

National Park Service
U.S. Department of the Interior

Big Thicket National Preserve
Texas



Environmental Assessment

Famcor Oil, Inc.
Proposal to Directionally Drill and Produce The:

Carroll-BSMC #2 and #3 Wells from a New Surface Location
and the
Carroll-BSMC #1 and #5 Wells and the Carroll #4 Well
from an Existing Surface Location

Outside the Big Sandy Creek Unit
Big Thicket National Preserve
Polk County, Texas

May 21, 2013

In 1916, Congress created the National Park Service in the Department of the Interior to:

...promote and regulate the use of the Federal areas known as national parks, monuments, and reservations...by such means and measures as to conform to the fundamental purpose of said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations. (NPS Organic Act, 16 U.S.C. § 1)

Prepared by
United States Department of the Interior □ National Park Service

Environmental Assessment

**Famcor Oil, Inc.
Proposal to Directionally Drill and Produce Five Wells;
The Carroll-BSMC #1 #2, #3 and #5 Wells and the Carroll #4 Well,
From Two Locations Outside the Big Sandy Creek Unit of
Big Thicket National Preserve
Polk County, Texas**

Summary: In accordance with National Park Service (NPS) regulations for nonfederal oil and gas rights, Famcor Oil, Inc., (Famcor) submitted applications to the NPS to directionally drill and produce five wells from two surface locations outside the Big Sandy Creek (BSC) Unit of the Big Thicket National Preserve (BTNP or Preserve) to reach bottomhole targets beneath the Unit. Two wellpads are proposed to be used. One is the existing Carroll #1 wellpad, a vertical well, which will accommodate, without enlargement or alteration, three new directional wellbores – the Carroll-BSMC #1 and #5 and the Carroll #4 (Carroll 1-4-5). The second proposed wellpad will accommodate the Carroll-BSMC #2 and #3 wellbores (Carroll 2-3). The Carroll 2-3 wellpad, and the combined access road and flowline right-of-way (ROW) will be new construction, but will also utilize the existing Carroll 1-4-5 access road and flowline. The Carroll 1-4-5 wellpad perimeter is located approximately 245 feet east of the BTNP boundary at the nearest point. The northern corner of the Carroll 2-3 wellpad perimeter is located approximately 10 feet south of the BTNP boundary at the nearest point. All infrastructure and access for these five directional wells and two surface locations is located entirely on private property with no use of BTNP surface.

This Environmental Assessment (EA) evaluates two alternatives. Alternative A, No Action, evaluates baseline conditions in which the wells would not be drilled; therefore, there would be no new impacts on the environment. Alternative B, Proposed Action, evaluates the proposals to directionally drill and produce the wells. By directionally drilling from outside the BSC Unit and applying other mitigation measures, operators would substantially reduce impacts on Unit resources and values. Therefore, the NPS dismissed several topics from detailed analysis, and the EA provides the reasoning that supports this dismissal. Issues that were retained for more detailed analysis for all of the wells included the impact of elevated noise on the natural soundscape; impacts to air quality; impacts to lightscape/night sky; impacts to wildlife; impacts to visitor's experience; and impacts on certain resources and uses on adjacent lands, where impacts could potentially exceed minor levels. For the Carroll 2-3 (new construction) wellpad, these topics included geology, soils, and vegetation. For the Carroll 1-4-5, which is an existing wellpad that will not require enlargement; no impacts are anticipated that would exceed minor levels. Due to the proximity to the Preserve boundary and the particular environmental conditions at the proposed wellsites, the NPS also analyzed water resources/floodplains/wetlands in detail for those wells.

Through the analyses, the NPS concluded that the intensity of adverse impacts would range from negligible to moderate. No major adverse impacts were identified; and no impairment of NPS resources or values would occur as a result of the proposed actions. The duration of some impacts would be short-term, lasting from several days to 3 years (during construction and drilling); while other impacts would be long-term, extending beyond 3 years, depending on how long the wells are produced. Most impacts would primarily be localized around point sources, while some impacts could extend into the Unit and surrounding lands outside the Unit.

Public Comment: If you wish to comment on this EA, you may post comments online at <http://parkplanning.nps.gov/bith>, or mail or hand-deliver comments to the address below. Comments must be entered into the web-based system or postmarked by June 21, 2013 to be accepted. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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1.0 PURPOSE OF AND NEED FOR ACTION

This EA has been prepared to comply with the National Environmental Policy Act (NEPA) to provide a decision-making framework, and to determine whether an Environmental Impact Statement (EIS) should be prepared regarding the Famcor submitted application to the NPS to directionally drill the Carroll 2-3 and the Carroll 1-4-5 wells from two surface locations outside the BSC Unit of the BTNP to reach bottomhole targets beneath the Unit.

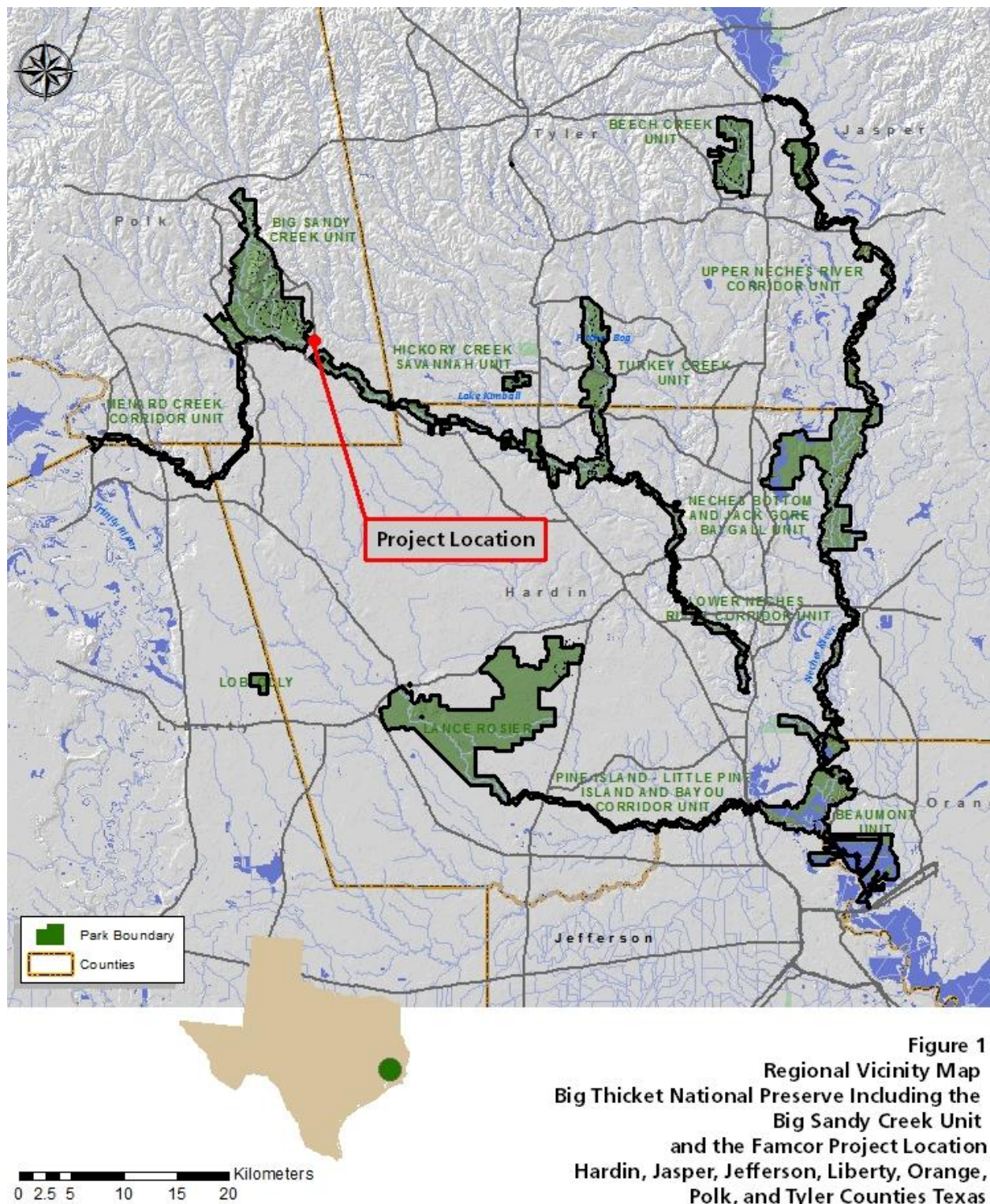
This EA evaluates the environmental impacts of two alternatives: the No Action Alternative or baseline alternative, and Famcor's proposals to directionally drill and produce five wells from two surface locations outside the BSC Unit of the Preserve to reach bottomhole targets beneath the Unit.

One of the purposes of this analysis is to determine whether Famcor's directional wells would qualify for an exemption from the NPS's nonfederal oil and gas rights regulations found at 36 CFR 9B. Specifically, § 9.32(e) governs operators that propose to develop nonfederal oil and gas rights in any unit of the National Park System by directionally drilling a well from a surface location outside unit boundaries to a location under federally-owned or controlled lands within park boundaries. Per § 9.32(e), an operator may obtain an exemption from the 9B regulations if the Regional Director is able to determine from available data that a proposed drilling operation under the park poses "no significant threat of damage to park resources, both surface and subsurface, resulting from surface subsidence, fracture of geological formations with resultant fresh water aquifer [sic] contamination or natural gas escape or the like." This EA also serves the purpose of disclosing to the public the potential impacts on the human environment, both inside and outside the Unit.

When Congress authorized the establishment of Big Thicket National Preserve on October 11, 1974, the U.S. Government acquired surface ownership of the area. Private entities retained the subsurface mineral interests on most of these lands, while the State of Texas retained the subsurface mineral interests underlying the Neches River and navigable reaches of Pine Island Bayou. Thus, the Federal Government does not own any of the subsurface oil and gas rights in the Preserve. To protect the Preserve from oil and gas operations that may adversely impact or impair Preserve resources and values, the NPS regulates those operations in accordance with NPS laws, policies and regulations. The NPS recognizes that the applicants possess private property rights to nonfederal oil and gas in the Preserve. Such rights are accorded protection under the 5th Amendment of the U.S. Constitution, which states "... no person shall be deprived of property without due process of law; nor shall private property be taken for public use without just compensation." Figure 1 is a regional/vicinity map depicting the proposed project locations.

The area of analysis for evaluating impacts of the proposed actions in this EA will vary depending on the impact topic. These analysis areas are described for each topic in Section 3. The area of analysis for cumulative impacts includes the Unit of the Preserve and areas contiguous to the Unit (approximately one-half mile beyond Preserve boundaries).

Figure 1. Regional/Vicinity Map



1.1 Objectives of Taking Action

The objectives of taking action are to:

- Avoid or minimize impacts on the Unit's resources and values, visitor use and experience, and human health and safety.
- Prevent impairment of the Unit's resources and values.
- Provide Famcor, as the lessee of nonfederal oil and gas mineral interests, access to explore for and develop oil and gas resources in a manner which will assure the natural and ecological integrity of the Preserve.

1.2 Special Mandates and Direction

The NPS evaluates project-specific proposals for directionally drilling and producing wells from surface locations outside the Preserve to reach bottomhole targets beneath the Preserve on a case-by-case basis prior to deciding whether to issue an exemption in accordance with § 9.32(e). The following discussion is a summary of the basic management direction the NPS follows for issuing such an exemption.

