives with Two Expansion Sites (Comparison with Table S.6.11-1).....	S-46

LIST OF FIGURES

	<u>Page</u>
Figure S.3.2-1: Existing and Proposed New SPR Facility Locations.....	S-5
Figure S.3.5-1: Proposed Location of Bruinsburg Storage Site and Infrastructure.....	S-8
Figure S.3.5-2: Proposed Location of Chacahoula Storage Site and Infrastructure	S-9
Figure S.3.5-3: Proposed Location of Richton Storage Site and Infrastructure	S-11
Figure S.3.5-4: Proposed Location of Stratton Ridge Storage Site and Infrastructure.....	S-12
Figure S.3.6-1: Location of Bayou Choctaw Expansion Site and Proposed New Facilities	S-13
Figure S.3.6-2: Location of Big Hill Expansion Site and Proposed Infrastructure	S-15
Figure S.3.6-3: Location of West Hackberry Expansion Site	S-16

Summary

S.1 BACKGROUND

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 storage capacity of 727 million barrels (MMB) and an inventory of 688.5 MMB as of November 10, 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 oil production, distribution, and refining facilities in the Gulf region 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 authority of the 1975 statute to "exchange" SPR crude oil with oil from private companies by which the SPR ultimately receives more oil than it released.

The U.S. Department of Energy (DOE) conducted planning activities for the expansion of SPR's capacity to 1 billion barrels under 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*. The expansion planning directive in 1990 likewise resulted in a plan called *Report to Congress on Candidate Sites for Expansion of the Strategic Petroleum Reserve to One Billion Barrels* and the preparation of *Draft Environmental Impact Statement on the Expansion of the Strategic Petroleum Reserve, DOE/EIS-0165-D* in 1992, which assessed 5 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/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 Environmental Impact Statement (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 the oil inventory of the SPR supported the need for further capacity development.

S.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

Vertical lines in the left margin indicate where text in the draft EIS has been deleted, revised, or supplemented in this final EIS.

studied, sites necessary to enable acquisition by the Secretary of the full authorized volume of the Strategic Petroleum Reserve.”

EPACT Section 301(e) directs the Secretary to “... acquire petroleum in quantities sufficient to fill ...” the SPR to 1 billion barrels, which is what was authorized by congressional directives. Thus, the purpose and need for agency action is to select and develop the sites to expand SPR capacity from 727 MMB to 1 billion barrels, that is, to add 273 MMB of capacity.

S.3 PROPOSED ACTION AND ALTERNATIVES

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].”

Consistent with these mandates, DOE’s proposed action is to develop one new SPR site, 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 S.3.1 and S.3.2 of this Summary of the EIS describe the potential new SPR sites and the potential expansion of existing SPR sites, respectively. Section S.3.3 identifies the alternatives considered in the EIS, including the preferred alternative. Section S.3.4 presents background information on SPR construction and operations. Sections S.3.5 and S.3.6 discuss the potential new and expansion sites and their associated infrastructure.

S.3.1 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 in which DOE has previously studied a site. The following five sites met those conditions and were considered in the draft EIS:

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

Subsequent to the publication of the draft EIS, DOE determined that use of the Clovelly site, located at the Louisiana Offshore Oil Port’s (LOOP’s) Clovelly facility, is not feasible because of geotechnical issues and thus is not a reasonable alternative. DOE therefore removed the site from detailed consideration in this EIS.

Recent seismic surveys of the Bruinsburg salt dome indicate that it may not be able to provide the needed storage capability; however, it is retained as a potential new site.

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 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. The Cote Blanche site would have been connected by pipeline to the Weeks Island pipeline.

S.3.2 Potential Expansion Sites

In addition to potential new sites, this 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.

The existing SPR site at Bryan Mound was not considered for expansion because the salt dome has no capacity available for additional storage caverns. Figure S.3.2-1 shows the location of the proposed new and expansion sites.

S.3.3 Alternatives

In developing the range of reasonable alternatives, DOE first considered expansions of 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 additional MMB by expanding capacity only at existing sites. The amount of new capacity that is reasonable to develop at an existing site is limited by the physical size of the salt dome, the site's infrastructure for cavern development, and the availability of the commercial petroleum distribution infrastructure to support the increased rate of oil withdrawal from the site.

DOE has the capability to expand three of its existing sites as follows:

- Bayou Choctaw is the SPR's smallest storage site with only 6 caverns and a current storage capacity of 76 MMB. The salt dome is small and DOE currently shares the salt dome with a commercial storage operating company. Expansion is very limited due to the size of the salt dome. DOE has the capability of developing 2 additional caverns on its current property, which would expand the site's capacity by 20 MMB. Other than developing two new caverns, DOE would have to acquire existing commercial storage caverns on the salt dome to increase capacity at Bayou Choctaw. Therefore, DOE has considered the potential expansion of 20 MMB at the Bayou Choctaw site.
- The West Hackberry storage site has a current capacity of 227 MMB and could also be expanded by acquiring land and developing or acquiring additional caverns. However, the West Hackberry site no longer has the offshore brine disposal system necessary to support a cavern development operation. There are 3 existing commercial caverns on the salt dome that could be acquired to increase the site capacity by 15 MMB, to a total capacity of 242 MMB, without developing new caverns. Therefore, DOE has considered the maximum potential expansion of 15 MMB at the West Hackberry site.
- The Big Hill storage site has a current capacity of 170 MMB and could be easily expanded by acquiring land and developing several additional caverns. However, DOE does not desire to expand its sites beyond 250 MMB due to the very high drawdown rates necessary to withdraw the oil in a timely manner and the lack of existing commercial infrastructure to accommodate oil distribution at those rates. Therefore, DOE has considered the maximum expansion of 80 to 96

MMB at Big Hill. (The Big Hill expansion of 96 MMB is considered an alternative to the West Hackberry expansion of 15 MMB.)

To achieve the full 1 billion barrels, DOE will be required to construct a new site with a capacity of 160 MMB with a drawdown rate of 1.0 MMBD. A 160-MMB site provides the needed capability to store 2 crude oil segregations at the site and the 7-8 caverns of each crude type to achieve a site drawdown rate of 1.0 MMBD. Four potential new sites were designated for consideration in this EIS: Bruinsburg, MS; Chachoula, LA; Richton, MS; and Stratton Ridge, TX.

Potential development of each new site in combination with potential expansion of existing sites led to the alternatives analyzed in this EIS, as presented in Table S.3.3-1.

Table S.3.3-1: Alternatives

New Sites and Capacity	Expansion Sites and Added Capacity	Total New Capacity*
Bruinsburg, MS (160 MMB)	115 MMB	275 MMB or 276 MMB
Chachoula, LA (160 MMB)	Bayou Choctaw (20 MMB) Big Hill (80 MMB) West Hackberry (15 MMB)	
Richton, MS (160 MMB)	OR 116 MMB	
Stratton Ridge, TX (160 MMB)	Bayou Choctaw (20 MMB) Big Hill (96 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.

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

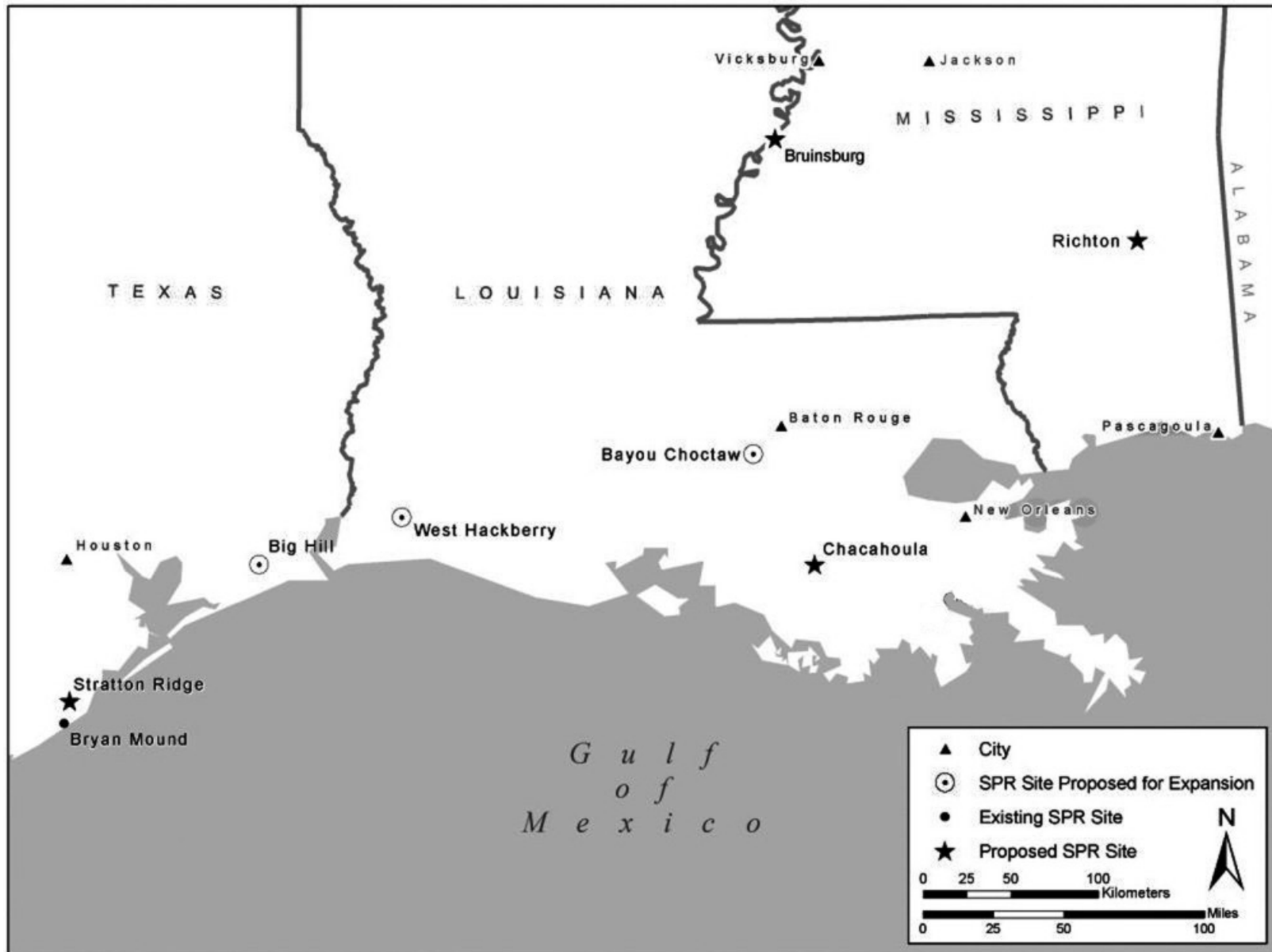
The Council on Environmental Quality (CEQ) regulations require an agency to identify its preferred alternative or alternatives, if one or more exists, in the draft EIS and identify such alternative in the final EIS. DOE identifies the Richton site alternative (with expansion of the Bayou Choctaw, Big Hill, and West Hackberry sites) as the **preferred alternative** based on crude oil distribution system capabilities, environmental considerations, project risks, and project costs. However, the three commercial caverns at the West Hackberry site were recently sold to Sempra Pipelines and Storage and ProLiance Transportation and Storage. As a result, DOE may not be able to acquire the West Hackberry site caverns at a reasonable cost. DOE will weigh the cost of expansion at the West Hackberry site as a factor in selecting sites.

DOE has analyzed the potential impact of its proposed action for each potential new and expansion site location separately. This will permit the public and DOE decisionmakers to understand the impacts unique to each site and each combination of sites. In its Record of Decision (ROD), DOE will determine which combination of sites best meets its goal of adding 273 MMB of capacity.

S.3.4 Background on Construction and Operations of SPR Storage Sites

Developing a new SPR storage site generally would include preparing the site; constructing the raw water intake (RWI) and brine disposal systems, including pipelines; creating caverns; installing oil pipelines to connect to existing petroleum distribution networks; and constructing support structures. Expanding an existing site would involve creating or acquiring additional storage caverns; using or modifying the existing RWI, brine disposal, and oil distribution systems; and augmenting support systems.

Figure S.3.2-1: Existing and Proposed New SPR Facility Locations



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Site preparation in dry upland areas would involve clearing, grading, stabilization, and compaction. Site preparation in wetlands would include dredging to allow for construction barges and filling to create areas for drill pads, roads, pipelines, buildings, and other structures. A 300-foot (91-meter) security buffer would be cleared around each new site area and new land acquired for expansion.

An RWI system would supply the large amounts of water needed for cavern creation and later oil drawdown. Individual storage caverns would be created in salt domes by solution mining, which would involve pumping raw water into the salt dome, dissolving the salt, pumping out the brine solution, and thereby forming a cavern. The brine solution would be pumped through a pipeline into the Gulf of Mexico or into underground injection wells for disposal.

Site preparation, development of support infrastructure, and construction of pipelines would take 4 to 5 years to complete. This would be followed by up to 5 years of cavern development; therefore, developing a new storage site may take up to 10 years to complete. The Richton alternatives could take longer if low flows in the Leaf River limit the amount of water available for solution mining for two reasons: (1) the volume of water available from the supplemental source, the Gulf of Mexico, may be smaller than the reduction in the volume from the Leaf River; and (2) a greater volume of saltwater than freshwater is needed in solution mining. See further discussion of the Leaf River and supplemental water sources for the Richton alternatives in section S.5.2.1.

When a cavern is completed, brine would be pumped out and displaced by crude oil. Crude oil would be stored until drawdown for redistribution through onsite and offsite pipelines and pumps connecting to an existing oil distribution network expanded as necessary to include new tank farms, terminals, marine docks, and other equipment.

Prior to brine disposal and crude oil distribution pipeline construction, DOE would clear and grade rights-of-way (ROWs) for pipelines. As needed, DOE would build temporary facilities such as roads and bridges for use during pipeline construction. The methods deployed for pipeline construction would depend on terrain, pipe size, and presence of groundwater and surface water. All pipelines would be buried, except where they would cross levees. Pipelines would require both temporary construction easements and permanent easements. Where feasible, new pipeline ROWs would follow existing ROWs.

In addition, a variety of structures would be needed at each site, including support buildings and enclosures. Power lines would be built along existing ROWs or along ROWs shared with pipelines or roads, where possible, to supply a new SPR storage site and the RWI, brine disposal, and oil distribution systems with the needed electric power.

S.3.5 Potential New Sites and Associated Infrastructure

This section describes the proposed action at each of the proposed new sites in alphabetical order. The following section S.3.6 describes the proposed action at each of the proposed expansion sites in alphabetical order. The descriptions to follow include a figure showing the location of the proposed new or expansion site and its proposed new infrastructure. Table S.3.5-1 presents the basic information on the key elements of the proposed action for each proposed new and expansion site.

Bruinsburg, MS

The Bruinsburg salt dome is located in Claiborne County, MS, 10 miles (16 kilometers) west of the town of Port Gibson and 40 miles (64 kilometers) southwest of the city of Vicksburg (not shown in figure S.3.5-1). Figure S.3.5-1 shows the location of the proposed Bruinsburg site and associated pipelines and other infrastructure. The proposed storage site encompasses a cypress swamp, cotton fields, forested

Summary

Table S.3.5-1: Key Elements of Proposed Action for Each Storage Site and Associated Infrastructure

Proposed Site	Increased Storage Capacity	Storage Site and Buffer	Water Source	Brine Disposal Facilities	Length of ROWs for New Pipelines, Roads, & Power Lines ^a	Other New Facilities	
						Facility Type	Size
Bruinsburg	160 MMB in 16 caverns ^b	365 acres	Mississippi River	60 new underground injection wells	230 miles	Terminals/tank farms at Peetsville, MS, and Anchorage, LA	141 acres
Chacahoula	160 MMB in 16 caverns	320 acres	ICW	New brine diffuser in Gulf of Mexico	184 miles	None ^c	N/A
Richton	160 MMB in 16 caverns	350 acres	Leaf River and Gulf of Mexico	New brine diffuser in Gulf of Mexico	229 miles	Terminals/tank farms at Liberty, MS, and Pascagoula, MS, and intermediate pump station near Columbia, MS	130 acres
Stratton Ridge	160 MMB in 16 caverns	371 acres	ICW	New brine diffuser in Gulf of Mexico	61 miles	Terminal/tank farm in Texas City, TX	39 acres
Bayou Choctaw	20 MMB in 2 caverns	0 acres ^d	Cavern Lake (existing RWI)	Existing and 6 new underground injection wells	2 miles	None ^c	N/A
Big Hill 80	80 MMB in 8 caverns	206 acres	ICW (existing RWI)	Existing brine diffuser in Gulf of Mexico	24 miles	None ^c	N/A
Big Hill 96	96 MMB in 8 caverns	206 acres	ICW (existing RWI)	Existing brine diffuser in Gulf of Mexico	24 miles	None ^c	N/A
West Hackberry	15 MMB in 3 caverns	81 acres ^e	ICW (existing RWI)	Existing underground injection wells	None	None ^c	N/A

1 acre = 0.405 hectares; 1 mile = 1.609 kilometers; N/A = not applicable; ICW = Intracoastal Waterway.

^a Length of each ROW that would be used for two or more SPR purposes (e.g., pipelines, roads, and power lines) is counted once.

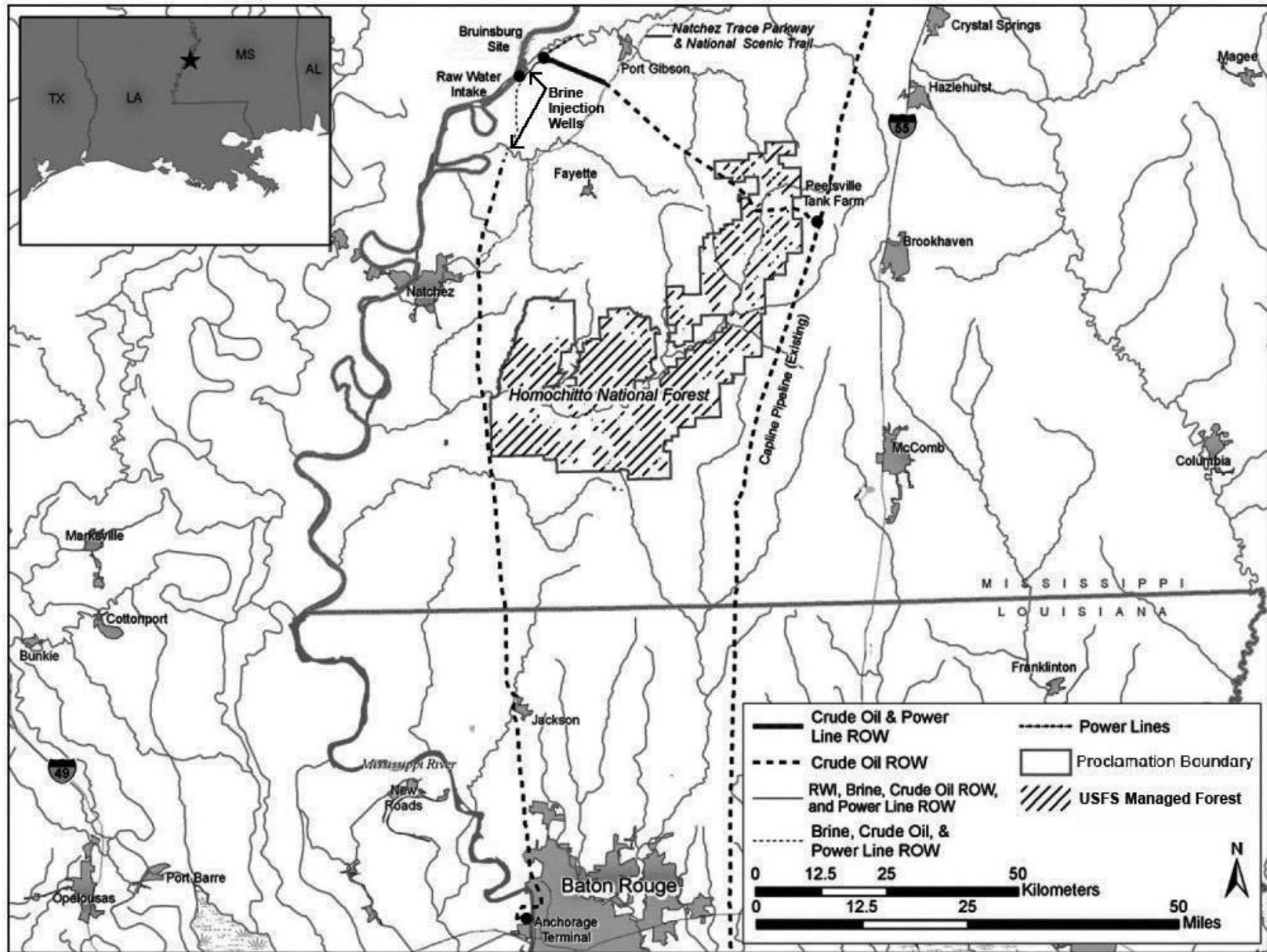
^b Surveys indicate the salt dome can accommodate only 70 MMB above 5,000 feet (1,500 meters) and that development lower would be technically difficult and would involve operational risks.

^c Terminal(s) for the proposed site already exist and the current distribution capacity is sufficient to handle the potential increase in oil storage and distribution.

^d Two new caverns would be on existing SPR land.

^e DOE also would purchase, but not entirely develop, an additional 147-acres adjacent to the existing site, which is part of a parcel needed for the 81-acre expanded site and buffer area.

Figure S.3.5-1: Proposed Location of Bruinsburg Storage Site and Infrastructure



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areas, and a bluff overlooking the Mississippi River. DOE recently conducted seismic surveys of the Bruinsburg salt dome to measure the size of the dome to confirm its capability to provide 160 MMB of oil storage capacity. Analysis of the surveys indicates that the salt dome is smaller than initially thought and would likely be incapable of accommodating the planned 16 caverns with 10-MMB capacity each in the salt strata above 5,000 feet (1,500 meters) below the surface, as would be required under current SPR operating criteria. Surveys of salt dome characteristics at depths below 5,000 feet (1,500 meters) indicate that there may be an ability to develop oil storage caverns below 5,000 feet (1,500 meters), but doing so would be more difficult technically and would involve uncertain operational risks. This EIS retains the Bruinsburg site as presented in the draft EIS.

The infrastructure associated with the Bruinsburg storage site would include new terminals with a tank farm at Peetsville, MS, and Anchorage, LA.

Chacahoula, LA

The Chacahoula salt dome site is located 40 miles (64 kilometers) north of the Gulf of Mexico in northwestern Lafourche Parish, southwest of Thibodaux, LA. Figure S.3.5-2 shows the location of the proposed Chacahoula site and associated (existing) infrastructure. The proposed storage site largely lies underwater in wetlands.

Richton, MS

The Richton salt dome is located in northeastern Perry County, MS, 18 miles (29 kilometers) east of Hattiesburg, MS. Figure S.3.5-3 shows the location of the proposed Richton site and associated infrastructure. The proposed storage site is comprised of an actively managed pine plantation with a small emergent wetland area. The infrastructure associated with the Richton storage site would include new terminals with a tank farm at Liberty, MS, and Pascagoula, MS. Also, RWI structures would be built in both the Leaf River and the Gulf of Mexico at Pascagoula.

Stratton Ridge, TX

The Stratton Ridge salt dome is located in Brazoria County, TX, 3 miles (4.8 kilometers) east of Lake Jackson-Angleton, TX. Figure S.3.5-4 shows the location of the proposed Stratton Ridge site and associated infrastructure. The proposed storage site is currently used for cattle ranching and has some forested wetlands. The infrastructure associated with the Stratton Ridge storage site would include a new terminal with a tank farm in Texas City, TX.

S.3.6 Potential Expansion Sites and Associated Infrastructure

Bayou Choctaw, LA

The Bayou Choctaw SPR storage site occupies a 356-acre (144-hectare) site in Iberville Parish, LA, about 12 miles (19 kilometers) southwest of Baton Rouge. The Mississippi River is located about 4 miles (6.4 kilometers) east of the salt dome, and the Intracoastal Waterway (ICW) is about 0.5 miles (0.8 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. Figure S.3.6-1 shows the location of the Bayou Choctaw site and proposed new infrastructure.