1.2.1 Big Thicket National Preserve Enabling Act

Congress established the Preserve with the Act of October 11, 1974, Pub. L. No. 93-439, 88 Stat. 1254, codified as amended at 16 U.S.C. §§ 698-698e (2000), as the nation's first preserve, "[i]n order to assure the preservation, conservation, and protection of the natural, scenic, and recreational values of a significant portion of the Big Thicket area in the State of Texas and to provide for the enhancement and public enjoyment thereof." The authorizing legislation directs the Secretary of the Interior to administer the lands within the Preserve "in a manner which will assure their natural and ecological integrity in perpetuity." The Preserve comprises 15 separate units, totaling approximately 106,000 acres. After the Preserve's establishment, the United States began acquiring lands within the Preserve's authorized boundaries. However, private entities retained ownership of the mineral estate underlying their lands, and the State of Texas retained ownership of the mineral estate underlying the Neches River and navigable reaches of Pine Island Bayou. Although the United States does not own any of the mineral estate underlying the Preserve, Congress charged the NPS with protecting the Preserve from oil and gas operations that may adversely impact the Preserve's resources and values. The statute states:

In the interest of maintaining the ecological integrity of the preserve, the Secretary [of the Interior] shall ... promulgate and publish such rules and regulations in the *Federal Register* as he deems necessary and appropriate to limit and control the use of, and activities on, Federal lands and waters with respect to ... exploration for, and extraction of, oil, gas, and other minerals ... 16 U.S.C. § 698c (b)

The establishment of Big Thicket as a national preserve created a new National Park System category, which meets different criteria than other parks and recreation areas within the System. These criteria were set forth in the House of Representatives committee report (House Committee Report No. 93-676 pertaining to the establishment of Big Thicket National Preserve and Big Cypress National Preserve, approved on the same date), as follows:

In the past, the Congress has authorized and established many areas for inclusion in the National Park System: national parks, national monuments, national recreation areas, national historic sites, and others. A systematic effort has been made to establish standards or criteria for each of these different categories in an effort to maintain the integrity of the values which each attempts to serve. The description of the [Big Thicket] area as a national preserve will establish a new category which can serve as a feasible and desirable vehicle for the consideration of other nationally significant natural areas which differ from the qualities attributed to national parks and national recreation areas. The committee chose to call the area a preserve rather than a reserve, feeling that such distinction may be important.

Reserve refers to stock – a commodity held for future use. Preserve refers more definitively to the keeping or safeguarding of something basically protected and perpetuated for an intended or stated purpose, as with the specific objectives for [Big Thicket] provided by this legislation. In general, national preserves will be areas of land and/or water which may vary in size, but which possess within their boundaries exceptional values or qualities illustrating the natural heritage of the Nation. Such areas would often be characterized by significant scientific values, including, but not limited to, ecological communities illustrating the process of succession, natural phenomena, or climax communities. In addition they could be characterized by a habitat supporting a vanishing, rare or restricted species; a relict flora or fauna persisting from an earlier period; or large concentrations of wildlife species. Other scientific, geologic, geomorphic or topographic values might also contribute to the purposes for which an area might be recognized.

The principal purpose of these areas should be the preservation of the natural values which they contain. They might differ, in some respects, from national parks and monuments insofar as administrative policies are concerned. Hunting, for example, subject to reasonable regulation by the Secretary, could be permitted to the extent compatible with the purposes for which the area is established. Other activities, including the extraction of minerals, oil, and gas could be permitted if such activities could be conducted without jeopardizing the natural values for which the area seeks to preserve. Management of the watershed resources might also be appropriate if that would enhance the value of the preserve as it serves other needs.

All management activities within these areas should be directed toward maintaining the natural and scientific values of the area, including the preservation of the flora and fauna and the reestablishment of the indigenous plant and animal life, if possible. Areas where scientific discoveries or historical events took place would contribute to the values of the preserve and should be managed in a manner which will maximize both the natural and historical values.

National preserves may accommodate significant recreational uses without impairing the natural values, but such public use and enjoyment would be limited to activities where, or periods when, such human visitation would not interfere with or disrupt the values which the area is created to preserve. Construction of physical facilities of any kind would be minimized and would be limited to those developments which are essential to the preservation and management of the area and the safety of the public. To the extent

such facilities are deemed necessary and appropriate; they would be constructed in a manner which would minimize their impact on the environment and their intrusion on the natural setting.

Given the park's enabling statute, oil and gas exploration and development activities at the Preserve is an activity clearly contemplated by Congress and addressed in both statute and NPS regulations, and are not unusual or unexpected occurrences. Mineral exploration and development is addressed in the Preserve's *General Management Plan* (1980), and *Oil and Gas Management Plan* (2006).

1.2.2 NPS Nonfederal Oil and Gas Regulations, 36 CFR 9B

The authority to manage and protect Federal property arises from the Property Clause of the United States Constitution. The Property Clause provides that "Congress shall have Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States . . ." U.S. Const. Art. IV, § 3, cl. 2.

In 1916, Congress exercised its power under the Property Clause and passed the NPS Organic Act, 16 U.S.C. § 1 *et seq.* Section 3 of the Organic Act authorizes the Secretary of the Interior to "make and publish such rules and regulations as he may deem necessary or proper for the use of the parks. . ." 16 U.S.C. § 3.

Pursuant to § 3 of the NPS Organic Act and individual park statutes, including that of Big Thicket National Preserve, the Secretary of the Interior promulgated regulations at 36 CFR Part 9, Subpart B ("9B regulations") in 1979. The 9B regulations apply to operations that require access on or through federally-owned or controlled lands or waters in connection with non-federally owned oil and gas in all National Park System units (36 CFR § 9.30(a)). The Service's jurisdiction under these regulations does not extend to any activities occurring outside park boundaries, even if such activities are associated with a nonfederal oil and gas operation occurring inside a park.

The NPS Nonfederal Oil and Gas Rights Regulations (36 CFR 9B) and other regulatory requirements assist park managers in managing oil and gas activities so they may be conducted in a manner consistent with the NPS mandate to protect park resources and values. In implementing these regulations, the NPS must determine whether proposed operations meet the 36 CFR 9B approval standards and whether the operations have the potential to impair park resources and values.

Section 9.32(e) of the regulations governs operators that propose to develop their nonfederal oil and gas rights in a park by directionally drilling a well from a surface location outside unit boundaries to a location under federally-owned or controlled lands or waters within park boundaries. It is limited in scope to those aspects of the directional drilling operation occurring within park boundaries.

Per § 9.32(e), an operator may obtain an exemption from the 9B regulations if a Regional Director is able to determine from available data that a proposed drilling operation under the park poses "no significant threat of damage to park resources, both surface and subsurface, resulting from surface subsidence, fracture of geological formations with resultant fresh water aquifer [sic] contamination or natural gas escape or the like." The regulations define operations

as "all functions, work and activities within a unit in connection with exploration for and development of oil and gas resources, the right to which is not owned by the United States..." (36 CFR § 9.31(c), underlining added). The potential impacts considered in the §9.32(e) exemption process relate only to effects on park resources from downhole activities occurring within the boundary of the park, not threats to park resources associated with the operation outside park boundaries.

Under the regulations, the NPS may determine that: 1) an operator qualifies for an exemption from the regulations with no needed mitigation to protect park resources from activities occurring within park boundaries; 2) an operator qualifies for an exemption from the regulations with needed mitigation to protect subsurface park resources from activities occurring within park boundaries; or 3) an operator must submit a proposed plan of operations and a bond to the NPS for approval. Each one of these legally permissible options is briefly described below.

1. Exemption with No Mitigation (*no approval or permit issued*): The NPS determines that the proposed operation inside the park qualifies for an exemption under § 9.32(e) without any mitigation or conditions required by the NPS on the downhole activities. This option will arise when there is no potential for surface or subsurface impacts in the park from the downhole activities (e.g., the wellbore does not intercept an aquifer within the park). Under this option, the NPS is not granting an approval or issuing a permit.
2. Exemption with Mitigation (*no approval or permit issued*): The NPS determines that the proposed operation inside the park qualifies for an exemption under § 9.32(e) if there is no potential for surface impacts to park resources from downhole operations in the park and the operator adopts mitigation measures or conditions that reduce potential impacts on subsurface resources (e.g., an aquifer) to "no measurable effect." As in option #1 above, the NPS is not granting an approval or issuing a permit.
3. Plan of Operations (approval and "permit" issued): This regulatory option would apply if the NPS determines that it cannot make the requisite finding for a § 9.32(e) exemption because (1) impacts to surface resources from the downhole operations are involved, or (2) impacts to subsurface resources cannot be adequately mitigated to yield "no measurable effect." This option would also apply if an operator does not apply for an exemption and the NPS does not consider granting an exemption on its own initiative. In these cases, a prospective operator must submit and obtain NPS approval of a proposed plan of operations and file a bond before commencing directional drilling activities inside a park. The required plan and bond will be limited in scope to those aspects of the directional drilling operation that occur within park boundaries. As a result, many of the general plan information requirements set forth under § 9.36 would not apply. Mitigation measures and/or conditions of approval would be integral to this option. Such mitigation could encompass the protection of cultural resources, cave/karst resources, aquifers, floodplains, wetlands and other surface resources from operations occurring inside the park. Under this option, an operator must have the NPS's approval of a proposed plan before commencing any activity in the boundaries of the park. The approved plan constitutes the operator's "permit."

All of the five proposed directional wells (from two surface locations) would qualify for an Exemption with No Mitigation (Option 1), because no surface access in the Unit would be needed for any phase of drilling, production, transportation, or reclamation activities; and the wellbores would be drilled to cross into the Unit at substantial depths so as to not cross usable quality groundwater. The NPS identified no resource occurring on the surface of the Preserve that could be affected by the wellbores crossing into the plane of the Preserve at substantial depth to extract hydrocarbons and other associated liquids from beneath the Preserve. There is no threat to park resources or values regardless of what methods and materials Famcor uses to drill, case, cement, or plug and abandon the sections of holes inside the Units. Likewise, if the wells are produced, any methods of completion, stimulation, or injection that occur inside the Unit within the boreholes would not pose a substantial threat of damage to the Unit's resources and values.

1.2.3 Protecting Park Resources from External Activities

The NPS may seek compensation under 16 U.S.C. § 19jj and other appropriate statutes, if any activities outside park boundaries, including oil and gas operations, damage park resources.

1.2.4 NPS Monitoring of Nonfederal Oil and Gas Operations

The NPS ability to monitor and inspect directional drilling operations is limited to downhole operations within the park (e.g., setting and cementing surface casing and plugging operations, etc.). As a practical matter, monitoring of downhole activities inside the park can only be accomplished from the surface location outside the park. As a result, the NPS may need to access the surface locations and should make such access a condition of an exemption under option 2 or a condition of approval under option 3. The NPS must coordinate the timing of such access with the operator. For directional drilling operations sited outside a park, the 9B regulations provide no authority to require an operator to grant the NPS access for the purpose of observing compliance with terms unrelated to the downhole activities inside the park. When the NPS has made an upfront determination that a directional drilling operation is exempt without conditions from the regulations because of the lack of impacts, there is no 9B regulatory reason to access the surface location outside the park (option 1).

Where a State or Federal agency, other than the NPS, has applied mitigation measures via their respective environmental compliance or permitting processes, that agency, not the NPS, has sole responsibility for monitoring and enforcing its mitigation measures. In the event the NPS becomes aware of a compliance concern related to another agency's jurisdiction, the NPS should alert that agency in a constructive manner.

1.2.5 National Environmental Policy Act of 1969 (NEPA)

NEPA applies to major Federal actions and requires agencies to take a "hard look" at the environmental consequences of their proposed actions. (Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 350 (1989)). A legally adequate NEPA document (EA or EIS) must consider the direct, indirect, and cumulative impacts (effects) of the proposed action on the environment, along with connected, cumulative and similar actions. (40 C.F.R. § 1508.25; DO-12 Handbook, Chapter 2, § 2.4)

The requirements of NEPA are triggered by *Federal* actions (projects, activities, or programs funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; those requiring a federal permit, license, or approval; and those subject to state or local regulation administered pursuant to a delegation or approval by a federal agency). The NEPA process must be completed before a decision can be made to proceed with the proposal.

While it can be argued that NEPA is not triggered under options #1 and #2 described above because the NPS does not grant an approval or issue a permit under these options, the prudent course of action the NPS has selected is to comply with this statute in making § 9.32(e) determinations. In addition, the NEPA document will contain the analysis and documentation required under § 9.32(e) and will disclose to the public the potential impacts that could occur both inside and outside of the park.

The types of impacts considered are direct, indirect, and cumulative. Actions may be connected, cumulative, and similar.

1. Connected actions are closely related and, therefore, should be discussed in the EA. Actions are connected if they:
 - (i) automatically trigger other actions, which may require environmental analysis under NEPA;
 - (ii) cannot or will not proceed unless other actions are taken previously or simultaneously; or
 - (iii) are interdependent parts of a larger action and depend on the larger action for their justification.

Connected actions occurring outside of the park related to the directional drilling operation inside the park include the construction of the wellpad(s), gas flowline, and access road; drilling and completion; hydrocarbon production and transportation; and well plugging and surface reclamation. The impacts of these connected actions both inside and outside of the Preserve will be addressed in this EA.

2. Cumulative actions when viewed with other proposed actions may have cumulatively significant impacts and should, therefore, be discussed in the same environmental document. Cumulative actions that should be analyzed in the NEPA document include surface drilling and production operations outside of the park as well as any other activities that may have additive impacts to resources (e.g., logging, road building, construction projects, prescribed burns, etc.).
3. Similar actions when viewed with other reasonably foreseeable or proposed agency actions have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. An agency may wish to analyze these actions in the same NEPA document. The agency should do so when the best way to assess the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement. Similar actions could include activities such as the construction of private and public roads, drilling of water wells, and other types of construction activities. Similar actions were not identified for analysis in this EA.

1.2.6 Approved Park Planning Documents

Approved park planning documents also provide a framework for determining how nonfederal oil and gas operations are conducted within Big Thicket National Preserve.

The General Management Plan (GMP) is the major planning document for all National Park System units. The GMP sets forth the basic philosophy of the Unit, and provides strategies for resolving issues and achieving identified management objectives required for resource management and visitor use. The GMP includes environmental analysis and other required compliance documentation. A GMP was completed for Big Thicket National Preserve in 1980. The park is currently in the process of preparing a new GMP.

The NPS completed an *Oil and Gas Management Plan* for the Preserve on February 28, 2006 (NPS, 2006b). The *Oil and Gas Management Plan*:

- identifies Preserve resources and values susceptible to adverse impacts from oil and gas operations;
- establishes performance standards and impact mitigation measures for oil and gas operations to protect and prevent impairment to Preserve resources and values from adverse impacts from oil and gas operations;
- establishes performance standards and impact mitigation measures for oil and gas operations to avoid or minimize impacts from oil and gas operations on visitor use and enjoyment, and human health and safety;
- provides holders of oil and gas rights reasonable access for exploration and development; and
- provides pertinent information to oil and gas operators to facilitate planning and compliance with NPS and other applicable regulations.

Famcor's proposal is in accordance with the goals and objectives articulated in the above mentioned planning documents.

1.3 Issues and Impact Topics Evaluated

In accordance with Director's Order 12, scoping, or requesting early input before the analysis formally begins, is required on all EAs prepared by NPS. Although public scoping is encouraged where an interested or affected public exists, issuing offices are only required to involve appropriate Federal, State, and local agencies and any affected Indian tribe. The issuing office decides the method of scoping.

Early in the planning and development of the directional drilling applications by Famcor, the NPS conducted scoping with them and their consultants, Raven Environmental Services, Inc. (Raven); and others, including the Alabama-Coushatta Tribe of Texas, the Texas Historical Commission, and the U.S. Fish and Wildlife Service, to identify the resources, values, and other concerns that could be potentially impacted by drilling and producing the wells, to define major issues, alternatives, potential impacts, and mitigation measures. Scoping was conducted through meetings, telephone conversations, written comments, and on-site observations and assessments. The Preserve released a public scoping brochure for each proposal to solicit public input prior to completing the EA for this proposal.

The Preserve released a public scoping brochure generally describing the Famcor proposed action on September 18, 2012, to announce a 30-day public scoping period. The public scoping brochure was mailed to affected State, Federal and local agencies, and other interested persons and organizations, including: the Alabama-Coushatta Tribe of Texas, the Austin and Houston Sierra Clubs, the Big Thicket Association, Raven, Famcor, the Railroad Commission of Texas, the Texas Commission on Environmental Quality, the Texas Committee on Natural Resources, the Texas Historical Commission, and the U.S. Fish and Wildlife Service. The Preserve also posted the public scoping brochure on the park's website. One scoping comment letter was received from the Lone Star Chapter and Houston Regional Group of the Sierra Club. Substantive scoping comments focused on analyzing cumulative effects, acquisition of mineral rights, and the enforceability of mitigation measures.

Based on project scoping concerns, and the level and extent of potential impacts likely to occur, the NPS determined that the impact topics listed in Table 1, below, would likely have more than minor impacts and, therefore, would be carried forward for detailed analysis in Section 3 of this EA. Other topics were addressed by taking a hard look at potential impacts; however, these were dismissed from further analysis, because their impacts would not be expected to exceed minor levels (see Section 1.3).

Table 1. Impact Topics Carried Forward for Detailed Analysis in Section 3

Carroll 2-3 (new construction)	Carroll 1-4-5 (existing)
Natural Soundscape in and outside the Big Sandy Creek Unit	Natural Soundscape in and outside the Big Sandy Creek Unit
Air Quality in and outside the Big Sandy Creek Unit	Air Quality in and outside the Big Sandy Creek Unit
Lightscares / Night Sky in and outside the Big Sandy Creek Unit	Lightscares / Night Sky in and outside the Big Sandy Creek Unit
Wildlife in and outside the Big Sandy Creek Unit	Wildlife in and outside the Big Sandy Creek Unit
Visitor experience, aesthetic resources in and outside the Big Sandy Creek Unit	Visitor experience, aesthetic resources in and outside the Big Sandy Creek Unit
Adjacent Landowners, Resources and Uses, focusing on an analysis of the following resources and values located outside the Unit: Geology and Soils Vegetation	Adjacent Landowners, Resources, and Uses, focusing on an analysis of the following resources and values located outside the Unit: None – pad already exists

Based on the above list of impact topics, issue statements were developed to help define problems or benefits pertaining to the proposal to drill and produce the directional wells (see Table 2). The issue statements describe a cause and effect relationship between an activity and the impact topic.

Table 2. Issue Statements for Impact Topics Retained for Detailed Analysis

Impact Topic	Issue Statement
Natural Soundscape in and outside the Big Sandy Creek Unit	<ul style="list-style-type: none"> Existing natural soundscapes in the project areas are intermittently impacted by human development as the proposed surface locations are within a working farm. Natural sounds are intrinsic elements of the environment that are vital to the functioning of ecosystems and can be used to determine the diversity and interactions of species within communities. Natural soundscapes are often associated with parks and preserves and are considered important components of the visitor experience as well as natural wildlife interactions. Construction and/or maintenance of the Carroll 2-3 access road, wellpad, and flowline along with associated noise from construction and operation equipment would affect the quality of the natural soundscape in the general vicinity of the operations. This would occur primarily during the Carroll 2-3 construction phase and the drilling phase of all five wells, but would extend on a smaller scale to the production phases. Vehicles and equipment used for construction and/or maintenance of the Carroll 2-3 access road, wellpad, and flowline; and drilling, production, plugging, and reclamation activities for all five wells, would result in increased noise in the vicinity of the operations.
Air Resources in and outside the Big Sandy Creek Unit	<ul style="list-style-type: none"> Air resources in the Preserve are influenced by the Beaumont/Port Arthur/Orange and Houston/Galveston airsheds, and portions of the Preserve are within the non-attainment area for ozone in Liberty, Hardin, Jefferson, and Orange Counties. Specific pollutants can injure vegetation and fish and wildlife, damage materials, and affect water quality (e.g., acidify water). Construction and/or maintenance of the Carroll 2-3 access road, wellpad, and flowline along with, for all five wells, exhaust from combustion of gasoline and diesel-powered vehicles and equipment used for drilling and production operations would increase emissions of particulate matter, which could affect air resources in the general vicinity of the operations. For all five wells: Drilling, production, transport and storage of hydrocarbons and the use of gasoline and diesel-powered engines (vehicles, generators, compressors, etc.) would emit pollutants, including nitrogen oxides, volatile organic compounds, carbon monoxide, sulfur dioxide, and particulate matter. These emissions could degrade air resources within the general vicinity of the operations and contribute toward regional air quality degradation. Nitrogen oxides and volatile organic compounds are primary precursors to ozone formation, which, depending on ambient concentrations, can have damaging effects on some vegetation and on the health of humans and wildlife.
Lightscapes/Night Sky in and outside the Big Sandy Creek Unit	<ul style="list-style-type: none"> The existing lightscape of the proposed sites is relatively natural, with only a few small residential lights in the vicinity of the two locations. Typical impacts to natural lightscapes include the introduction of