Figure S.3.5-2: Proposed Location of Chacahoula Storage Site and Infrastructure

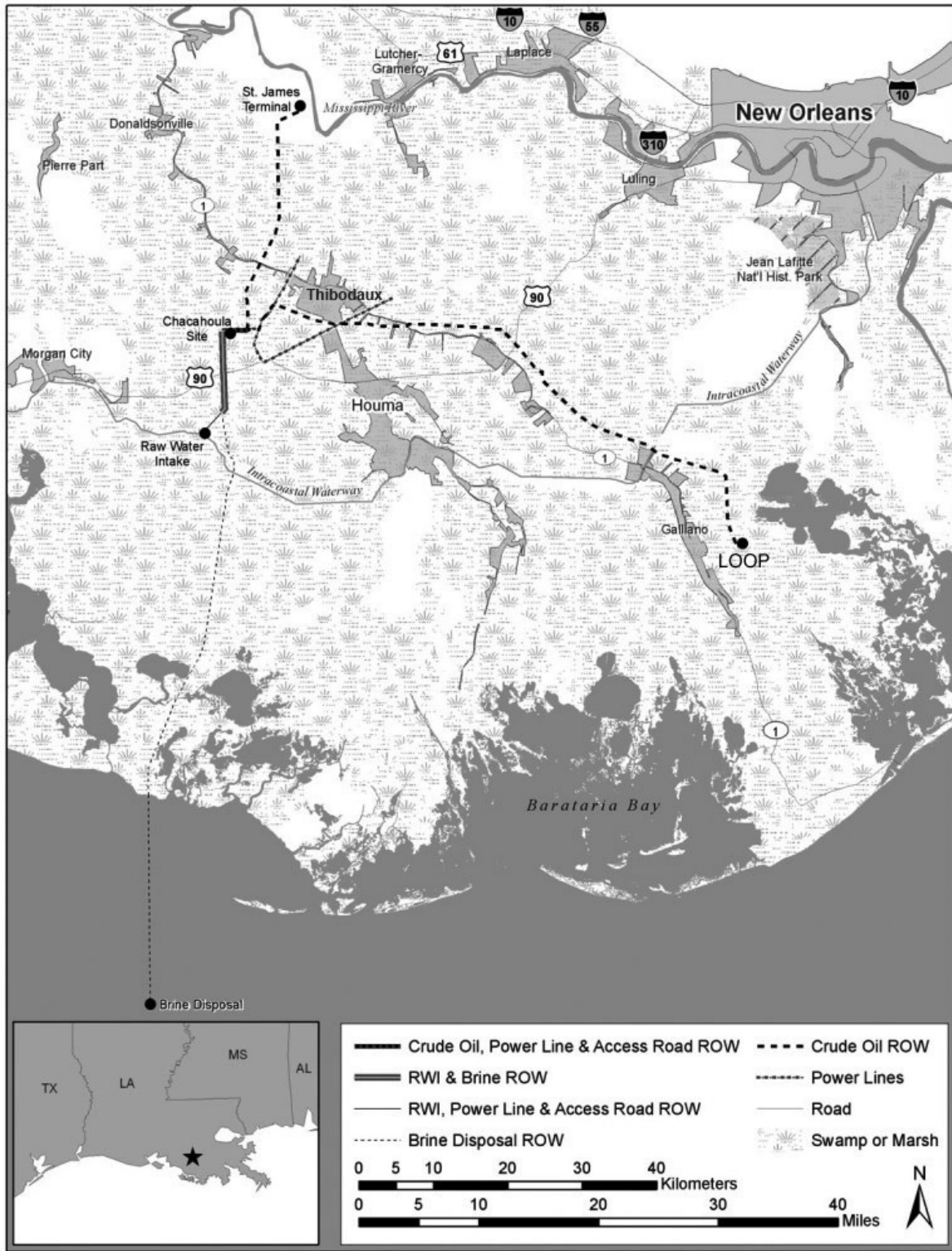
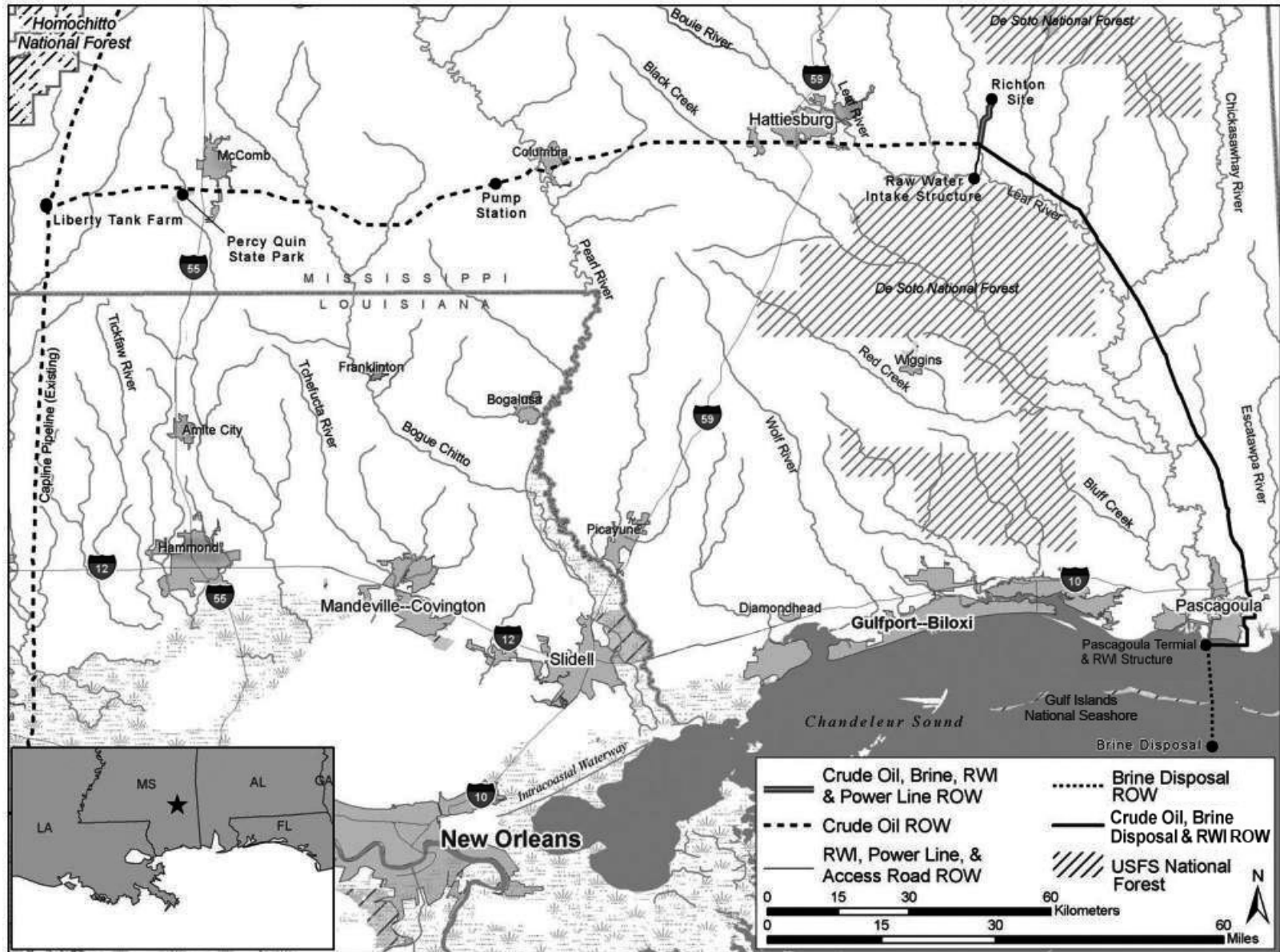
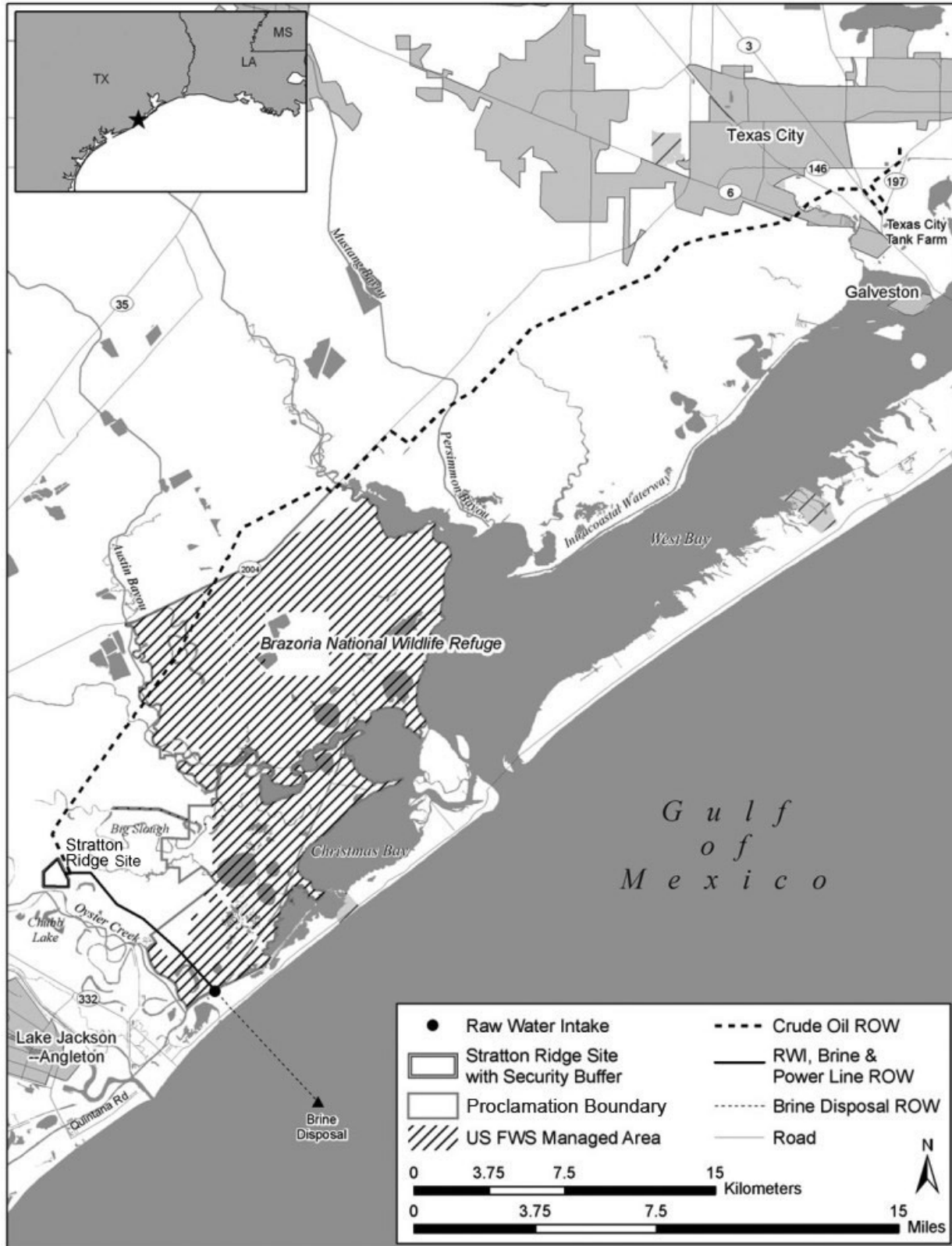


Figure S.3.5-3: Proposed Location of Richton Storage Site and Infrastructure



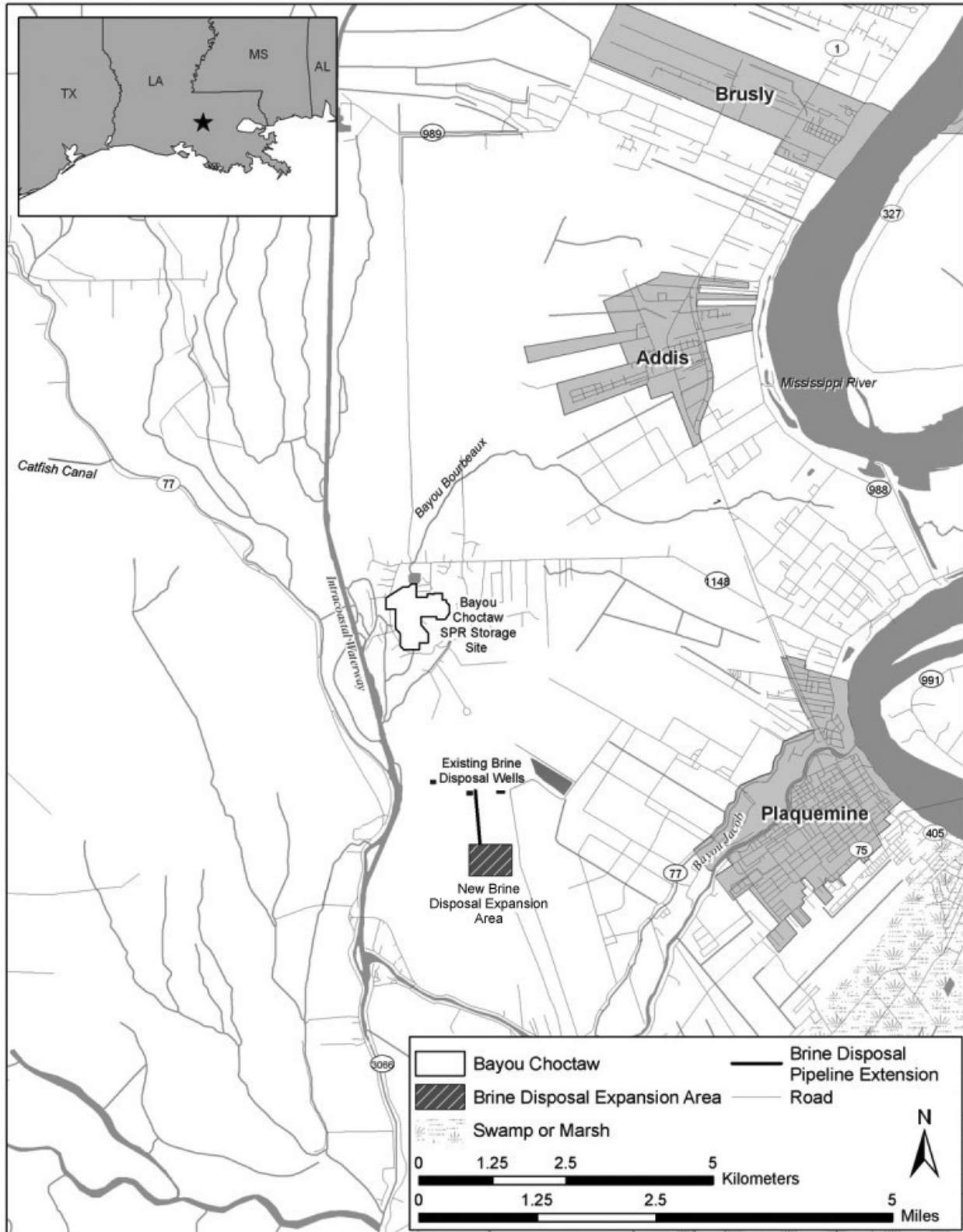
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Figure S.3.5-4: Proposed Location of Stratton Ridge Storage Site and Infrastructure



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Figure S.3.6-1: Location of Bayou Choctaw Expansion Site and Proposed New Facilities



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Big Hill, TX

The Big Hill SPR storage site is located in Jefferson County, TX, 17 miles (27 kilometers) southwest of Port Arthur. The existing site occupies approximately 250 acres (101 hectares). The surrounding area is predominantly rural with agricultural production as the primary land use. Figure S.3.6-2 shows the location of the Big Hill site and proposed new infrastructure. The site consists of low-to-moderate quality forest and wetlands.

West Hackberry, LA

The West Hackberry SPR storage site occupies a 565-acre (229-hectare) site in Cameron and Calcasieu Parishes in southwestern Louisiana. 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 (not shown in figure S.3.6-3). Figure S.3.6-3 shows the location of the West Hackberry site. The area is predominantly disturbed grassland habitat. Figure S.3.6-3 does not show any pipelines or other infrastructure for this site because no new infrastructure would be needed.

S.4 ALTERNATIVES ELIMINATED FROM DETAILED STUDY

As required by EPACT Section 303, DOE 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 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.

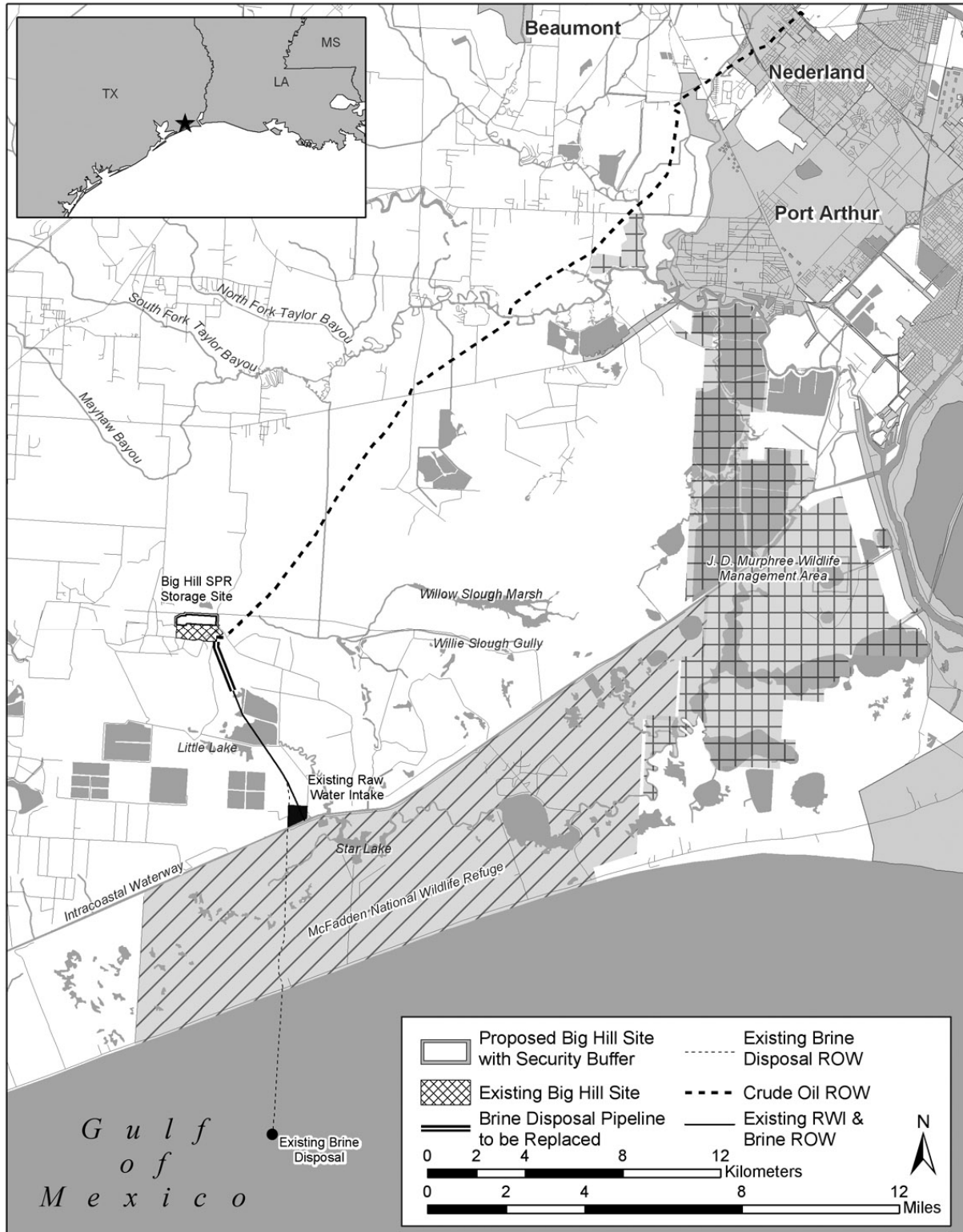
DOE eliminated the alternative of expanding capacity at Bryan Mound, TX, an existing SPR site, because the salt dome has no available capacity for additional storage. While the 1992 draft EIS addressed the potential new salt dome sites at Cote Blanche, LA, and Weeks Island, LA, DOE's review of these sites for this 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. The Cote Blanche site would have been connected by pipeline to the Weeks Island pipeline.

Subsequent to the publication of the draft EIS, DOE determined that the Clovelly 120-MMB alternative and the Clovelly 80- or 90-MMB and Bruinsburg 80-MMB alternatives are not feasible and therefore not reasonable. After the draft EIS was published, DOE completed additional studies of the geotechnical suitability of the Clovelly salt dome for SPR development. The dome's hourglass shape and its small size had required that DOE propose to place new SPR caverns for 120-MMB capacity below and in between Clovelly's existing caverns. This configuration has been found to present several risk factors to the integrity of the Clovelly caverns and infrastructure and overall operation of the proposed site.

Because of the potential mechanical interaction of the SPR caverns with the LOOP cavern field in the Clovelly dome formation, the maximum operating pressures for the SPR caverns would be greatly reduced to avoid severely damaging the bonding of the well casing within the salt formation. This reduction in maximum operating pressures would do the following:

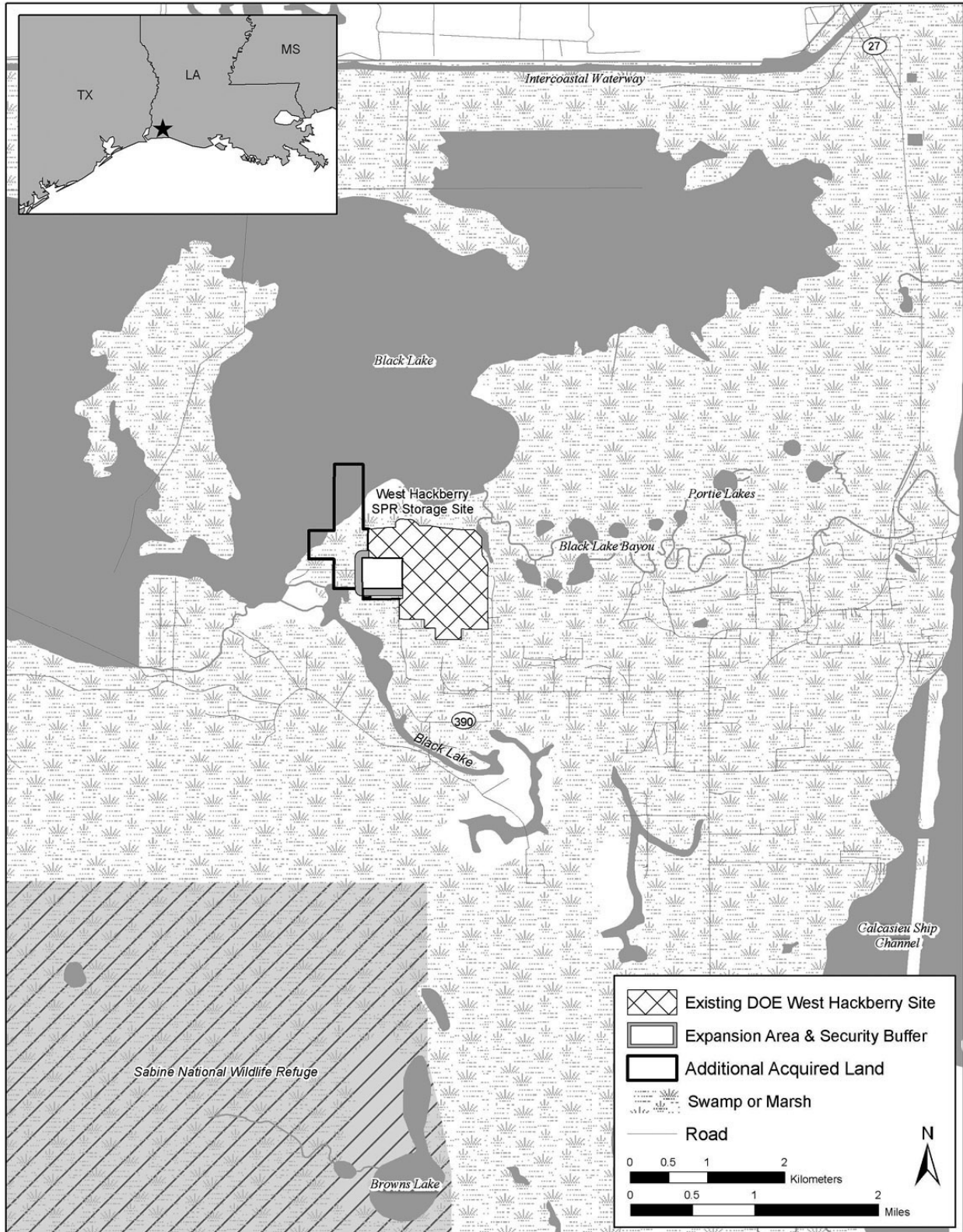
- Substantially limit the maximum rate of filling and withdrawing oil from the caverns, and
- Reduce DOE's ability to maintain the storage volume of the cavern. (Caverns at the depth DOE had proposed would incur high geological pressures that would cause the cavern volume to close or shrink, unless high pressures within the cavern are maintained.)

Figure S.3.6-2: Location of Big Hill Expansion Site and Proposed Infrastructure



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Figure S.3.6-3: Location of West Hackberry Expansion Site



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Because of these issues, development of the Clovelly 120 MMB alternative is no longer considered reasonable and feasible. DOE has removed the alternative from detailed consideration in the EIS.

In addition, DOE consulted with LOOP officials on whether an 80- or 90-MMB Clovelly facility, proposed in the draft EIS to be developed in conjunction with the Bruinsburg site, could be developed by constructing conventional SPR storage caverns entirely in the upper level of the unused portion of the salt dome around the existing LOOP caverns. LOOP indicated that it required space for three future caverns, which would leave space for only four to seven potential SPR caverns. That arrangement would provide only about 30 to 55 MMB of storage capacity. In addition, the arrangement would not meet DOE's minimum standoff distances from the edge of the dome and DOE's standard pillar-to-diameter ratio for the proposed caverns. Because of the small amount of overall capacity and the risk factors associated with cavern construction in the small salt dome, DOE does not consider this change in the conceptual plan for the Clovelly 80 MMB-Bruinsburg 80 MMB and the Clovelly 90 MMB-Bruinsburg 80 MMB alternatives to result in reasonable alternatives. Thus, DOE has removed these alternatives from detailed consideration in the EIS.

S.5 PUBLIC INVOLVEMENT

DOE published a Notice of Intent to Prepare an EIS on September 1, 2005 (70 FR 52088) and held four public scoping meetings. DOE received 67 scoping comment documents (comment letters and/or oral testimony) from 48 members of the public, companies, organizations, and government agencies. Section S.5.1 summarizes the major issues addressed in the scoping comments. Copies of the comment letters received during the scoping period and complete public scoping meeting transcripts are available from the Internet site <http://www.fossil.energy.gov/programs/reserves/spr/expansion-eis.html>.

DOE filed the draft EIS with the Environmental Protection Agency (EPA) on May 19, 2006. EPA published a Notice of Availability in the *Federal Register* on May 26, 2006 (71 FR 30400), starting the 45-day public comment period that ended on July 10, 2006. DOE received 93 written comment letters and 21 people testified at 5 public hearings for a total of 114 comment documents on the draft EIS from 108 members of the public, companies, organizations, and government agencies. Section S.5.2 summarizes the major issues raised by commenters and the resulting changes made by DOE to the final EIS. Copies of the comment letters and oral testimony received during the public comment period are available in appendix N and from the Internet site listed above. Also, chapter 8 presents the comments—organized by issue category—and the corresponding DOE responses.

S.5.1 Scoping Comments

This section summarizes the major scoping comments received by DOE on the Notice of Intent to prepare an EIS.

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 would present for the increased risks of terrorism or accidents because of proposals to build liquefied natural gas (LNG) facilities near the proposed 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 and cumulative impacts are discussed in chapter 4.

Land Use: Commenters 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 ROWs, 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 would be 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 (GUIS), and this is addressed in section 3.3.5.

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 national ambient air quality standards for ozone 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. The methodology for analyzing air quality impacts is discussed in appendix A. The related cumulative impacts are discussed in 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 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 alternate sources of RWI 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 appendices B, C, and O. The related cumulative impacts are discussed in 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, and candidate species such as the bald eagle, diamondback terrapin, gulf sturgeon, red-bellied turtle, brown pelican, and Louisiana black bear. Commenters identified specific biological resource areas (e.g., forested wetlands, wildlife refuges, national seashores, national forests, and benthic communities crossed by offshore brine disposal pipelines) or specific flora or fauna species (e.g., specific locations of bald eagle nesting areas) near specific SPR sites, pipeline ROWs, 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 and appendices B, C, D, E, F, G, H, I, K, and O. The impact assessment methodology for plants, wetlands, and wildlife is described in section 3.7.1.1 and appendix B. Special status species (including threatened and endangered species, marine mammals, and managed fisheries) are discussed in section 3.7.1.2 and appendices B, C, D, E, F, G, H, I,

K, and O; EFH is discussed in section 3.7.1.3 and appendix E. Special status areas (including national wildlife refuges, wilderness areas, Coastal Wetlands Planning, Protection and Restoration Act areas, and coastal natural resource areas) are discussed 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 chapter 3, section 3.7 and appendices B, C, E, F, G, H, I, and O. The related cumulative impacts are discussed in chapter 4.

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 that could be affected and the potential impacts 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 and appendix J.

Alternatives: Commenters proposed alternative locations for storage of crude oil. The suggestions included sites in Louisiana, Texas, New Mexico, and Virginia. A discussion of the proposed action and alternatives, including the statutory basis for selection of alternatives and alternatives considered but eliminated from detailed study, is included in chapter 2, section 2.6.

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 LNG facilities, future oil and gas production and pipelines, commercial fishing) 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. 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 for proposed SPR storage sites, pipeline ROWs, RWI areas, or brine disposal areas. The potential impacts and the associated mitigation measures

are discussed in the relevant sections of the EIS (e.g., potential impacts and mitigation measures for impacts to wetlands are both discussed in section 3.7 and appendices B and O).

S.5.2 Public Review of Draft EIS

Section S.5.2.1 summarizes the major issues raised by commenters on the draft EIS. (To view these comments see www.fe.doe.gov/programs/reserves/spr/expansion-eis.html.) Section S.5.2.2 describes the major changes that DOE has made in the final EIS. (To view the draft EIS, see www.fe.doe.gov/programs/reserves/spr/expansion-eis.html.)

S.5.2.1 Major Issues Raised in Comments on Draft EIS

Use of the Leaf River: Commenters expressed concern that raw water withdrawal from the Leaf River during low flow conditions for the Richton alternatives would result in adverse water quality and endangered species impacts. They suggested that DOE consider other sources for water withdrawals for the Richton alternatives. DOE consulted with natural resource agencies, but identified no other practicable alternative for the entire proposed RWI withdrawal rate of 1.2 MMBD.

DOE has modified the Richton alternatives to reduce its dependence on the Leaf River by adding a supplemental water source, a RWI in the Gulf of Mexico at Pascagoula. The draft EIS identified a 16-inch (41-centimeter) diameter, 88-mile (142-kilometer) pipeline between Pascagoula and the Richton site to transport crude oil (to serve as blanket oil) from Pascagoula to Richton at the start of cavern development. DOE has changed this conceptual design by increasing the diameter of the pipeline to 36 inches (91 centimeters) so that the pipeline would also be available to transport sea water from the Gulf of Mexico to Richton during periods of low flow in the Leaf River, both for cavern development and for drawdown operations.

Other features of the conceptual design or use of pipelines between Pascagoula and the Richton site remain unchanged from the draft EIS. That is, once development of all the caverns has been completed, the 36-inch pipeline described above would discharge small volumes of brine associated with cavern filling as was described in the draft EIS for the 16-inch (41-centimeter) pipeline. A second, larger pipeline in the same ROW (48-inch [112-centimeter] diameter), as described in the draft EIS, would discharge brine during cavern development and transport crude oil during operation.