Impact Topic	Issue Statement
	<p>artificial light sources such as permanent lights used at residences and oil and gas production sites, and temporary lights on vehicles and equipment.</p> <ul style="list-style-type: none"> • Construction and/or maintenance of the Carroll 2-3 access road, wellpad, and flowline; and for all five wells, associated lights from construction and operation equipment would affect the quality of the lightscape in the general vicinity of the operations. • For all five wells: Drilling would require the use of rig and location lighting. If the wells prove to be productive, automated location lighting may be permanently installed over the producing life of the well. Artificial lighting could interfere with views of the night sky in the area of activity, and possibly affect wildlife.
Wildlife in and outside the Big Sandy Creek and Unit	<ul style="list-style-type: none"> • For all five wells: Drilling, production, and maintenance activities could adversely affect wildlife over the short- to long-term. These activities could result in avoidance of the area by wildlife due to increased noise, lighting, and human presence. • For all five wells: The release of hydrocarbons or other hazardous and contaminating substances from vehicles, drilling/production equipment, leaks, and rupture of flowlines and pipelines could injure or kill wildlife. • For all five wells: Heavy equipment used for reclamation operations could injure or kill wildlife and degrade habitat over the short-term. However, reclamation of oil and gas sites over the long-term could restore and surface and subsurface water quality and quantity that support wildlife.
Visitor experience, aesthetic resources in and outside the Big Sandy Creek Unit	<ul style="list-style-type: none"> • Construction and/or maintenance of the Carroll 2-3 access road, wellpad, and flowline and for all five wells, associated lighting and noise from construction and operation of equipment could affect visitor experience in the southeastern portion of the Big Sandy Creek Unit, specifically in the vicinity of the Big Sandy Horse Trail. • For all five wells: The temporary drilling and completion of the wells and also the production of successful wells for an indefinite period of time could affect visitor experience in the southeastern portion of the Big Sandy Creek Unit due to the increase in ambient noise and artificial light levels.
Adjacent Landowners, Resources, and Uses	<ul style="list-style-type: none"> • Siting of the proposed wells, production facilities, flowlines, and access roads outside the Preserve could result in adverse impacts on neighboring lands and landowners, including impacts on soundscapes, air quality, lightscapes, wildlife, and water resources (covered above), as well as on certain other resources that could be affected outside the Preserve at more than negligible levels. Those retained for detailed analysis outside the Unit boundaries include the following: • Carroll 2-3 Geology and Soils. Construction and operation of the proposed facilities would result in impacts to geology and soils outside the Preserve at one wellpad location. <ul style="list-style-type: none"> • Construction and maintenance of the access road, wellpad, and flowline, could increase surface runoff, increase soil erosion, rutting, and compaction; affect the permeability of soils (and other soil

Impact Topic	Issue Statement
	<p>characteristics); and could directly and indirectly affect the growth and regeneration of vegetation.</p> <ul style="list-style-type: none"> • Soils compacted by foot or vehicle use could reduce soil permeability, change surface drainage patterns, and hinder the penetration of plant roots. In general, clayey soils are more subject to compaction than sandy soils. • The release of hydrocarbons or other contaminating and hazardous substances from vehicles, equipment, or flowlines during drilling and production operations could alter the chemical and physical properties of the soil in the vicinity of the oil and gas activities. Changes in soil properties could result directly from contact with contaminants on-site, or indirectly, via runoff from contaminated areas. • Carroll 2-3 Vegetation. Construction and operation of the proposed facilities would result in impacts to vegetation outside the Preserve at one wellpad location. <ul style="list-style-type: none"> • Vegetation would be totally removed in areas for the construction of access road, wellpad, and flowline. Vegetation removal could change the future structure and composition of vegetative communities in the project areas and increase storm runoff and soil erosion. • The release of hydrocarbons and contaminating or hazardous substances could damage or kill vegetation directly, via contact with contaminants on-site, or indirectly, via pathways from contaminated areas. • Disturbances/removal of vegetation could lead to the unintentional spread and establishment of non-native plant species transported in or on drilling and maintenance equipment. • Reclamation of the oil and gas sites could re-establish vegetative communities and surface and subsurface drainage patterns necessary to support vegetative growth.

1.4 Issues And Impact Topics Eliminated From Further Analysis (All Wells)

In this section of the EA, NPS provides a limited evaluation and explanation as to why some impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation in this EA if:

- they do not exist in the analysis area,
- they would not be affected by the proposal, or the likelihood of impacts are not reasonably expected, or
- effects (following the proposed mitigation) would not exceed minor levels, and there is little controversy on the subject or reason to otherwise include the topic. Generally, a minor effect would result in a detectable change, but the change would be small and of little consequence.

Because there would be no effect or the effects would be minor or less, there would either be no or little contribution towards cumulative effects. For each issue or topic presented below, if the

resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct and indirect, and cumulative effects is presented (see Appendix A).

The topics listed in the following table have been eliminated from further analysis for one or more of the reasons listed above.

Table 3. Impact Topics Eliminated from Further Analysis

Carroll 2-3 (new construction)	Carroll 1-4-5 (existing)
<ul style="list-style-type: none"> • Socioeconomics • Catastrophic Incidents, such as Well Blowouts, Well Fires or Major Spills • Environmental Justice • Prime and Unique Farmland Soils in the Big Sandy Creek Unit • Geology and Soils in the Big Sandy Creek Unit • Water Resources: Groundwater, streamflow, floodplain and wetlands in and outside the Big Sandy Creek Unit • Fish and Aquatic Life in or outside the Big Sandy Creek Unit • Vegetation in the Big Sandy Creek Unit • Threatened and Endangered Species in and outside the Big Sandy Creek Unit and Other Species of Management Concern in the Unit • Cultural Resources in and outside the Big Sandy Creek Unit 	<ul style="list-style-type: none"> • Socioeconomics • Catastrophic Incidents, such as Well Blowouts, Well Fires or Major Spills • Environmental Justice • Prime and Unique Farmland Soils in the Big Sandy Creek Unit • Geology and Soils in the Big Sandy Creek Unit • Water Resources: Groundwater, streamflow, floodplain and wetlands in and outside the Big Sandy Creek Unit • Fish and Aquatic Life in or outside the Big Sandy Creek Unit • Vegetation in the Big Sandy Creek Unit • Threatened and Endangered Species in and outside the Big Sandy Creek Unit and Other Species of Management Concern in the Unit • Cultural Resources in and outside the Big Sandy Creek Unit

The following sections explain why each of these topics was dismissed from further evaluation and provides limited analyses that support the dismissals. Wherever appropriate, the analyses describe the effects of “in-park operations” and “connected actions.”

- **In-Park Operations** would consist of the subsurface operations taking place under the Unit – i.e., the wellbores crossing into the Unit at substantial depths, so as to not cross usable quality groundwater, to reach bottomhole targets beneath the Unit to extract hydrocarbons and other associated fluids from beneath the Unit.
- **Connected Actions** would consist of activities associated with access road maintenance; construction and maintenance of the wellpad, production facilities and flowline, drilling and completion, hydrocarbon production and transportation and well plugging and surface reclamation outside the Unit.

The analysis of impacts from in-park operations contains the analysis and documentation required under § 9.32(e). The analysis of impacts from connected actions satisfies a broader NEPA requirement to assess impacts on the human environment.

1.4.1 Socioeconomics

Socioeconomic issues include the effect of the proposed drilling and possible production of the wells on the local and regional economies, and the effects of the proposed actions on visitation in the Preserve, which in turn affects those economies. The description presented below of past, present, and reasonably foreseeable oil and gas development in and adjacent to the Preserve provides supporting data to base the cumulative impact analyses in this section and for analyses presented in Section 3.

The proposed actions would generate an unknown amount of revenue for the local economy through rents or other payments to adjacent private surface owners. Mineral owners would receive bonus payments for leases, and could subsequently receive rentals or royalties. Local businesses would receive revenue from purchases of food, fuel, lodging, and other incidental purchases by drilling and production crews and managers. However, revenue from oil and gas production would likely affect only a small number of people, and the individuals or groups affected would not necessarily be from the socioeconomic area in the vicinity of the project. On the other hand, increased oil and gas activity in the area could potentially have restrictive effects on the local economy. An example of this effect would be fluctuations in the housing market and/or property values with the development of oil and gas operations near residences or from the demand for housing from workers. In addition, a small amount of pasture would be lost on up to 2.7 acres: approximately 2.06 acres for the new Carroll 2-3 wellpad and approximately 0.58 acres for the new Carroll 2-3 access road and flowline until the wells are plugged and the project areas are reclaimed.

Big Thicket National Preserve contributes to the local and regional economies by adding sales, taxes, and employment related to the acquisition of services, supplies and materials needed to administer the Preserve. In addition, tourism-related expenditures contribute to the economy, and also create jobs to support tourism. NPS has estimated there were 140,489 visitors to the Preserve in 2010 (NPS 2011a). Specific data detailing how many total visits (for all users) to the Big Sandy Creek Unit is unavailable because the Preserve does not track visits to the individual Units, except those generated from hunting surveys. Visitors primarily use this Unit for overnight camping, canoeing, hiking, bird watching, hunting, and fishing. Hunting is permitted within portions of the Big Sandy Creek Unit from the opening date of the Texas fall hunting season through (normally) the second Sunday in January. An extended hunting season for feral hogs runs until the end of February. During the 2011-2012 hunting season, with 256 surveys regarding this Unit returned, 1,649 hunting trips to the Big Sandy Creek Unit were reported.

There are two picnic areas located at two trailheads: the Big Sandy Trail in the southeast and the Woodlands Trail in the far north. The Beaver Slide Trail is also located in the extreme southeast corner, and south of Big Sandy Creek, but has no picnic facility.

It is estimated that in the 2005 fiscal year, visitors to the Preserve spent a total of \$6,592,000, creating or supporting 141 area jobs (Stynes, 2006). In the event of a serious oil spill and/or accident involving serious personal injury or death, the public could perceive that the Preserve is

not a desirable place to visit. Tourism could fall, resulting in reduced revenues to the local and regional economies. However, the likelihood of this happening is relatively low, because the applicants would be required to take precautions to prevent accidents under Federal statute and numerous Statewide Rules administered by the Railroad Commission of Texas (RRC). Please see the section below that addresses the possibility of catastrophic incidents, such as well blowouts, well fires, or major spills.

Big Thicket National Preserve lies within the Railroad Commission of Texas' District 3. RRC District 3 includes 29 counties in southeast Texas. Seven counties within District 3 contain portions of the Preserve. As of December 2010, there were approximately 7,841 regular producing oil wells and 3,828 regular producing gas wells in RRC District 3, totaling 11,669 wells. Of these, 2,920 wells, or 25 percent of the District total, are located within the seven Preserve counties. These include 2,093 oil wells and 827 gas wells. The number of wells currently producing oil or gas from nonfederal mineral acreage beneath the Preserve is very small in relation to both the total producing wells in the seven counties containing the Preserve and the total producing wells in RRC District 3.

The NPS has prepared a revised reasonably foreseeable development (RFD) scenario to project future oil and gas development, based on an assessment by the United States Geological Survey of remaining hydrocarbons beneath Big Thicket National Preserve. (Schenk, 1999) The revised RFD was produced in response to public comments received on the *Draft Oil and Gas Management Plan Environmental Impact Statement* (NPS, 2005), for which the original RFD had been produced, and the increase in drilling activity experienced in RRC District 3 in 2005 and throughout the United States and Texas from 2002 to the present. (Baker Hughes Incorporated, 2007) The RFD provides a reasonable assumption of future development of nonfederal oil and gas for park planning purposes, and provides a basis for measuring potential environmental impacts. It does not represent a benchmark or decision point for acceptable levels of activity that could occur to develop the oil and gas underlying the Preserve. During the revision effort, the USGS's assessment of the remaining hydrocarbon potential beneath the Preserve was reviewed, and the NPS contacted operators who have recently drilled wells in and adjacent to the Preserve to verify the assumptions made.

The RFD projects that, initially, 3-D seismic surveys would be conducted throughout the entire Preserve, and the data obtained would be used to delineate oil and gas drilling prospects. It was assumed that approximately 40 additional wells would be drilled over the next 15 to 20 years to produce the 4 million barrels of oil and natural gas liquids (condensate) and 94 billion cubic feet of natural gas from Tertiary and Upper Cretaceous-age reservoirs assumed to underlie the Preserve. Based on an exploratory drilling success rate of approximately 50 percent and a developmental drilling success rate of 75 percent, of the 40 wells anticipated to be drilled, 27 could be commercially successful (the remaining 13 would be plugged as dry holes). The NPS acknowledges that the RFD is based on available production data, and that more or fewer wells could be drilled or produced. Under the RFD scenario, it would reasonably be anticipated that Preserve-wide, up to 465 acres could be disturbed for geophysical exploration operations; and up to 241 acres could be developed for drilling, production and transportation operations for a total future development of 706 acres.

Due to the narrow, linear nature of many of the Preserve's units many of the drilling and production operations are anticipated to follow the existing trend for siting from surface locations outside the Preserve to access hydrocarbons beneath the Units using directional

drilling technology. However, exploratory and development wells are expected to be sited within some Units that are greater in size, like the Big Sandy Creek and Neches Bottom and Jack Gore Baygall Units. Therefore, it is possible that the actual acreage disturbed by drilling, production and transportation operations would approximate that projected by the RFD. However, the NPS expects the actual figure to fall somewhere between the RFD projection and zero (0) acres (which would be the case if all oil and gas wells under the Preserve were drilled directionally without the disturbance of federal surface).

A survey of NPS records indicates that nine two-dimensional (2-D) seismic surveys were conducted in the Big Sandy Creek Unit between 1977 and 1983. Five of these surveys were conducted as cable-only, or walk-across, operations, and the remaining four involved the use of drilling equipment (typically referred to as highland rigs or Ardco buggies) to place energy sources (explosives) within the Unit. One of the latter surveys was conducted over four separate lines within the Unit. A three-dimensional (3-D) seismic survey involving the drilling of shotholes with articulating tractor drills was completed in 2004 over most of this Unit.

The trend over the past decade for drilling wells to produce oil and gas underlying the Preserve is towards directionally drilling from surface locations outside the Preserve to bottomhole targets beneath the Preserve. From 1998 through the present, there have been no wells drilled from surface locations within the Preserve. However, oil and gas exploration and development has continued during that time. Since the last well drilled from inside the Preserve was completed in 1997, 27 directional wells were drilled from surface locations outside the Preserve to reach bottomhole targets beneath the Preserve. During the same period, applicants received § 9.32(e) exemption determinations for 15 additional directional wells that have not yet been drilled.

Only two wells have been drilled from surface locations within the Big Sandy Creek Unit. Both were dry holes and were plugged and abandoned. One well was drilled in 1937, and the other in 1982. The 2.42 acre drilling pad for the latter well is located immediately adjacent to the Big Sandy Horse Trail, and is still recovering. Nine directional wells have been drilled under this Unit. Four of these wells are currently producing. Two of the wells are currently shut-in. All of the producing wells, and one of the shut-in wells, were completed in the Sunflower (Upper Woodbine) Field. The field was discovered in 2000, and is centered around the northern end of the Unit. Production from the field peaked in 2004, when 12,709,803 mcf gas, and 96,339 bbl condensate were produced. Production is currently declining. Total reported production from the field up to February 2007 was 34,892,141 mcf gas and 265,145 bbl condensate. Three natural gas transpark pipelines ranging in size from 24 to 31 inches cross the Big Sandy Creek Unit within a common corridor that occupies 55.8 acres. These lines were constructed from 1944 through 1952. One natural gas pipeline right-of-way makes up part of the northern boundary of the Unit.

Currently, there are no new proposals for oil and gas exploration or development within the Big Sandy Creek Unit.

Impacts from In-Park Operations and Connected Actions: The analysis of impact to socioeconomic resources is not separated into in-park operations and connected actions, since both the in-park borehole and connected action together are needed to produce the effect on socioeconomics. The proposed action (if the directional wells were drilled and hydrocarbons are discovered and produced) would result in only a negligible effect on the local or regional

economy, since they represent such a small amount the total production in the RRC District 3. The amount of revenue generated from leases, royalties, and rents would be very limited, and revenue related to production would not necessarily be retained locally. Revenue from sales of goods to crews would be limited and sporadic, and short-term.

Cumulative Impacts: Cumulative impacts on socioeconomics within the project area would continue to occur because of Preserve operations, visitor use, hunting, development including oil and gas operations, commercial timber harvest creating demand for goods and services, and other sources of economic development. An example of the latter would be residential or commercial development adding to the tax base of the area. The divestiture of timberlands surrounding the Preserve by traditional, integrated forest products companies could also affect socioeconomics of the area. All three of the major landholding neighbors to the Preserve, International Paper, Louisiana Pacific, and, most recently, Temple-Inland have sold their timberlands. The sale of these lands has been primarily to institutional investors. This represents a shift in land management strategy towards maximizing returns on timberland assets for shareholders.

It is unclear what the cumulative effect to socioeconomics of institutional investment in timberlands adjacent to the Preserve would be. As impacts from the proposed directional wells are not expected to create more than a negligible impact on the local or regional economy, the implementation of the proposals is not expected to add cumulative impacts to socioeconomic values in the project area.

Conclusion: Because revenue from oil and gas production of the five wells would likely affect only a small number of people, and their development would have such a small effect on the local and regional economies, socioeconomics was dismissed from further analysis in this EA.

1.4.2 Catastrophic Incidents, such as Well Blowouts, Well Fires or Major Spills

One issue related to the proposed actions is the potential for catastrophic incidents, including well blowouts, well fires, or major spills. The Railroad Commission of Texas (RRC) oversees the State's oil and gas industry, gas utilities, pipelines, safety in the liquefied petroleum gas industry, and surface mining and reclamation of coal and uranium. The RRC divides the state up into 12 Districts for purposes of administering and regulating oil and gas operations under its jurisdiction, and maintains statistics on blowout and well control problems, and spills. In this section, data are provided for calendar years 2010 and 2011 for incidents reported in RRC District 3, which includes Big Thicket National Preserve and would be representative of blowout events/well control problems, fires and spills that occur in or adjacent to the Preserve. RRC District 3 includes 29 counties in southeast Texas. Data are also presented for the seven counties within District 3 in which Big Thicket National Preserve is located: Hardin, Jasper, Jefferson, Liberty, Orange, Polk, and Tyler.

As of September 2011, there were approximately 7,438 regular producing oil wells and 3,862 regular producing gas wells in RRC District 3, totaling 11,300 wells. Of these wells, a total of 2,941 wells or 26 percent of the District total are located within the 7 counties where Big Thicket National Preserve is located. These include 2,103 oil wells (28 percent of the District total) and 838 gas wells (22 percent of the District total). See the following links for the RRC raw data on well counts, spills (H8 reports), and blowouts:

<http://www.rrc.state.tx.us/data/wells/wellcount/index.php>
<http://www.rrc.state.tx.us/environmental/spills/h8s/index.php>
<http://www.rrc.state.tx.us/data/drilling/blowouts/index.php>

In addition to the information provided on their website at the above links, the RRC provided an Excel spreadsheet that included information on all reported well fires that occurred in District 3 during 2010 and 2011. Well fire information is not readily available online and the data was provided by RRC in response to an open records request. Table 4, below, shows the number of reported well control problems, well fires, and major spills in RRC District 3 during calendar years 2010 and 2011.

Table 4. Well Control Problems, Well Fires, and Major Spills in RRC District 3 and the Seven Counties around Big Thicket National Preserve during 2010 and 2011

Type of Incident	No. of Incidents in RRC District 3 during 2010 and Rate of Occurrence	No. of Incidents in 7 Counties around Big Thicket National Preserve during 2010 and Rate of Occurrence	No. of Incidents in RRC District 3 during 2011 and Rate of Occurrence	No. of Incidents in 7 Counties around Big Thicket National Preserve during 2011 and Rate of Occurrence
Blowouts or Well Control Problems during Drilling Operations	2 1 well control problem per 5,704 wells per year	1 1 well control problem per 2,906 wells per year	12 1 well control problem per 942 wells per year	2 1 well control problem per 1,471 wells per year
Well Fires	11 1 well fire per 1,037 wells per year	4 1 well fires per 727 wells per year	21 1 well fires per 538 wells per year	9 1 well fires per 327 wells per year
Major Oil Spills (defined as exceeding 5 barrels)	48 1 major spill for every 238 wells per year	13 1 major spill for every 224 wells per year	20 1 major spill for every 565 wells per year	4 1 major spill for every 735 wells per year

Well Blowouts. The term “blowout” means the uncontrolled escape of formation fluids (water/brine, gas, oil) from a well. Given present day technology, a well blowout is extremely rare. According to RRC data, the vast majority of reports deal with well control problems that never manifested in full, sustained blowouts.

During 2010, there were 2 well control problems reported in RRC District 3, of which 1 was located in the seven counties where Big Thicket National Preserve is located. This incident did not affect the resources and values in the Preserve. During 2011, there were 12 well control problems reported in RRC District 3, of which 2 were located in the seven counties where Big Thicket National Preserve is located. Neither of these incidents affected the resources and values in the Preserve. See <http://www.rrc.state.tx.us/data/drilling/blowouts/index.php>

Of the 30 directional wells drilled outside the Preserve since 1986 for which NPS issued § 9.32(e) exemption determinations, the Comstock Black Stone B1 is the only well that reported well

control problems. The well control problems reported by Comstock for the Black Stone B1 well did not result in a well blowout or well fire. During wireline operations to retrieve the measured well depth, the internal float on the drill string failed and the packoff on the wireline lubricator failed, resulting in oil-based drilling mud flowing up the drill pipe. The wireline was pulled out of the hole, the safety valve was shut in and the well was secured. No injuries or fatalities occurred during the incident. The well control problems did not result in impacts off the wellpad; and there were no impacts on the resources and values in the Preserve.

Well Fires. During 2010, there were 11 fires that resulted from well control problems encountered during well drilling. The 11 reported fires in RRC District 3 during 2010 equates to 1 fire for every 1,037 wells per year. Of these 11 fires, 4 occurred in the seven-county area where Big Thicket National Preserve is located. During 2011, 21 well fires were reported in RRC District 3. Of these 21 total fires in the district, 9 occurred in the seven-county area where Big Thicket National Preserve is located.

Major Spills. The Texas RRC defines “major spills:” as those exceeding five barrels of oil and require reporting of release of that amount (Tex. Admin. Code Tit. 16, § 1.30 (2005)). During 2010, in RRC District 3, there were 48 spills reported greater than 5 barrels of oil, equating to approximately 1 spill for every 238 wells per year. Thirteen of the 48 spills were located in the seven counties in which Big Thicket National Preserve is located. During 2011, in RRC District 3, there were 20 spills reported greater than 5 barrels of oil, equating to approximately 1 spill for every 565 wells per year. Four of the 20 spills were located in the seven counties in which Big Thicket National Preserve is located.