The Pascagoula RWI and associated pipeline would transport water from the Gulf of Mexico, if needed, for cavern development, maintenance, and drawdown as follows:

- During normal and high flow conditions, DOE would withdraw water only from the Leaf River.
- During low flow conditions, excluding emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico and reduce or terminate its withdrawal from the Leaf River so that it would not cause the Leaf River to be below the Minimum Instream Flow designated by regulatory agencies to protect special status species.
- If low flow conditions exist in the Leaf River during emergency drawdown events (declared as a National Emergency), DOE would withdraw water from the Gulf of Mexico and, as necessary to reach the oil drawdown rate of 1.0 MMBD, from the Leaf River even if it caused the Leaf River to be below the Minimum Instream Flow.

The supplemental water source at Pascagoula would be designed to provide 0.5 MMBD of supplemental water, rather than the full 1.2 MMBD for two reasons. First, expanding the RWI system capacity would

involve substantial construction and operational costs, even though this extra capacity may never be needed during cavern development and drawdown. The costs would be higher, for example, because of a large diameter pipeline, high pumping capacity, and the electricity needed to pump water 88 miles. Second, due to its salinity, water from the Gulf of Mexico is less efficient in solution mining than fresh water from the Leaf River and its use would take more time than using freshwater, thereby increasing operational costs.

DOE has determined that withdrawal from the Leaf River during an emergency drawdown (declared as a National Emergency) may result in adverse impacts on water resources, may adversely affect aquatic communities, and may adversely affect species protected under the Endangered Species Act (ESA). In addition, withdrawal of water from the Leaf River at other times may adversely affect aquatic communities and protected species. If one of the Richton alternatives were selected, these potential impacts would require DOE to initiate formal consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries). During this consultation, DOE would develop a Water Conservation Plan as a mitigation measure. DOE also would consider supplemental water sources, such as water from underground sources, existing reservoirs, or river intakes during drawdown. DOE also would coordinate with the Mississippi Department of Environmental Quality to secure a Beneficial Use of Public Waters Permit, which would include withdrawal conditions.

Wetlands Impacts: Commenters stated that the Chacahoula and Stratton Ridge alternatives would have substantial adverse effects to wetlands. Commenters noted that the Clovelly alternative would be the environmentally preferable alternative because it would potentially affect the smallest amount of wetlands. Since the draft EIS was issued, however, DOE has determined that the Clovelly and Clovelly-Bruinsburg alternatives are not reasonable, as described above in section S.4. Commenters noted that DOE did not conduct Clean Water Act Section 404/401 permitting, delineate wetlands, or present a compensation plan during the preparation of the EIS and instead will wait until after the ROD. DOE determined that, to inform decisionmaking, general impacts to wetlands could be analyzed without conducting wetland delineations, and instead used National Wetlands Inventory data and conducted spot checks at each site. Also, in light of the broad geographic area covered by the alternatives, consultations with the U.S. Army Corps of Engineers (USACE) indicated that it would be a better use of USACE's and DOE's resources to wait until DOE selects an alternative in the ROD before delineating wetlands and initiating the Section 404/401 consultation and permitting process. DOE has added a conceptual wetland compensation plan (appendix O) that provides more information on possible mitigation strategies for wetland impacts.

Brine Discharge to Gulf of Mexico: Commenters requested additional analysis of the potential impacts of brine discharge into the Gulf of Mexico. Commenters also questioned the conclusion for the Richton alternatives that the increase in water salinity resulting from the brine discharge would be within natural salinity variation. The EIS presents an expanded analysis of brine discharge and explains that DOE would conduct additional modeling and monitoring of the brine discharge for the selected SPR alternative consistent with the permits needed from the state and Federal agencies.

Stratton Ridge Site Resource Conflicts: Commenters opposed SPR development of the Stratton Ridge storage site because it would conflict with Dow Chemical's desire to use salt that DOE would solution mine to create storage caverns. The commenters stated that loss of access to that salt would have a substantial adverse effect on Dow Chemical's long-term operations and would result in a loss of jobs in Brazoria County. Commenters also stated that construction of caverns at the Stratton Ridge site would result in irreversible and irretrievable loss of salt. DOE acknowledges that SPR development of the Stratton Ridge site could potentially conflict with Dow Chemical's future operations and thereby result in

adverse socioeconomic impacts in Brazoria County. In addition, DOE acknowledges that solution mining of SPR caverns would result in the irreversible and irretrievable loss of salt.

Essential Fish Habitat: A commenter requested that DOE identify and examine impacts to onshore EFH for all alternatives and identify and examine impacts to seagrass near the brine disposal pipeline for the Richton alternatives. DOE conducted additional geographic information system analyses to identify and examine such potential impacts. As discussed in section 3.7 and appendix E, the underwater construction of an offshore brine pipeline and diffuser for Chacahoula, Richton, and Stratton Ridge may pass through EFH, which would permanently remove submerged aquatic vegetation and EFH within the ROW. Construction of onshore pipelines, RWI structures in the ICW, and the proposed new terminal and RWI at Pascagoula for the Richton alternatives would affect EFH. DOE would avoid direct impacts to submerged aquatic vegetation and EFH (if practicable) and minimize indirect impacts. DOE's consultation with NOAA Fisheries would include a plan to mitigate and compensate for impacts to EFH, which would be included as part of the Section 404/401 permit.

S.5.2.2 Major Changes to the Final EIS

This section summarizes major changes DOE made in the final EIS.

Elimination of Clovelly Site Alternatives: Subsequent to the publication of the draft EIS, DOE determined that the Clovelly 120 MMB alternative and the Clovelly 80 or 90 MMB and Bruinsburg 80 MMB alternatives are neither reasonable nor feasible for geotechnical issues. DOE has eliminated these alternatives from detailed consideration in the final EIS, as discussed in S.4 and section 2.6.

Raw Water Source for Richton Alternatives: As discussed in the discussion of the Leaf River in section S.5.2.1, DOE has modified the Richton alternatives to provide a supplemental source of water for cavern construction, maintenance, and drawdown. During low flow conditions in the Leaf River, DOE would use water from a new RWI structure in the Gulf of Mexico at Pascagoula.

Preferred Alternative: DOE identifies the Richton alternative (with expansion of the existing Bayou Choctaw, Big Hill, and West Hackberry sites) as the preferred alternative based on crude oil distribution system capabilities, environmental considerations, project risks, and project costs as discussed in sections 1.4.4 and 2.2.3.

Wetlands Impacts: DOE added Appendix O, Conceptual Compensation Plan for Impacts to Wetlands and Waters, to the final EIS in response to requests for additional information regarding potential compensation sites required by the Clean Water Act Section 404. DOE revised appendix B to incorporate updated conceptual designs for RWI structures at Bruinsburg and Richton, an additional access road at the Chacahoula storage site, additional filling of floodplains at the Bruinsburg storage site, and the change to the Richton site infrastructure, as noted above. DOE also incorporated additional information into sections 3.6 and 3.7 to identify and examine potential impacts to wetlands as a result of the new conceptual designs.

Essential Fish Habitat and Brine Discharge: DOE conducted additional geographic information system analyses to identify and examine potential impacts to onshore EFH and offshore EFH, such as submerged aquatic vegetation and impacts due to the added RWI at Pascagoula for the Richton alternatives. The results are included in sections 3.6 and 3.7 and appendix E. The EIS also presents expanded analyses of potential impacts of brine discharge in sections 3.6.2 and 3.7.2, and appendices C and E.

S.6 ENVIRONMENTAL CONSEQUENCES

This section discusses the potential environmental impacts of the proposed action across 10 resource areas. The largest potential impacts are to land use, water resources, biological resources, and cultural resources, as shown in table S.6-1 and discussed below.

Table S.6-1: Potential Resource Impacts by Alternative

Alternative (With Three Expansion Sites) ^{a,b}	Environmental Risks, Health, & Safety	Land Use	Geology and Soils	Air Quality	Water Resources	Biological Resources	Socioeconomics	Cultural Resources	Noise	Environmental Justice
1 – Bruinsburg	-	-	-	-	-	●	-	●	-	-
2 – Chacahoula	-	-	-	-	-	●	-	-	-	-
3 – Richton	-	-	-	-	●	●	-	-	-	-
4 – Stratton Ridge	-	●	-	-	-	●	-	-	-	-
5 – No-Action	-	-	-	-	-	-	-	-	-	-

● = Greatest potential resource impacts

^a Under the alternatives with two expansion sites (Bayou Choctaw and Big Hill), the amount of wetlands affected would be 5 acres smaller, but none of the largest potential impacts would change.

^b Includes storage sites and associated infrastructure.

- **Land Use.** For Stratton Ridge alternatives, the proposed action would create potential conflicts with Dow Chemical Company’s use of salt on the salt dome and where two ROWs for the Stratton Ridge site would pass through a national wildlife refuge.
- **Water Resources.** The Richton alternatives would use the Leaf River, which has a highly variable flow, to serve as the primary raw water source for the Richton storage site. DOE has determined that withdrawal of water from the Leaf River during an emergency drawdown may result in adverse impacts on water resources. DOE would not withdraw water below the Minimum Instream Flow established for the Leaf River that is protective of aquatic resources, except for an emergency drawdown declared as a National Emergency.
- **Biological Resources.** The primary biological resources that would be affected by the proposed action include wetlands and species protected under the Federal ESA or related state requirements. All alternatives would affect a variety of wetlands, and some of the wetlands at all new and existing sites are regionally rare. DOE would avoid wetlands, to the extent possible, but the impacts may be adverse. If avoidance were not possible, the adverse effects would be mitigated to some extent by the wetland compensation requirements of the Section 404/401 permit under the Clean Water Act. All alternatives, except the no-action alternative, may affect at least one federally listed endangered or threatened species. If the selected alternative could adversely impact any federally listed endangered or threatened species or adversely modify any designated critical habitat, DOE would initiate formal ESA Section 7 Consultation with USFWS or NOAA Fisheries. The RWI in the Leaf River for the Richton alternatives may adversely affect two federally listed species (the yellow-blotched map turtle and the Gulf sturgeon) and a Federal candidate species (the pearl darter). DOE would consider the pearl darter as a “listed species.” DOE would prepare a Biological Assessment for the three species and implement any recommendations in the Biological Opinion. DOE would develop a Water Conservation Plan to work in conjunction with the Minimum Instream Flow established to protect the

aquatic resources. DOE has developed a revised conceptual plan for the Leaf River RWI that would reduce the potential for impingement and entrainment of aquatic species.

- Cultural Resources. SPR development under the Bruinsburg alternatives 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 following text summarizes the potential impacts by resource area in the order listed in table S.6-1. In addition, tables S.6.11-1 and S.6.11-2 at the end of this section compare the potential impacts for each alternative.

S.6.1 Environmental Risks and Public and Occupational Safety and Health

The EIS evaluates and describes the potential environmental impacts of a release of oil, brine, and several hazardous materials. For this analysis, DOE considered risk to be the likelihood (or chance) of occurrence and its potential consequences.

The risk of an oil spill from SPR activities generally is greatest during transfer activities. The initial filling of storage facilities represents the greatest chance of spills associated with imports into the United States because subsequent drawdowns and refills would only replace a transfer of oil from interrupted imports. Thus, the analysis focuses on the likelihood of an oil spill during initial-fill activities.

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

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 oil spill, the consequences of a release could be significant if the release was large and/or if it migrated into a sensitive aquatic system or plant community. A large release of oil could result in mortality of 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 oil 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 the release of 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 risk of brine spills would be low for all action alternatives. The risk is primarily a function of the amount of brine disposed, and this amount is similar for all alternatives, excluding the no-action alternative. The total number of brine spills predicted for each alternative would range from 91 to 98 (see table 3.2.2-2). 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 water bodies 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.

In addition to the brine spills associated with each action alternative, the Richton alternatives could result in spills of salt water from the Gulf of Mexico. If the Leaf River is unable, because of low flow conditions, to supply the full amount of water needed for cavern development and drawdown, a pipeline between Pascagoula and Richton would supply salt water from the Gulf of Mexico. Any spills of this water would have lower salinity (and lower potential impacts) than would be associated with spills of brine.

The risk of chemical spills and fire would be low and similar for all action alternatives because risk is primarily a function of the types of activities conducted. Activities are nearly identical for all alternatives, except for the no-action alternative. The occupational injuries also would be small and similar across action 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 Statistics average of 5.3 workdays per 200,000 worker hours.

Release of oil, brine, salt water, or hazardous materials could result from an accidental or deliberate system failure, with deliberate failures arising from sabotage or terrorism and accidental ones from design or construction flaws, human errors, or natural events. The EIS considers both minor and major releases so that the potential impacts of a terrorist action are captured within the EIS. Although the range of potential consequences can be described, the likelihood of a terrorism or sabotage event cannot be predicted or evaluated to the same degree.

S.6.2 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 the high end of 4,495 acres (1,819 hectares) for the Richton alternative with 3 expansion sites to the low end of 2,206 acres (893 hectares) for the Stratton Ridge alternative with 3 expansions sites. With 2 expansion sites, each alternative would require 81 fewer acres. Tables S.6.11-1 and S.6.11-2 identify the area required for the other alternatives.

At the expansion sites, the new storage facilities would be similar to existing facilities and therefore land use would not change substantially. Differences in land use conflicts among the alternatives would result from land use conflicts at new storage, pipeline, and other infrastructure sites. No substantial land use conflicts would arise for the Chacahoula site. For the other new sites, the following conflicts would arise for their infrastructure development.