Any oil and gas operator that could reasonably be expected to discharge oil in harmful quantities, as defined in 40 CFR 110.3, into navigable waters, as defined in 40 CFR 110.1, is required to have a Spill Prevention Control and Countermeasure Plan in accordance with 40 CFR Part 112. Some of the specific requirements that an operator of onshore oil drilling and workover facilities must adhere to under 40 CFR 112.14, Spill Prevention, Control, and Countermeasure (SPCC) Plan requirements for onshore oil drilling and workover facilities, include:

- Meet the general requirements listed under Sec. 112.7, and also meet the specific discharge prevention and containment procedures listed under this section.
- Position or locate mobile drilling or workover equipment so as to prevent a discharge as described in Sec. 112.1(b).
- Provide catchment basins or diversion structures to intercept and contain discharges of fuel, crude oil, or oily drilling fluids.
- Install a blowout prevention (BOP) assembly and well control system before drilling below any casing string or during workover operations. The BOP assembly and well control system must be capable of controlling any well-head pressure that may be encountered while that BOP assembly and well control system are on the well.

Due to these requirements, in the rare event of a major spill consisting of five or more barrels of oil, the spill would be rapidly contained and removed, so that impacts are short-lived and limited to the immediate area of operations. In the event that a spill did occur and did spread into the Preserve, the impacts could be remedied and mitigated over time. In the rare event that

spilled substances from a well blowout or major spill would be transported into the Preserve, or a well fire would spread into the Preserve, the NPS would seek damages and restoration costs under the Park System Resources Protection Act, 16 U.S.C. § 19jj (2005). While applicability of the Park System Resources Protection Act would be applied only after damages to the Preserve's resources or values have occurred, this tool is also an effective deterrent for operators to apply the necessary preventative measures to prevent an incident from affecting the Preserve.

Analysis of impacts from reasonably expected spill incidents, which would not reach the magnitude of a reportable major spill consisting of five or more barrels of oil, is presented under other impact topics in Sections 1 and 3 of this EA.

Impacts from In-Park Operations: Under the proposed action, the directional wells would be drilled from two wellpads located outside the Unit boundary. The proposed in-park operations, consisting of the directionally drilled wellbores crossing into the plane of the Unit at a depth below the usable quality groundwater zone and extracting hydrocarbons and other fluids from beneath the Unit, would have no impact on the surface regardless of what methods and materials Famcor uses to drill, case, cement, or plug and abandon the section of the hole inside the Unit. Likewise, if the wells are produced, any methods of completion, stimulation, or injection that occur inside the Unit will not pose a substantial threat of damage to park resources. Surface subsidence caused by fluid withdrawals is not a reasonable expectation because of the target reservoir properties (depth, porosity, compaction, hydropressure, etc.) and adjacent overlying sediments. Fracture of geologic formations with resultant usable quality water zone contamination is not an issue in the § 9.32(e) determination because activities inside the Preserve would occur below the deepest usable quality water zone. Further, in-park operations would have no potential for well-blowouts, well fires, or major spills.

Impacts from Connected Actions: The NPS recognizes that unplanned incidents associated with oil and gas operations such as well blowouts, fires, and major spills near the boundaries of Big Thicket National Preserve present a risk of damage to park resources and values. However, the rates of occurrence for such incidents are low and are not a reasonable expectation of project implementation. If such an incident did occur, required mitigation measures provided in Famcor's application would reduce the potential for spilled substances or a well fire to spread into the Preserve, and would provide for timely response and cleanup. Therefore, there is a reasonable expectation that the spill would be confined to the wellpads, or, if it did reach the Preserve, that the natural environment could be reclaimed or would otherwise recover over time so that impairment would not occur. In the event that Preserve resources or values would be damaged, the NPS could seek remedy both on the ground and in the form of monetary compensation. Any further analysis on this topic would be highly speculative.

Cumulative Impacts: Cumulative impacts related to this topic can be assessed by examining relevant data for wells located within the seven counties that contain the Preserve. There are very low rates of occurrence for all three types of incidents, ranging from 4 well fires, 13 major spills and 1 blowout reported in 2010, out of a total of 2,906 wells in service (1 incident for every 161 wells) and 9 well fires, 4 major spills, and 2 blowouts reported in 2011 (1 incident for every 196 wells). Cumulatively, the addition of five directional well bores from the two Famcor wellpad locations in this proposed action would not add more than negligible effects to these regional incident statistics.

Conclusion: Because there would be no potential for a catastrophic incident, such as well blowout, well fire or major spill occurring as a result of the in-park operations, and because the likelihood of such incidents from the connected actions is very low, it is not expected that catastrophic incidents, such as a well blowout, well fire and major spill in and outside the Unit, would result in more than negligible impacts, and this topic was dismissed from further analysis in this EA.

1.4.3 Environmental Justice

Executive Order 12898, “General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires all Federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minority and low-income populations and communities. Per the Department of Human Health and Services, Polk County is considered a “low income” county, as 22.6% of its individual residents are below the poverty level (Ibid). Polk County is not considered “minority” as 82.4% of its residents are white (Ibid). Although Polk County is considered “low income”, the proposed action would not have disproportionate health or environmental effects on the community. Therefore, environmental justice was dismissed as an impact topic in this EA.

1.4.4 Prime or Unique Farmland Soils in the Units

As a result of a substantial decrease in the amount of open farmland, Congress enacted the Farmland Protection Policy Act (Public Law 97-98). In August 1980, the Council on Environmental Quality directed that Federal agencies must assess the effects of their actions on prime or unique farmland soils classified by the U.S. Department of Agriculture’s Natural Resources Conservation Service. Prime or unique farmland is defined as soil that particularly produces general crops such as common foods, forage, fiber, timber, and oil seed; unique farmland is defined as soil that produces specialty crops such as fruits, vegetables, and nuts. Prime and unique farmland soils are those that are actively being developed and could be converted from existing agricultural uses to nonagricultural purposes, as described above. Urban or built-up land, public land, and water areas cannot be considered prime farmland.

Soils inside the Unit cannot be considered prime and unique farmland soils because they are public lands unavailable for food or fiber production. The Farmland Protection Policy Act only applies to direct Federal actions and does not apply to the connected actions identified in this EA (that is, the surface disturbances outside the Unit).

Because there are no prime and unique farmland soils in the Units, and the Farmland Protection Policy Act does not apply to private projects on private properties, this impact topic was dismissed from further analysis in this EA.

1.4.5 Geology and Soils

The geology and soils within the Preserve adjacent to the proposed new construction of the Carroll 2-3 wellpad, access road and flowline and also the existing Carroll 1-4-5 wellpad, access road and flowline were examined to determine if more than negligible effects could occur from

either in-park or connected actions. The soils and characteristics of the area surrounding the well and access road is described below:

The soils beneath approximately 90% of the proposed Carroll 2-3 wellpad location are described as Stringtown-Bonwier association (STE), which occur on 5% to 15% slopes, are well drained, are not hydric with no frequency of flooding, and have a depth of more than 80 inches to the water table. The remaining soil which represents approximately 5% of the wellpad and 100% of the access road and flowline is classified as Pinetucky loamy fine sand (PaB), which occur on 1% to 5% percent slopes, are moderately well drained, are not hydric with no frequency of flooding, and have a depth of more than 80 inches to the water table (U.S. Department of Agriculture, Soil Conservation Service, 1983).

The geology and soils within the Preserve adjacent to the existing Carroll 1-4-5 wellpad and access road were examined to determine if more than negligible effects could occur from either in-park or connected actions. The soils and characteristics of the areas surrounding the well and access road is described below:

The existing Carroll 1-4-5 wellpad, access road and flowline are located entirely within the Pinetucky loamy fine sand (PaB), which occur on 1% to 5% percent slopes, are moderately well drained, are not hydric with no frequency of flooding, and have a depth of more than 80 inches to the water table (U.S. Department of Agriculture, Soil Conservation Service, 1983).

Impacts from In-Park Operations: Under the Proposed Action, all wells would be directionally drilled into the Preserve at substantial depths under the land surface. The Carroll 2-3 will be directionally drilled from a single wellpad located on privately owned surface. The Carroll-BSMC #2 wellbore will cross the Unit boundary at approximately 385 feet (horizontal distance) and at an approximate true vertical depth (TVD) of 2,040 feet beneath the Unit boundary. The Carroll-BSMC #3 wellbore will cross the Unit boundary at approximately 304 feet (horizontal distance) and at an approximate TVD of 3,080 feet beneath the Unit boundary. The Carroll 1-4-5 will be directionally drilled from an existing wellpad named the Carroll #1 (a vertical well). The Carroll #4 wellbore will cross the Unit boundary approximately 430 feet (horizontal distance) and at an approximate (TVD) of 2,010 feet. The Carroll-BSMC #5 wellbore will cross the Unit boundary at approximately 655 feet (horizontal distance) and at an approximate TVD of 2,000 feet beneath the Unit boundary. The Carroll-BSMC #1 wellbore will cross the Unit boundary at approximately 655 feet (horizontal distance) and at an approximate TVD of 2,750 feet beneath the Unit boundary. Target depth for all five wellbores is approximately 5,100 feet TVD, where they will extract hydrocarbons and other fluids from beneath the Unit. All five wellbores would cross into the plane of the park at TVDs ranging from between 2,000 and 3,080 feet to target depths of about 5,100 TVD. Therefore, based on these depths below the surface of the Preserve, there would be no impacts on the geology and soils within the Preserve from the in-park subsurface oil and gas operations proposed for any of the wells.

Impacts from Connected Actions: To evaluate whether the proposed activities outside the Preserve could impact geology and soils in the adjacent Units, the NPS considered the potential for surface subsidence caused by the production of hydrocarbons and the potential for contamination of adjacent lands from operations outside the Preserve. For this, the NPS examined types and volumes of contaminants that would be present at the well/production site, the probability of release, and the potential for migration into the Unit.

The potential for subsidence is not a concern in the vicinity of the Preserve. The hydrocarbon producing zones are deep and have moderate porosity. There is a long history of oil and gas production in the area without evidence of subsidence occurring.

The potential for runoff of contaminants onto Preserve soils was evaluated at each site. There is very little potential for impacts to geology and soils in the Preserve at all well locations, as described below:

The potential for runoff of contamination to offsite soils was considered for all phases of oil and gas development: construction, drilling, production, and plugging/reclamation. The effects from the connected actions to geology and soils would be primarily associated with surface impacts from vehicle use, construction, drilling, and fluid transport at the wellpads and flowline corridors. Construction operations would require clearing of land, removal of vegetation, and disturbance of soils, especially at the wellpads. During rain events, runoff containing sediment or oils from construction equipment could reach adjacent lands. Drilling and production could result in releases of hydrocarbons, produced waters, or treatment chemicals, which could runoff to neighboring properties, along with soil from bare areas on the pad. No major spills would be likely, as previously described (see “Catastrophic Incidents”, above). Plugging and reclamation would provide for regrading of soils and revegetation, but runoff and the potential for off-site contamination would persist until the sites were totally reclaimed and any cleanup completed.