- For the Bruinsburg site and associated infrastructure, 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 U.S. 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 Richton site and associated infrastructure, the crude oil pipeline to Liberty, MS, would cross the Percy Quin State Park for about 0.5 miles (0.7 kilometers) in a new ROW. If one of the Richton alternatives is selected, DOE would work with the State of Mississippi to realign the pipeline to cross the park in an existing ROW where feasible. In addition, the brine disposal pipeline would pass through GUIS, between two islands that are also partially designated as a Federal wilderness area and in an area of the Mississippi Sound that is managed by the GUIS. The Pascagoula terminal, tank farm, refurbished docks, and RWI would be located at the Naval Station Pascagoula, a Base Realignment and Closure site for which the future uses have not been determined.
- For the Stratton Ridge site and associated infrastructure, 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 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 one of the Stratton Ridge alternatives is selected, DOE would work with the USFWS to reduce these land use conflicts, such as by placing the power line underground. The Stratton Ridge site would conflict with Dow Chemical's desire to use the salt that DOE would solution mine to create SPR caverns. Dow has stated that loss of access to the salt would have a substantial adverse effect on Dow Chemical's long-term operations and the local economy.

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. Any such 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 site would have a visual impact on the historic Civil War landscape, as described in section S.6.8.
- As described under land use conflicts above, the ROWs for several sites 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 site and associated infrastructure, 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, which would be as long as up to 6 to 10 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 need not be given further consideration for protection.¹

Coastal Zone Management

The Stratton Ridge storage site and associated infrastructure would be in the coastal zone. The Bruinsburg, Chacahoula, Richton, and Bayou Choctaw storage sites would be outside the coastal zone, but some of the associated infrastructure would be in the coastal zone. The expansion site and infrastructure of Big Hill and the expansion site of West Hackberry would be in the coastal zone. DOE consulted with the coastal zone management agencies for all three states regarding compliance with the Federal Coastal Zone Management Act. The agencies prefer that DOE coordinate its consistency determination for the selected alternative through the USACE during the Clean Water Act 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.

S.6.3 Geology and Soils

Local subsidence, limited to the area above the proposed storage caverns, would range from about 2.6 to 6.1 feet (0.8 to 1.9 meters) over 30 years for the Bruinsburg, Richton, or Stratton Ridge storage sites and about 5 feet (1.5 meters) for the Chacahoula storage site. Local subsidence at expansion sites would be less than 3 inches (8 centimeters) per year. 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.

¹ The location of some of the proposed sites and their infrastructure changed slightly since DOE consulted with NRCS. These minor changes would not increase the score above 160 points for any site and its infrastructure.

S.6.4 Air Quality

The proposed action would generate low emissions of criteria pollutants. Emissions levels would be below levels of concern and 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 EIS estimates that the maximum emissions of volatile organic compounds would be slightly below the threshold that triggers a full conformity determination. Thus, if one of the Stratton Ridge alternatives is selected, DOE would conduct an additional conformity review using the final site design to determine whether thresholds would be exceeded and trigger a full conformity determination.

The largest source of greenhouse gas emissions for SPR expansion is carbon dioxide emitted from construction equipment and motor vehicles, and methane emitted 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 equivalent. The emissions during SPR operations would be smaller, about one-third as much as during construction.

S.6.5 Water Resources

The analysis of water resources addresses potential impacts to surface water, groundwater, and floodplains. Each of these topics is discussed below.

Surface Water

The proposed new and expansion sites 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. One new site (Richton) and one expansion site (Bayou Choctaw) would withdraw water from other local surface water bodies, the Leaf River and Cavern Lake, respectively. The Richton site also would withdraw water from the Gulf of Mexico if the flow of the Leaf River is low. The water withdrawal from water bodies other than the Leaf River would represent a small amount of the average available water from the water body because the water bodies are large or tidal. For the proposed Richton site, the flow rate of the Leaf River is highly variable and withdrawal has the potential to be a significant fraction of the total river flow during drought periods. The amount needed for construction of the proposed site would come from the Leaf River and would be supplemented by water from the Gulf of Mexico during low flow conditions in the Leaf River. The withdrawal from the Leaf River would stop if flow reaches the Minimum Instream Flow established by the regulatory agencies. However, if a National Emergency is declared, which requires a drawdown of oil, DOE may have to withdraw from the Leaf River even when flow is below the Minimum Instream Flow, in order to meet DOE's proposed oil drawdown rate of 1.0 MMBD.

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 would not affect navigation. Small increases in salinity levels would occur from the discharge for all sites with brine discharge into the Gulf of Mexico. Modeling indicated a maximum of 4.7 parts per thousand extending 1.5 nautical miles (2.8 kilometers) out from the diffuser. This increase would be comparable to natural salinity variations in the Gulf of Mexico. However, for the Chacahoula site, brine discharged through the proposed 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 for the Chacahoula brine discharge could be restricted due to the bathymetry resulting from the presence of the shoal area. DOE would secure National Pollutant Discharge Elimination System (NPDES) discharge permits from the appropriate state agency for the brine discharge into the Gulf.

All alternatives would involve construction of multiple pipelines that would cross surface water bodies ranging from large rivers to small streams. Construction activities across these surface water bodies may cause temporary stream bed or stream bank erosion, suspension of sediments, and possibly siltation in the water channel. The proposed pipeline surface water crossings would require a Section 404/401 permit from the USACE and appropriate state agency. These permits would require engineering methods to reduce any erosion or sediment impacts, and may require compensation for the loss of aquatic resources.

Pipelines for the Bruinsburg, Richton, and Stratton Ridge sites would pass through and may cross surface water bodies in established wellhead protection areas. These areas are established around surface water or groundwater supply sources to guard against contaminants entering the drinking water supply. Given the required permitting process and other measures that would be taken to guard against pipeline leakage, the pipelines are unlikely to discharge contamination into the wellhead protection areas.

The brine or oil discharges into surface water described above are potential impacts under Environmental Risks and Public and Occupational Safety and Health and Biological Resources.

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 brine injection system, which would result in a very small increased risk to the underlying sole source aquifer. Bayou Choctaw would use existing and proposed new injection wells. 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 ensure 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 have the capacity needed for expanding the site. 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 one of the Bruinsburg alternatives, the total disposal capacity and pressure build-up would be determined during the development of the detailed design and adjusted accordingly. If needed, brine would be injected in both the Sparta and Wilcox formations. Brine injected into these aquifers 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.

Pipelines associated with the Bruinsburg, Richton, and Stratton Ridge sites would cross areas with state programs (e.g., wellhead protection areas) to protect against contamination of particular groundwater sources of drinking water. Given the required permitting process and other measures that would be taken to guard against pipeline leakage, the pipelines are unlikely to discharge contamination into the wellhead protection areas.

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 floodplains. Between 84 acres (34 hectares) under the Richton alternatives and 307 acres (124 hectares) under the Bruinsburg alternatives of the 100-year floodplain would be permanently affected. Between 27 acres (11 hectares) under the Chacahoula or Richton alternatives and 213 acres (86 hectares) under the Stratton Ridge alternatives 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 the Stratton Ridge and Bruinsburg storage sites. Offsite pipeline construction would affect floodplains only during construction. Areas would be restored to grade following construction. Pipeline construction associated with the Chacahoula alternatives would cross the largest area of floodplains.

While some impacts to flood storage and flooding attenuation would occur, impacts generally would be limited because most of the infrastructure on the affected floodplains would be built below ground. The primary impacts would result from aboveground facility construction and placing fill for the new caverns at Bruinsburg, Chacahoula, Stratton Ridge, Bayou Choctaw, and Big Hill. These fill areas, however, would each constitute only a small proportion of the total area of the floodplain where they are located. The Chacahoula, Stratton Ridge, and Big Hill sites would be located in floodplains that extend over hundreds of acres in coastal basins. The Bruinsburg and Bayou Choctaw sites would be 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 not have significant 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 demonstrate that the proposed fill and structures would not increase the base flood elevation. Based on the factors discussed above and in detail in section 3.6 and appendix B, DOE expects that overall impacts to floodplain hydraulic function, lives, and property in the area, would not be significant.

S.6.6 Biological Resources

The analysis of biological resources addresses potential impacts to wetland, threatened and endangered species, special status areas such as parks, national wildlife refuges, and EFH. Each of these topics is addressed below.

Plants, Wetlands, and Wildlife

Each alternative would result in the clearing, grading, and filling of a variety of upland and wetland communities on the salt dome, at the ancillary facilities, security buffers, and in the ROWs. Filled wetlands would cause a permanent loss of all functions and values of the wetlands.

For each alternative, the construction and operation of ROWs would cause temporary impacts to wetlands within the construction easement, such as by clearing and equipment use, and permanent impacts within the permanently maintained ROW, such as by converting forested or scrub-shrub wetland communities to emergent wetlands. The impacts to wetlands within the ROWs and security buffer would include the loss or impairment of some wetland functions and values, such as aesthetics, some wildlife habitat, water quality, and biological productivity. Other functions and values, such as flood attenuation, groundwater recharge, some wildlife habitat and food production, may not be affected.

DOE would complete a wetland delineation for the selected alternative and secure a jurisdictional determination or confirmation of the wetlands boundaries from the USACE. For all filling of wetlands, temporary construction disturbance, and permanent conversion of wetlands from one type to another, DOE would secure a Clean Water Act Section 404/401 permit from the USACE and appropriate state agency. The impact to wetlands for each alternative other than the no-action alternative would be a potential adverse effect. DOE would prepare a wetland compensation plan to mitigate the impacts to wetlands, as described in appendix B, section B.4 and appendix O.

Table S.6.6-1 summarizes potential wetland acreage affected by each alternative with three expansion sites: Bayou Choctaw, Big Hill, and West Hackberry. In this table, the potentially affected wetland acreage is listed for forested, scrub-shrub, and emergent or other types of wetlands at the SPR storage sites, associated ancillary facilities, security buffers, and ROWs (such as for each site's associated utility lines, access roads, and pipelines for RWI, brine disposal, and crude oil). In table S.6.6-1:

- **Permanently Lost (Filled) Wetlands** are wetlands that would be filled to support wellheads and other structures.
- **Permanently Converted and/or Periodically Disturbed Wetlands** are wetlands within a security buffer or permanently maintained ROW. Forested and scrub-shrub wetlands would be permanently converted to emergent wetlands by cutting trees and shrubs. Emergent wetlands would re-establish in these areas, but periodic clearing would prevent trees and shrubs from growing back. This category also includes emergent wetlands that would be cleared during construction and periodically disturbed by maintenance clearing activities.
- **Temporarily Affected Wetlands** are wetlands that would be temporarily affected by construction in a ROW, such as wetlands within a temporary construction easement. Forested, scrub-shrub, and emergent wetlands would be cleared, but would be allowed to re-establish. Wetlands could be disturbed by construction activities such as equipment and material storage, construction traffic, and some grading. DOE would restore original contours, replace the original hydric topsoil in the disturbed area where practical, and seed with native species. Re-establishment of scrub-shrub or forested wetlands may take 5 to 25 years depending on the type of wetland affected. Emergent and other wetland types would return to the pre-existing conditions shortly after restoring original contours, seeding, and implementation of best management practices.

Appendix B presents a detailed discussion of the wetland types and impacts associated with each site and alternative.

The Bruinsburg alternatives would potentially affect about 708 acres (287 hectares) of wetlands. This includes a permanent loss through filling of about 156 acres (63 hectares) and a permanent conversion of about 123 acres (50 hectares) of relatively rare and ecologically important forested wetlands. About 118 acres (48 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROWs.

The Chacahoula alternatives would potentially affect 2,502 acres (1,013 hectares) of wetlands. About 182 acres (74 hectares) of ecologically important forested wetlands would be filled and about 699 acres (283 hectares) of forested wetlands would be permanently converted to emergent wetland. About 503 acres (204 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROW.

Table S.6.6-1: Potential Acreage of Wetlands Affected by Alternatives with Three Expansion Sites

Alternative ^a	Permanently Lost (Filled) Wetlands			Permanently Converted and/or Periodically Disturbed Wetlands			Temporarily Affected Wetlands			Total Potentially Affected Wetlands
	Forested	Scrub-Shrub	Emergent/ Other Wetlands ^b	Forested Converted to Emergent	Scrub-Shrub Converted to Emergent	Emergent/ Other Wetlands ^b Periodically Disturbed	Forested	Scrub-Shrub	Emergent/ Other Wetlands ^b	
Bruinsburg	156	9	7	123	26	81	118	28	160	708
Chacahoula	182	0	11	699	22	366	505	34	683	2502
Richton	59	0	54	295	79	163	506	114	287	1557
Stratton Ridge	227	16	49	70	8	183	9	4	275	841

^a Under the alternatives with two expansion sites (Bayou Choctaw and Big Hill, but not West Hackberry), the amount of permanently converted scrub-shrub wetlands and the total acreage of potentially affected wetlands would be lower by 5 acres.

^b Emergent/other wetlands include the following type of wetlands: Palustrine – emergent, Estuarine – emergent, Palustrine – aquatic bed, Lacustrine, Riverine, Marine, Palustrine – unconsolidated bottom, and Palustrine – open water.

The Richton alternatives would potentially affect 1,557 acres (630 hectares) of wetlands. The majority of the wetland areas affected (more than 1,400 acres [583 hectares]) in association with the Richton alternatives would be located in the long pipeline ROWs, which total over 200 miles and which pass through forested and emergent wetlands. The Richton alternatives would permanently fill about 59 acres (24 hectares) of forested wetlands and about 295 acres (119 hectares) of forested wetlands would be permanently converted to emergent wetlands. About 506 acres (205 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROWs.

The Stratton Ridge alternatives would potentially affect 841 acres (349 hectares) of wetlands. This includes a permanent loss through filling of 227 acres (92 hectares) of relatively rare and ecologically important forested wetlands. About 70 acres (28 hectares) of forested wetlands would be permanently converted to emergent wetlands. About 9 acres (4 hectares) of forested wetlands would be disturbed and cleared by construction activities within the temporary easement of the ROWs.

Threatened and Endangered Species

Each new site and associated infrastructure may affect one to five federally listed species. No federally listed endangered or threatened species would be affected at expansion sites. The following summarizes potential impacts for the proposed new sites.

Bruinsburg Site and Associated Infrastructure

- Fat pocketbook mussel, a federally endangered species, may be affected by the Bruinsburg ROW in-stream construction in Coles and Fairchild creeks.
- Pallid sturgeon, a federally endangered species, may be affected by the in-river construction and operation of the Bruinsburg RWI structure.

Chacahoula Site and Associated Infrastructure

- Bald eagle, a federally threatened species, 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, a federally endangered species, may be affected by the construction along the Chacahoula ROW to LOOP. Roosting habitat may be affected.