However, the potential for runoff to reach lands inside the Preserve would be remote, based on the mitigation measures that Famcor has committed to for all phases of the operation. The drainage pathway to the Unit from the perimeter of both wellpads is gently sloping to relatively flat, and with low gradient sheet flow drainage. The overall pathway of migration into the Unit (at the boundary) from the perimeter of the Carroll 2-3 wellpad is estimated to be 100 feet (rather than the nearest 10 foot proximity) due to the way the wellpad would be constructed, where the wellpad surface (grade) would slope away from the unit boundary. The overall pathway of migration into the Unit (at boundary) from the perimeter of the Carroll 1-4-5 wellpad is estimated to be over 250 feet. Mitigation would include scheduling initial construction to avoid rain events, constructing a berm around the wellpad, constructing a washout emergency pit, using a closed-loop containerized mud system, reducing the size of the wellpad after drilling completion, constructing a 2-foot berm around the tank battery, and adherence to a Spill Prevention Control and Countermeasure Plan. Erosion control measures would include the use of mulching, seeding, silt fences, and hay bales (see Table 6 for a complete list of mitigation). Reclamation would include restoring the site to original contours, removal of any contaminated soils, replacing topsoil, and revegetation. Based on these measures and site conditions, there would be a low potential for migration of contaminants into the Unit; and if it were to occur, there would be ample time and space to respond to even a major release before there would be impacts on geology and soils in the Unit. The potential for adverse impacts to soils and geology in the Unit would be negligible from the development of the Carroll 2-3 and the Carroll 1-4-5 wells over the short or long-term.

Cumulative Impacts: Vehicle uses, existing and future oil and gas operations in and outside the Preserve, maintenance of transpark oil and gas pipelines, routine park operations, forestry operations adjacent to the Preserve, and continued land development near the Preserve boundary would all contribute to cumulative impacts on geology and soils in the Preserve. The cumulative effect of drilling and producing the up to 40 wells projected in the RFD scenario was

considered in the Preserve's *Oil and Gas Management Plan Environmental Impact Statement* (NPS, 2005), and negligible to minor cumulative impacts were identified for this impact topic. Overall, the proposed actions would contribute negligible adverse effects to the cumulative impacts on geology and soils in the Preserve and adjacent lands.

Conclusion: Because there would be no impacts on the Preserve's geology and soils from in-park oil and gas operations, and impacts from the connected actions would be negligible based on site topography and mitigation that would help to confine any releases to the site, the topic of geology and soils in all adjacent Units of the Preserve was dismissed from further analysis in this EA.

1.4.6 Water Resources: Groundwater, Streamflow, Floodplain and Wetlands

The proposed location for the new Carroll 2-3 is situated on an existing slope of approximately 20% and the north corner of the wellpad perimeter is approximately 10 feet from the Unit boundary. There are no "waters of the United States" (wetlands) in the treatment area (or area of disturbance, i.e. the analysis area) which includes the wellpad, access road and flowline. The nearest stream is inside the Unit and is located about 600 feet northwest of the wellpad perimeter. It is an unnamed tributary of Big Sandy Creek. At the point where it is estimated that runoff from the wellpad would enter this stream, it then flows southerly about 0.5 miles (measured along the centerline) before emptying into Big Sandy Creek.

The existing Carroll 1-4-5 is situated on a flat with very little slope. The nearest stream is inside the Unit and is also located about 600 feet west of the wellpad perimeter. It is the same unnamed tributary of Big Sandy Creek as described above. At the point where it is estimated that runoff from the wellpad would enter this stream, it then flows southerly about 0.25 miles (measured along the centerline) before emptying into Big Sandy Creek.

According to National Wetland Inventory (NWI) data, and corroborated by direct observation during the August 22, 2012 field survey conducted by Joe Hamrick (Raven Environmental, Project Manager), the nearest wetland to either wellpad is the manmade, privately owned pond generally located between the two wellpad locations. The spillway, or outflow, of this pond empties into a manmade ditch which connects to an unnamed intermittent stream that flows southeasterly (and under Farm to Market 1276) about 0.4 miles until it empties into Big Sandy Creek. As mentioned earlier, all soils within the analysis area are not hydric. Drainage patterns for both wellpads are away from this pond. Due to the drainage patterns and Famcor's implementation of its SPCC Plan, the escape of fluids or contaminants from either location into this pond is highly unlikely.

Farm to Market Road (FM) 1276 will be utilized as access for both wellpads. About 1,502 feet of existing access road was constructed to drill the vertical Carroll #1 well and will also be used to access the proposed new Carroll 2-3 wellpad and the existing Carroll 1-4-5 wellpad.

According to the TCEQ form 0051R, the base of usable quality groundwater for the Carroll-BSMC #1 and the Carroll-BSMC #5 occurs from the land surface to a depth of 1,800 feet; the interval from land surface to a depth of 425 feet and the freshwater contained in the Jasper aquifer from a depth of 800 feet to 1,150 feet must be isolated from water in underlying and overlying beds.

According to the TCEQ form 0051R, the base of usable quality groundwater for the Carroll-BSMC #2, the Carroll-BSMC #3 and the Carroll #4 occurs from the land surface to a depth of 1,825 feet; the interval from land surface to a depth of 450 feet and the freshwater contained in the Jasper aquifer from a depth of 825 feet to 1,175 feet must be isolated from water in underlying and overlying beds.

Impacts from In-Park Operations: Under the Proposed Action, both well locations would be directionally drilled from outside the Preserve and cross into the Unit at substantial depths, as described under “Geology and Soils,” above. Therefore, there would be no impacts on either the surface water flows or usable quality groundwater zones either in or outside the Unit, floodplains, or wetlands from the subsurface oil and gas operations in the Unit.

Impacts from Connected Actions: Both well locations and their associated access and flowlines are located on upland areas with no floodplains, wetlands, or special aquatic sites. The proposed surface casing and cementing program; the site location, site design, and mitigation measures that Famcor would implement at these wells during construction, drilling, and production activities are designed to confine impacts to the wellsite and the wellbore.

Cumulative Impacts: Vehicle uses, existing and future oil and gas operations in and outside the Unit, maintenance of transpark oil and gas pipelines, routine park operations, forestry operations adjacent to the Unit, and land development near the Unit boundary could contribute to cumulative impacts on water resources, floodplains or wetlands in and around the Big Sandy Creek Unit. An analysis of the cumulative effect of drilling and producing the up to 40 wells projected in the RFD scenario was performed in the Preserve’s *Oil and Gas Management Plan Environmental Impact Statement* (NPS, 2005), and up to moderate impacts were identified from all actions that could affect water resources, floodplains and wetland in the cumulative impacts analysis area. The effects of the proposed action would not contribute more than negligible adverse impacts to the overall cumulative impact of all these actions in the region.

Conclusion: There would be no impacts on water resources from in-park oil and gas operations, and impacts from the connected actions would be negligible, based on mitigation to prevent off-site contamination, and the low chance of catastrophic release. Therefore, the topic of water resources, floodplains, and wetlands in and outside the Big Sandy Creek Unit was dismissed from further analysis in this EA.

1.4.7 Fish and Aquatic Life

Drainage patterns for both Carroll wellpads are away from the nearby existing, manmade and privately owned pond. Due to these drainage patterns and Famcor’s implementation of its SPCC Plan, the escape of fluids or contaminants from either location into the pond is highly unlikely. Because the entry-point of runoff from either wellpad to the nearest streams is 600 feet or more distant, and from that point, between 0.25 and 0.5 miles distant to the confluence with Big Sandy Creek, and because Famcor will implement its SPCC Plan, the escape of fluids or contaminants from either location into the unnamed tributary and then downstream into Big Sandy Creek is highly unlikely. Therefore, this topic was dismissed from further analysis for all wells.

1.4.8 Vegetation

Impacts on vegetation would occur from the proposed action both outside the Preserve Unit, on adjacent lands where the Carroll 2-3 wellpad, access road, and flowline are constructed, and also on lands located in the Unit if runoff occurs from the wellsites (similar to impacts to soils and geology in the Preserve, as discussed above). However, impacts to vegetation within the Units are not expected to exceed negligible levels, as discussed below.

The newly constructed Carroll 2-3 wellpad, access road, and flowline will require clearing an estimated total of about 2.64 acres. Constructing the wellpad will require clearing 2.06 acres, of which, approximately 0.25 acres will be within a timber stand and the remaining 1.82 acres will be within an existing improved pasture. Vegetation removal within the timber stand will include: loblolly pine (*Pinus taeda*), southern magnolia (*Magnolia grandiflora*), redbay (*Persea borbonia*), willow oak (*Quercus phellos*), Chinese privet (*Ligustrum sinense*), sweetgum (*Liquidambar styraciflua*), yaupon holly (*Ilex vomitoria*), American holly (*Ilex opaca*), and American beautyberry (*Callicarpa americana*). The 1.82 acres of improved pasture that will be cleared is primarily bahiagrass (*Paspalum notatum*) with some scattered ragweed (*Ambrosia artemisiifolia*), Chinese tallotree (*Triadica sebifera*) and southern dewberry (*Rubus trivialis*).

The existing 0.94 acres Carroll 1-4-5 wellpad has been stabilized with a 4 to 6 inch thick layer of caliche rock, and is essentially devoid of vegetation. The existing 1.03 acre Carroll 1-4-5 access road and flowline ROW has also been stabilized with a layer of rock and is also essentially devoid of vegetation.

Impacts from In-Park Operations: Under the Proposed Action, all wells would be directionally drilled into the Preserve at substantial depths under the land surface, as described under “Geology and Soils.” Therefore, there would be no impacts on vegetation either within or outside the Units from the in-park subsurface oil and gas operations proposed for any of the wells.

Impacts from Connected Actions: The possible impacts to the vegetation inside the Units from all phases of development would be similar to those described above under “Geology and Soils” for all the wells, with the primary concern being off-site migration of contaminants and sediment that could adversely affect adjacent vegetation. Hydrocarbons, chemicals, and produced water can damage or kill vegetation, and soils and sediment can smother plants or coat leaves. Herbicides used to control site vegetation could migrate off-site, although this is unlikely if they are applied according to label instructions. As previously described, topography between the Unit and the wellpads is gently sloping to relatively flat, and even though the north corner of the Carroll 2-3 wellpad is about 10 feet from the Unit boundary, based on the existing topography it is estimated that runoff from either wellpad would have to travel approximately 600 feet before entering the nearest stream.

Mitigation that would reduce impacts to offsite vegetation would be similar to those measures listed for “Geology and Soils” and includes Famcor’s SPCC Plan, berms, erosion control measures, and self-contained systems. There would be a low potential for migration of contaminants into the Units; and if this were to occur, there would be ample time and space to respond to even a major release before there would be impacts on vegetation in the Units. For these reasons, and with the application of mitigation measures, potential adverse impacts to

vegetation in the Units from development of the wells over the short- and long-term are expected to be negligible.

Cumulative Impacts: Existing and future oil and gas operations outside the Unit, maintenance of transpark oil and gas pipelines, and especially forestry operations adjacent to the Unit would contribute to cumulative impacts on vegetation. An analysis of the cumulative effect of drilling and producing the up to 40 wells projected in the RFD scenario was performed in the Preserve's *Oil and Gas Management Plan Environmental Impact Statement* (NPS, 2005), and up to moderate adverse impacts were identified from all actions that could affect vegetation in the cumulative impacts analysis area. The effects of the proposed action would not contribute more than negligible adverse impacts to the overall cumulative impact of all these actions in the region.

Conclusion: There would be no impacts on vegetation from in-park oil and gas operations, and impacts from the connected actions would be negligible based on the low chance of a catastrophic release, mitigation to prevent releases and off-site contamination, and the relatively flat site topography and low runoff potential. Therefore, the topic of vegetation in all Units was dismissed from further analysis in this EA.