Richton Site and Associated Infrastructure

- Gopher tortoise, a federally threatened species, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and tortoises.
- Black pine snake, a Federal candidate species, may be affected by the construction along the Richton ROWs, which may result in a loss of habitat and snakes.
- Yellow blotched map turtle, a federally listed species, may be adversely affected by the in-water construction and operation of the Richton RWI structure on the Leaf River. A loss of habitat, impingement and entrainment of juvenile turtles, and alteration of the hydrologic regime or water quality in the Leaf River may occur.

- Gulf sturgeon, a federally listed species, may be adversely affected by the in-water construction and operation of the Richton RWI structure at the Leaf River, and may be affected by the brine discharge pipeline in the Mississippi Sound and the operation of the RWI at Pascagoula. The RWI may adversely affect designated critical habitat and may adversely affect the population through impingement and entrainment of eggs and juvenile sturgeon and alteration of water quality and the hydrologic regime in the Leaf River.
- Pearl darter, a Federal candidate species, may be adversely affected by the in-water construction and operation of the Richton RWI structure. The RWI may result in a loss of habitat, impingement and entrainment of pearl darters, or alteration of the water quality and hydrologic regime in the Leaf River.

Stratton Ridge Site and Associated Infrastructure

- Bald eagle, a federally threatened species, 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 ESA, 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 and NOAA Fisheries in accordance with Section 7 of the ESA.

Special Status Area

Expansion sites and the Chacahoula site and associated infrastructure would not affect any special status areas. The Bruinsburg site and associated infrastructure would involve a ROW crossing of the Natchez Trace Parkway. In addition, the crude oil ROW to Peetsville for the Bruinsburg site would pass through the proclamation area of the Homochitto National Forest. The Richton site and associated infrastructure would involve a ROW crossing of the Percy Quin State Park and the brine discharge pipeline would cross a managed area of the GUIS Seashore. The Stratton Ridge site would involve two ROWs that would pass through the Brazoria National Wildlife Refuge. The biological 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, Homochitto National Forest, Brazoria National Wildlife Refuge, GUIS, and Percy Quin State Park, DOE would coordinate with the National Park Service (NPS), the U.S. Forest Service, the USFWS, NOAA Fisheries, and Mississippi to minimize the impacts to important natural resources.

Essential Fish Habitat

The Big Hill, Chacahoula, Richton, and Stratton Ridge sites would require developing new offshore brine disposal systems and pipelines and structures that could affect onshore and offshore EFH. The underwater construction of an offshore brine pipeline and diffuser for these sites would pass through EFH and would temporarily increase suspended sediments and cause marine species to leave the area. Construction of onshore pipelines and some RWI structures would temporarily affect estuarine and tidally influenced palustrine wetlands in a similar manner. Some EFH would be permanently destroyed with the construction of RWI structures on the ICW and a terminal and RWI structure at Pascagoula for the Richton alternatives.

The operation of the offshore diffusers would cause minor increases in the salinity concentrations under the Chacahoula, Stratton Ridge, and Richton alternatives around discharge points in the Gulf of Mexico. 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 typically 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 potential impacts associated with onshore and offshore construction and brine diffusion on EFH.

S.6.7 Socioeconomics

The proposed action would require a peak construction work force of approximately 230 to 550 employees at the new storage site 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.

The development of the Stratton Ridge site could cause a loss of jobs if Dow Chemical would be unable to access the salt that DOE would solution mine to create SPR caverns.

S.6.8 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 all of the proposed new and expansion sites and associated pipelines and other infrastructure.

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 the Bruinsburg 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.

Under the terms of a programmatic agreement with the State Historic Preservation Officer (SHPO) in each state and the Advisory Council on Historic Preservation, DOE would 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 potential project effects and resolve adverse effects in consultation with the SHPOs and the tribes that are concurring parties to the programmatic agreement.

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.

Specific to the Bruinsburg alternatives, several measures could mitigate the effects of altering the setting at the Union Army 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 NPS 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.

S.6.9 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.

S.6.10 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 site and associated infrastructure 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.

S.6.11 Comparison of Alternatives

This section contains two tables that identify potential impacts in each resource area.

- Table S.6.11-1 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.
- Table S.6.11-2 addresses the difference between the alternatives in the first table (excluding the no action alternative), 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 at this site under both sets of alternatives.) As shown in the table, the differences between having three versus two expansion sites would be the same for each alternative.

S.7 CUMULATIVE IMPACTS

Other past, present, and reasonably foreseeable projects that could cause cumulative impacts in combination with the proposed action include projects such as pipeline construction, oil and gas development, roads, flood control, and real estate development in general. Both the largest direct effects and the most important cumulative impacts would be to wetlands. DOE determined that all candidate alternatives except the No Action would have a potentially adverse cumulative effect on wetlands. The EIS assesses the cumulative effects to water resources, but found negligible effects. DOE does not expect the cumulative effects to threatened and endangered species to be significant for any alternative, except for the Richton alternatives, which may have a cumulative adverse effect on the Gulf sturgeon, pearl darter, and yellow-blotched map turtle.

The Chacahoula alternatives would affect the most acres of wetlands of any alternative in combination with other projects in the same ecosystem. Louisiana has lost substantial amounts of wetlands associated with agricultural activities, land development, natural land subsidence, and erosive forces over many decades.

For the Bruinsburg site and associated infrastructure, with the exception of one of the proposed crude oil pipelines and a new casino affecting the same wetlands, there are no other potential projects nearby.

There are no existing or proposed projects near the Richton site and associated infrastructure that would have a meaningful cumulative effect. In general, however, Mississippi wetlands have been under significant development pressure in recent decades due to agricultural activities and more recently from residential and commercial coastal development.

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 and gas development. The Freeport LNG project is currently under construction on the Stratton Ridge salt dome, which is in close proximity to the proposed site of the DOE caverns. The natural gas storage cavern will be a major development in the area and will create cumulative pipeline construction and site development impacts on wetlands and EFH with the potential SPR site.

Several highway-widening projects would intersect the pipelines near the Stratton Ridge site and associated infrastructure and may cause localized cumulative effects to wetlands. In general, the coastal wetlands of Texas have also come under similar pressures as Louisiana and Mississippi.

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Environmental Risks and Public and Occupational Safety and Health	<p>Possible oil spills during initial fill. 16 oil spills predicted.</p> <p>Possible brine spills during the solution mining of caverns and fill. 91-98 brine spills predicted.</p> <p>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.</p> <p>Low likelihood of fire, based on historical operating data for existing SPR sites. There have been approximately 10 reportable fire incidents at SPR sites since 1992. None resulted in environmental impacts or long-term consequences to SPR operations.</p> <p>Number of occupational injuries (0.83 workdays per 200,000 worker hours) would be less than similar industries, based on SPR experience.</p>	Same impacts as under Bruinsburg alternative.	<p>Same impacts as under Bruinsburg alternative, except as noted below.</p> <p>Possible salt water spills if water from Leaf River is supplemented with water from Gulf of Mexico for cavern development or drawdown.</p>	Same impacts as under Bruinsburg alternative.	No impact.
Land Use: Land Use Conflicts	<p>3,485 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs.</p> <p>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.</p>	<p>2,901 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs.</p> <p>No potential land use conflicts.</p>	<p>4,495 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs.</p> <p>The terminal, tank farm, refurbished docks, and RWI at Pascagoula would be at the former Naval Station Pascagoula, a Base Realignment and Closure site for which the future uses have not been determined.</p>	<p>2,206 acres would be committed for alternative. Most acreage would be for pipeline and power line ROWs.</p> <p>Potential conflict with Dow Chemical's desire to use same salt.</p> <p>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.</p>	No impact.
Land Use: 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.	<p>Same visual impacts as Chacahoula.</p> <p>Brine discharge pipeline would cross GUIS Managed Area.</p>	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: 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.	No impact.
Land Use: Coastal Zone Management	<p>The Bruinsburg site and associated infrastructure would not be in the coastal zone. The Big Hill site and infrastructure and West Hackberry site and infrastructure would be in coastal zones.</p> <p>DOE and the state coastal zone agency would use the Clean Water Act Section 404 wetlands permitting process to reach a determination on coastal consistency.</p>	<p>Some of the Chacahoula infrastructure, Big Hill site and infrastructure, and West Hackberry site and infrastructure would be in coastal zones.</p> <p>Same coastal zone determination process as under Bruinsburg alternative.</p>	<p>Some of the Richton infrastructure, Big Hill site and infrastructure, and West Hackberry site and infrastructure would be in coastal zones.</p> <p>Same coastal zone determination process as under Bruinsburg alternative.</p>	<p>The Stratton Ridge site and infrastructure, Big Hill site and infrastructure, and West Hackberry site and infrastructure would be in coastal zones.</p> <p>Same coastal zone determination process as under Bruinsburg alternative.</p>	No impact.
Geology and Soils	Potential minor surface subsidence (2.6 to 6.1 feet over 30 years) at the Bruinsburg site. Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	Potential minor surface subsidence (approximately 5 feet over 30 years). Cavern construction and use would not interfere with use of other caverns on the salt dome. Local subsidence at expansion sites would be less than 3 inches per year.	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. Local subsidence at expansion sites would be less than 3 inches per year.	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. Local subsidence at expansion sites would be less than 3 inches per year.	No potential subsidence, except at new and existing sites where natural geologic conditions or current or future infrastructure would contribute to local subsidence.

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Air Quality	<p>Low airborne emission levels from construction activities would not exceed National Ambient Air Quality Standards.</p> <p>Emissions levels would be below levels of concern, including below conformity determination thresholds in the ozone nonattainment areas at Bayou Choctaw and Big Hill.</p> <p>Low levels of emissions of greenhouse gases from construction equipment and motor vehicles.</p>	Same air quality impacts as under Bruinsburg alternative.	Same air quality impacts as under Bruinsburg alternative.	Same as Bruinsburg, except that emission levels of volatile organic compounds would be just below the conformity determination threshold in the ozone nonattainment areas at Stratton Ridge. Because estimated levels are only slightly below the level that triggers a conformity determination process, DOE would conduct additional analysis based on the detailed design if one of the Stratton Ridge alternatives is selected.	No impact.
Water Resources: Surface Water	<p>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.</p> <p>DOE would also secure a Clean Water Act Section 404 permit and Section 401 Water Quality Certificate for construction activities in jurisdictional water bodies.</p> <p>Construction and operation would potentially affect 35 water bodies for the Bruinsburg site and infrastructure and 12, 4, and 3 water bodies for the expansions at Bayou Choctaw, Big Hill, and West Hackberry, respectively.</p> <p>There would be a potential for significant adverse water quality impacts if a brine or oil release occurred and traveled into a water body. The risk of such a release is small based on the history of existing SPR facilities.</p>	<p>Same erosion and sedimentation impacts as under Bruinsburg alternative.</p> <p>Same requirements as under Bruinsburg alternative for construction activities in jurisdictional water bodies.</p> <p>Chacahoula site and infrastructure would potentially affect 18 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative.</p> <p>Same spill risk as under Bruinsburg alternative.</p>	<p>Same erosion and sedimentation impacts as under Bruinsburg alternative.</p> <p>Same requirements as under Bruinsburg alternative for construction activities in jurisdictional water bodies.</p> <p>Richton site and infrastructure would potentially affect 63 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative.</p> <p>Same spill risk as under Bruinsburg alternative.</p>	<p>Same erosion and sedimentation impacts as under Bruinsburg alternative.</p> <p>Same requirements as under Bruinsburg alternative for construction activities in jurisdictional water bodies.</p> <p>Stratton Ridge site and infrastructure would potentially affect 17 water bodies. Same water bodies for expansion sites as under Bruinsburg alternative.</p> <p>Same spill risk as under Bruinsburg alternative.</p>	No impact.
	Bruinsburg RWI would withdraw from the Mississippi River 50 million gallons per day for 4 to 5 years, which is a small fraction of the river's flow.	Chacahoula RWI would withdraw 50 million gallons per day for 4 to 5 years from the ICW, a tidally influenced water body. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient by less than 1 part per thousand.	Richton RWI would withdraw 46 million gallons per day from the Leaf River during normal and high flow conditions. During low flow conditions, DOE would supplement the Leaf River withdrawal with up to 23 million gallons per day from the Gulf of Mexico to withdraw a total of up to 46 million gallons per day. Regulatory agencies would establish a Minimum Instream Flow for the Leaf River. DOE also would secure a Beneficial Use of Public Waters Permit from Mississippi. DOE would terminate Leaf River withdrawals if the flows reach the Minimum Instream Flow, except during an oil drawdown that is required by a National Emergency. The Leaf River withdrawal during drawdown may have an adverse effect on water resources. If DOE is required to limit its withdrawals from the Leaf River during cavern construction, the construction period may extend beyond 4 to 5 years because the volume of water from the Gulf of Mexico may be smaller than the reduction in the volume from the Leaf River and a greater volume of saltwater than freshwater is needed in solution mining.	Stratton Ridge RWI would withdraw 42 million gallons per day for 4 to 5 years from the ICW, a tidally influenced water body. Withdrawal would not significantly change the ICW water flow or volume, but may cause a slight upstream migration of the salinity gradient by less than 1 part per thousand.	

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Water Resources: Surface Water (continued)	<p>Big Hill and West Hackberry expansions would use existing RWIs from the ICW, a tidally influenced water body, without changing existing water body conditions. Bayou Choctaw would withdraw 25 million gallons per 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 by less than 1 part per thousand.</p> <p>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.</p>	<p>The impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.</p> <p>Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.</p>	<p>Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.</p> <p>Impact of Big Hill brine discharge would be the same as under Bruinsburg alternative.</p>	<p>Impact from water withdrawal for Bayou Choctaw, Big Hill, and West Hackberry expansions would be same as under Bruinsburg alternative.</p> <p>Impact of the Big Hill brine discharge would be the same as under Bruinsburg alternative.</p>	
Water Resources: Groundwater	<p>Bruinsburg pipelines would cross multiple source water protection areas with programs protecting against contaminating groundwater that is used as a source of drinking water; however, risk of groundwater contamination from pipeline spills would be low.</p> <p>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. EPA and/or appropriate state agency.</p> <p>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 one of the Bruinsburg alternatives, the total disposal capacity and pressure build-up would be determined during the development of the detailed design, which would be adjusted accordingly.</p>	<p>Chacahoula pipelines would not cross source water protection areas.</p> <p>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. EPA and/or appropriate state agency.</p>	<p>Richton pipelines would be constructed through and adjacent to several source water protection areas; however, risk of groundwater contamination from pipeline spills would be low.</p> <p>Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative.</p>	<p>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 would be low.</p> <p>Brine injection at Bayou Choctaw and West Hackberry would be same as under Chacahoula alternative.</p>	No impact.
Water Resources: Floodplains	<p>Construction of Bruinsburg storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 307 acres of 100-year floodplain and 49 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.</p> <p>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.</p> <p>ROWs for the Bruinsburg site and 3 expansion sites would temporarily affect 49 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.</p>	<p>Construction of Chacahoula storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 185 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.</p> <p>Site floodplain requirements and impacts would be same as under Bruinsburg alternative.</p> <p>ROWs for the Chacahoula site and 3 expansion sites would temporarily affect 110 miles of 100-year and 3 miles of 500-year floodplain.</p>	<p>Construction of Richton storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 84 acres of 100-year floodplain and 27 acres of 500-year floodplain. Construction of tanks and other infrastructure at Pascagoula terminal would involve placing fill within a floodplain.</p> <p>Site floodplain requirements and impacts would be same as under Bruinsburg alternative.</p> <p>ROWs for the Richton site and 3 expansion sites would temporarily affect 46 miles of 100-year floodplain and 6 miles of 500-year floodplain.</p>	<p>Construction of Stratton Ridge storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would affect 165 acres of 100-year floodplain and 213 acres of 500-year floodplain. Wellheads, well pads, and roads would involve placing fill or infrastructure in a floodplain.</p> <p>Site floodplain requirements and impacts would be same as under Bruinsburg alternative.</p> <p>ROWs for the Stratton Ridge site and 3 expansion sites would temporarily affect 60 miles of 100-year and 11 miles of 500-year floodplain.</p>	No impact.

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Water Resources: Floodplains (continued)	The filling and loss of floodplain area would reduce the flood storage area in the immediate watershed, and cumulatively in the larger watersheds. Floodplain area loss also would result in loss of habitat for certain species as the filling would alter the existing habitat and ecosystem. Permits may require that any loss of floodplains be compensated for in another area within the watershed.	ROW floodplain impacts would be same as under Bruinsburg alternative.	ROW floodplain impacts would be same as under Bruinsburg alternative.	ROW floodplain impacts would be same as under Bruinsburg alternative.	
Biological Resources: Wetlands	<p>Construction of Bruinsburg storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 172 acres of wetlands, including 91 acres of ecologically important palustrine forested wetland for the Bruinsburg storage site area. The type of palustrine forested wetland is bald cypress forest, which is relatively rare and ecologically and economically important.</p> <p>Security buffer at Bruinsburg, West Hackberry, and Big Hill storage sites would cause a permanent conversion of 19 acres of forested and scrub-shrub wetlands to emergent wetlands.</p> <p>Proposed ROWs for Bruinsburg and 3 expansion sites would affect 211 acres of wetlands within the permanently maintained easement and 306 acres within the temporary construction easement.</p> <p>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.</p> <p>Impact from permanent filling of wetlands and permanent conversion would be a potentially adverse effect because of the 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 Clean Water Act Section 404/401 permit for all impacts to wetlands. DOE would develop a comprehensive plan to further avoid and minimize wetland impacts and to mitigate for unavoidable impacts to wetlands by creating, restoring, or preserving wetlands, contributing a fee in lieu of creating, restoring, or preserving wetlands, or purchasing credits from a mitigation bank.</p>	<p>Construction of Chacahoula site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 193 acres of wetlands, including 128 acres of relatively rare and ecologically important palustrine forested wetland for the Chacahoula storage site area. The type of palustrine forested wetland is bald cypress forest, which is relatively rare and ecologically and economically important.</p> <p>The clearing of an additional 213 acres of palustrine forested wetlands is necessary for the security buffer at Chacahoula. The security buffer at West Hackberry and Big Hill storage sites would cause permanent conversion of 7 acres to emergent wetlands or open water.</p> <p>Proposed ROWs for Chacahoula and 3 expansion sites would affect 867 acres of wetlands within the permanently maintained easement and 1,222 acres within the temporary construction easement.</p> <p>The general nature of the wetland impacts and re-establishment periods would be same as under Bruinsburg alternative.</p> <p>The impact from the permanent filling of wetlands and permanent conversion would be same as under Bruinsburg alternative.</p>	<p>Construction of Richton storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 113 acres of wetlands, including 43 acres of disturbed low value estuarine wetlands at the Pascagoula terminal site.</p> <p>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.</p> <p>The proposed ROWs for Richton and the 3 expansion sites would affect 527 acres of wetlands within the permanently maintained easement and 907 acres within the temporary construction easement.</p> <p>The general nature of the wetland impacts and re-establishment periods would be same as under Bruinsburg alternative.</p> <p>The impact from ROWs is a potentially adverse effect because of the size of the area (over 600 acres) of palustrine forested and scrub-shrub wetlands. The impact would be mitigated. DOE would undertake the same wetland mitigation activities as under Bruinsburg alternative.</p>	<p>Construction of Stratton Ridge storage site, 3 expansion storage sites, RWIs, and other facilities except ROWs would permanently fill 292 acres of wetlands, including up to 192 acres of ecologically important palustrine forested wetland for the Stratton Ridge storage site area. The type of palustrine forested wetland is bottomland hardwood, which is relatively rare and ecologically important.</p> <p>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.</p> <p>The proposed ROWs for Stratton Ridge and the 3 expansion sites would affect 181 acres of wetlands within the permanently maintained easement and 288 acres within the temporary construction easement.</p> <p>The general nature of the wetland impacts and re-establishment periods would be same as under Bruinsburg alternative.</p> <p>The impact from the permanent filling of wetlands and permanent conversion is a potentially adverse effect because of the size 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 mitigation activities as under Bruinsburg alternative.</p>	No impact.

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
<p>Biological Resources: Threatened and Endangered Species</p>	<p>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 juvenile sturgeon. DOE would initiate formal ESA Section 7 Consultations with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect these species or designated critical habitat.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.</p>	<p>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 ESA Section 7 Consultations with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect these species or designated critical habitat.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.</p>	<p>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.</p> <p>The proposed RWI at Pascagoula and brine discharge pipeline would be located in designated critical habitat for the Gulf sturgeon in the Mississippi Sound.</p> <p>Proposed RWI on Leaf River may adversely affect the federally listed 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 individuals and because the withdrawal could change the hydrological regime and water quality 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. DOE has modified the conceptual plan for the Leaf River RWI structure to reduce the potential for impingement and entrainment of aquatic species. To mitigate, regulatory agencies would establish a Minimum Instream Flow and DOE would develop a Water Conservation Plan in consultation with the regulatory agencies that protects the listed and candidate species. The withdrawal from the Leaf River would be supplemented by a withdrawal from the Gulf of Mexico at Pascagoula during low flow conditions in the Leaf River. The Pascagoula RWI may affect the federally listed Gulf Sturgeon. The withdrawal from the Leaf River would be terminated if the flows reach the Minimum Instream Flow, except during oil drawdown under a National Emergency.</p> <p>DOE would initiate formal ESA Section 7 consultations with USFWS and NOAA Fisheries, prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect a listed species or designated critical habitat.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.</p>	<p>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 ESA Section 7 consultations with USFWS and prepare a Biological Assessment, and implement conditions of Biological Opinion if the project may adversely affect these species or designated critical habitat.</p> <p>Proposed expansion at Bayou Choctaw, Big Hill, and West Hackberry would not affect any federally listed species.</p>	<p>No impact.</p>
<p>Biological Resources: Special Status Areas</p>	<p>The pipeline ROW to the Peetsville terminal would cross Natchez Trace Parkway, which is managed by the 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.</p>	<p>No special status areas would be affected by this alternative.</p>	<p>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.</p> <p>Brine disposal pipeline would cross managed area of the GUIIS. The easement for the pipeline ROW would require a permit/consent from GUIIS. DOE would coordinate with the NPS to minimize impacts to fish and wildlife resources and secure approval for the easement.</p>	<p>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 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.</p>	<p>No impact.</p>

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	Richton	Stratton Ridge	No-Action
Biological Resources: Special Status Areas (continued)	Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.		Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.	Bayou Choctaw, Big Hill, and West Hackberry expansion sites would not affect any special status areas.	
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 not be adverse because the increase in salinity would typically be within the natural variability. Impacts to EFH would be temporary; the potentially affected area would represent a very small fraction of the total EFH in the Gulf of Mexico; and the dependent fishery species are generally tolerant of wider salinity changes than the predicted increase due to the brine discharge. Big Hill expansion would cause a temporary impact to about 5 acres of EFH due to pipeline construction.	Big Hill expansion site would have EFH impacts the same as the impacts from Big Hill under Bruinsburg alternative. Chacahoula would discharge brine near Ship Shoal, an important fishing area. A small salinity increase that may be above the natural variation may be experienced at Ship Shoal. Chacahoula would affect about 1,067 acres of EFH, most of which would be a temporary impact due to pipeline construction.	Big Hill expansion site would have EFH impacts the same as the impacts from Big Hill under Bruinsburg alternative. Richton would affect about 183 acres of EFH due to temporary impacts from construction and to about 43 acres of fill for a new terminal and RWI at Pascagoula. Brine pipeline construction may affect submerged aquatic vegetation. DOE would coordinate with NOAA Fisheries and GUIIS to minimize impacts to EFH and mitigate for permanent impacts to EFH.	Big Hill expansion site would have EFH impacts the same as the impacts from Big Hill under Bruinsburg alternative. Stratton Ridge would temporarily affect about 92 acres of EFH during construction of pipelines and would permanently affect about 17 acres due to the RWI, which is a permanent structure. Seventeen acres of EFH would be permanently affected due to the construction and operation of a RWI structure.	No impact.
Socioeconomics	Peak construction workforce of 474 for Bruinsburg site and its infrastructure. Peak construction workforce of 100 to 350 employees at expansion sites. Operations and maintenance workforce of 75 to 100 employees at Bruinsburg site and an additional 25 employees at each expansion site. 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.	Peak construction workforce of 445 for Chacahoula and its infrastructure. Same expansion site workforce as under Bruinsburg alternative. Same operations and maintenance workforce as under Bruinsburg alternative. Similar socioeconomic impacts as under Bruinsburg alternative.	Peak construction workforce of 499 for Richton and its infrastructure. Same expansion site workforce as under Bruinsburg alternative. Same operations and maintenance workforce as under Bruinsburg alternative. Similar socioeconomic impacts as under Bruinsburg alternative.	Peak construction workforce of 431 for Stratton Ridge and its infrastructure. Same expansion site workforce as under Bruinsburg alternative. Same operations and maintenance workforce as under Bruinsburg alternative. Similar socioeconomic impacts as under Bruinsburg alternative, with exception of potential loss of jobs if Dow Chemical cannot access salt.	No impact; additional economic impact would not be generated.
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. 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. Similar cultural resource impacts as under Bruinsburg alternative.	Adverse effects to Native American archaeological sites within the 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 the feeling and setting of historic districts along pipelines and at terminal. Similar cultural resource impacts as under Bruinsburg alternative.	Adverse effects to Native American archaeological sites at the Stratton Ridge facility and along pipelines, which could be mitigated. Possible residual effects to any historic settings along pipelines. Similar cultural resource impacts as under Bruinsburg alternative.	No impact.
Noise	Noise from construction activities at the new and expansion sites would be audible, but the impacts would be minor. Noise from operations and maintenance activities would be audible only at the expansion storage sites, where the impacts would be minor. 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 Chacahoula alternative.	Similar noise impacts as under Chacahoula alternative.	No impact.

Table S.6.11-1: Comparison of Potential Impacts for Alternatives with Three Expansion Sites and No-Action Alternative

Resource	Bruinsburg	Chacahoula	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, except that the potentially affected communities also include Native Hawaiian or Other Pacific Islander communities.	No impact.

1 mile = 1.609 kilometers

1 acre = 0.405 hectares

1 gallon = 0.0037854 cubic inches

1 inch = 2.54 centimeters

**Table S.6.11-2: Differences in Potential Impacts for Alternatives with Two Expansion Sites
(Comparison with Table S.6.11-1)**

Resource	Bruinsburg, Chacahoula, Richton, or Stratton Ridge
Environmental Risks and Public and Occupational Safety and Health	Slightly more (less than 0.1) predicted oil spills than presented in table S.6.11-1. 7 more predicted oil spills than presented in table S.6.11-1. No other notable differences.
Land Use: Land Use Conflicts	81 fewer acres (33 hectares) than the value presented in table S.6.11-1. No change in land use conflicts as presented in table S.6.11-1.
Land Use: Visual Resources	No notable difference from table S.6.11-1.
Land Use: Farmland	No notable difference from table S.6.11-1.
Land Use: Coastal Zone Management	Less impact because the coastal zone associated with West Hackberry would not be affected.
Geology and Soils	No notable difference from table S.6.11-1.
Air Quality	No notable difference from table S.6.11-1.
Water Resources: Surface Water	Up to three water bodies would not be affected because construction and operation would not occur at West Hackberry.
Water Resources: Groundwater	No increased risk to the sole source aquifer at West Hackberry because brine disposal would not increase.
Water Resources: Floodplains	No notable difference from table S.6.11-1.
Biological Resources: Plants, Wetlands, and Wildlife	5 fewer acres (2 hectares) of affected wetlands from the value presented in table S.6.11-1.
Biological Resources: Threatened and Endangered Species	No notable difference from table S.6.11-1.
Biological Resources: Special Status Areas	No notable difference from table S.6.11-1.
Biological Resources: Essential Fish Habitat	No notable difference from table S.6.11-1.
Socioeconomics	Less impact because construction workforce of up to 100 and increased operations and maintenance workforce would not be required for West Hackberry.
Cultural Resources	Less impact because Native American sites at West Hackberry would not be affected.
Noise	No notable difference from table S.6.11-1.
Environmental Justice	No notable difference from table S.6.11-1.