1.4.9 Threatened and Endangered Species and Other Species of Management Concern

Under the Endangered Species Act of 1973 (ESA), the NPS has responsibility to address impacts to federally-listed, candidate, and proposed species. Also, NPS policy requires that State-listed species, and others identified as species of management concern by the park, are to be managed in parks in a manner similar to those that are federally-listed. Big Thicket National Preserve does not have any species of management concern identified. Thus, Federal and State-listed species will be addressed in this EA following Federal law and NPS policy.

Under NPS policy, the proposed operations would qualify for an exemption with no mitigation. Under this scenario, actions by the NPS with respect to the Endangered Species Act (1973) are non-discretionary. The wells would originate on lands located outside of the Unit, and the wellbores would cross through the Unit at a sufficient depth to preclude any effect on surface resources (species or habitat). Therefore, the NPS has no Endangered Species Act § 7 responsibility or authority associated with the proposed wells, other than assessing potential impacts to threatened and endangered species from connected actions outside the Units.

Appendix B provides U.S. Fish and Wildlife Service lists of threatened or endangered species that may occur in Polk County. The list includes two federally-listed endangered species: the red-cockaded woodpecker (*Picoides borealis*) and Texas trailing phlox (*Phlox nivalis* ssp. *texensis*). Appendix C contains a current listing by the Texas Parks and Wildlife Department (TPWD) of threatened, endangered, and state-identified rare species (sensitive species) that may occur in Polk County. The State list includes a brief description of the habitats required by these species. There is no federally-designated critical habitat in or near Big Thicket National Preserve.

Impacts from In-Park Operations: As previously noted, under NPS policy, the proposed operations would qualify for an exemption with no mitigation. The wells would originate on lands located outside of the Unit, and the wellbores would cross through the Unit at a sufficient depth to preclude any effect on surface resources. Therefore, the NPS has no § 7 responsibility

or authority associated with the proposed wells; however, an assessment of impacts from in-park operations shows that there would be no impacts on threatened or endangered species in the Units from the subsurface oil and gas operations.

Impacts from Connected Actions: The Preserve has not documented any federally or State-listed threatened and endangered species in the area of the proposed Famcor wells. During 2003, no federally-listed species were documented in the Big Sandy Creek Unit during vegetation mapping and sampling. Also in 2003, a field survey for red-cockaded woodpeckers in all but the northern tip of the Unit found no individuals, vocalizations, or cavity trees of these species (DESCO, 2004). The field survey was conducted prior to a 3-D seismic survey by Seismic Assistants, Ltd., during 2004.

Famcor retained Raven Environmental Services, Inc. to conduct an endangered species survey of the area surrounding the proposed wellpad locations in Polk County. In addition to their general habitat review, target site reconnaissance was performed by Raven Environmental Services, Inc. to determine if any listed species were observed at the proposed sites. Field investigations were conducted on August 22, 2012. There were no indications of any State or federally-listed threatened or endangered species found on or in the vicinity of the proposed access roads, wellpads, or flowline corridors.

The design of Famcor's proposal would avoid any surface disturbance of habitat in the Preserve. Thus, no federally-listed, candidate or proposed species, nor State-listed species, on the NPS acreage would be directly impacted by the proposal through removal or disturbance of soils or vegetation. Less direct, yet potential impacts to species occupying the Unit could occur through noise and light disturbance, loss and fragmentation of habitat on adjacent private lands, and potential for spills of oil and other produced fluids. However, as previously described, the potential for more than short-term disturbances from noise, light, or contaminating substances is unlikely, based on site conditions and mitigation employed to reduce risk of runoff. Mitigation for potential oil spills which could affect habitat in the Unit is included in Famcor's application.

NPS determined that the directional drilling and production of the Carroll 2-3 and the Carroll 1-4-5 wells would have no effect on federally-listed threatened and endangered species or their habitat in or outside the Unit, nor would there be an effect to the State-listed species which may possibly occur in the Unit. This determination is based upon a combination of factors. First, the habitat in the project area is not suitable for any of the species identified by U.S. Fish and Wildlife Service. Second, there is an absence of observations of any species documented in Appendix B, Appendix C or Preserve records based on site-specific surveys completed by the proponent. Third, the depth with which the well would enter the Unit eliminates the possibility of surface habitat disturbance. Lastly, mitigation measures have been designed into the project to reduce impacts to wildlife.

Cumulative Impacts: Vehicle uses, existing and future oil and gas operations in and outside the Unit, maintenance of transpark oil and gas pipelines, routine park operations, recreational activities including hunting in and outside the Unit, and forestry operations adjacent to the Unit could impact threatened or endangered species, and other species of management concern. Over time, protection provided to species of management concern would maintain and improve habitat for those species in the Preserve, resulting in cumulative beneficial impacts. An analysis of the cumulative effect of drilling and producing the up to 40 wells projected in the RFD

scenario was performed in the Preserve's *Oil and Gas Management Plan Environmental Impact Statement* (NPS, 2005), and up to moderate adverse impacts were identified from all actions that could affect threatened and endangered species in the cumulative impacts analysis area. Considering the lack of habitat for listed species at any of the proposed well sites and the fact that the surveys conducted found no listed species at the well locations, the effects of the proposed action would not contribute more than negligible adverse impacts to the overall cumulative impact to species of management concern.

Conclusion: There would be no impacts on species of management concern from in-park oil and gas operations, and the connected actions would have no effect on federally-listed threatened and endangered species or their habitat in or outside the Units; nor would there be an effect on any State-listed species within the Units from connected actions. These conclusions are based on the lack of habitat for these species at the sites, field survey results that indicate these species are not present, and mitigation that would minimize impacts to wildlife in general. Therefore, the topic of species of management concern in and outside the Units was dismissed from further analysis in this EA.

1.4.10 Cultural Resources

Under § 106 of the National Historic Preservation Act of 1966, as amended, the NPS has a responsibility to consider the effects undertakings may have on cultural resources listed on or eligible for listing on the National Register of Historic Places. The law also requires that agencies discuss their actions, before taking them, with the State Historic Preservation Office or Tribal Historic Preservation Officer, the Advisory Council on Historic Preservation, if necessary, as well as other consulting parties, such as certified local governments.

Under the Proposed Action, the wells would be directionally drilled from surface locations outside the Units. The wellbores would cross into the Units at a depth below usable quality groundwater to extract hydrocarbons and other fluids from beneath the Units. The wells would qualify for an exemption with no mitigation because the wells would originate on lands located outside of the Units, and the wellbores would cross through the Units at a sufficient depth so as to have no impact on the surface of the Units. Under this scenario, actions by the NPS with respect to the National Historic Preservation Act are non-discretionary. Because the in-park operations would have no effect on cultural resources inside the Units, the NPS has no § 106 responsibility, nor authority, associated with the wells for the proposed in-park operations for which a 9.32(e) exemption is being evaluated. As part of the NEPA analysis, however, the NPS is providing the following analysis of the effects of the actions on cultural resources. Impacts from in-park operations for all wells are discussed below and dismissed from further analysis, along with impacts outside the BSC Unit. Famcor subcontracted Deep East Texas Archeological Consultants (DETAC, Nacogdoches, Texas) to conduct a “desktop” archeological review and a Cultural Resources Impact Statement; the result being that the “potential for finding intact cultural resources in the new construction area [the Carroll 2-3] is low”.

Impacts from In-Park Operations: There is no potential for surface or subsurface impacts within the Units from downhole operations occurring inside the Units. Therefore, in-park operations would have no effect on cultural resources.

Impacts from Connected Actions: As part of the NEPA analysis, the NPS also considered the impacts of the connected actions on cultural resources in and outside the Big Sandy Creek Unit. The NPS has no authority under 36 CFR § 9.32(e) to require Famcor to contract an archeological survey in the project area on lands adjacent to the Unit. However, Famcor retained Deep East Texas Archaeological Consultants, Inc. (DETAC, Nacogdoches, Texas) to conduct a “desktop” archeological review and a Cultural Resources Impact Statement; the result being that DETAC determined the “potential for finding intact cultural resources in the new construction area [the Carroll 2-3] is low”.

The possible impacts to the cultural resources inside the Units from all phases of development would be similar to those described above under “Geology and Soils” for all the wells, with the primary concern being off-site migration of contaminants that could adversely affect cultural resources. Hydrocarbons, chemicals, and produced water could damage cultural artifacts. As previously described, topography between the wellpad locations and the Preserve boundary is gently sloping to relatively flat. Also, this cultural landscape bears little resemblance to its historical condition with the practices of plantation silviculture, cattle grazing, oil and gas exploration and the creation of Big Thicket National Preserve all affecting the landscape in the area. The greatest effects of the proposed project on the cultural landscape, during drilling operations, would be temporary.

Mitigation that would reduce impacts to offsite cultural resources would be similar to those measures listed for “Geology and Soils” and includes Famcor’s SPCC Plan, berms, erosion control measures, and self-contained systems (see Tables 6, 7, and 8). There would be a low potential for migration of contaminants into the Unit; and if this were to occur, there would be ample time and space to respond to even a major release before there would be impacts on previously discovered cultural resources in the Unit. It is possible that undiscovered cultural resource sites exist in the Unit, but the mitigation measures discussed above are expected to confine potentially adverse impacts to the well sites. Therefore, adverse impacts to cultural resources in the Unit and outside the Unit are not expected from the development of the wells.

Cumulative Impacts: Vehicle uses, existing and future oil and gas operations in and outside the Unit, maintenance of transpark oil and gas pipelines, routine park operations, recreational activities including hunting in and outside the Units, and forestry operations adjacent to the Unit could impact cultural resources in the analysis area; however, compliance with the National Historic Preservation Act is anticipated to result in projects undertaken within the Unit having no adverse effect. Over time, cultural resources outside the Unit could be incrementally lost, with cumulative adverse impacts on cultural resources and traditional cultural practices in the region. An analysis of the cumulative effect of drilling and producing the up to 40 wells projected in the RFD scenario was performed in the Preserve’s *Oil and Gas Management Plan Environmental Impact Statement* (NPS, 2005), and up to moderate adverse impacts were identified from all actions that could affect cultural resources in the cumulative impacts analysis area. However, since no adverse impacts to cultural resources are expected inside or outside the Unit, the effects of this proposed action represent a negligible and short-term contribution to the overall cumulative impact of all actions in the region.

Conclusion: Because there would be no cultural resources affected in the Unit from in-park operations or connected actions; and there would similarly be only short-term, negligible effects to cultural resources in the project area on lands adjacent to the Big Sandy Creek Unit, the topic of cultural resources was dismissed from further analysis in this EA.

1.4.11 Climate Change Pollutants

On-going scientific research has identified the potential impacts of climate changing pollutants on global climate. These pollutants are commonly called “greenhouse gases” and include carbon dioxide, CO₂; methane; nitrous oxide; water vapor; and several trace gas emissions. Through complex interactions on a regional and global scale, these emissions cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although climate changing pollutant levels have varied for millennia (along with corresponding variations in climatic conditions), recent industrialization and burning of fossil carbon sources have caused CO₂ concentrations to increase dramatically, and are likely to contribute to overall climatic changes, typically referred to as global warming. Increasing CO₂ concentrations also lead to preferential fertilization and growth of specific plant species. Global mean surface temperatures have increased nearly 1.0°C (1.8°F) from 1890 to 2006 (GISS 2007). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern hemisphere. Figure 4 demonstrates that northern latitudes (above 24°N) have exhibited temperature increases of nearly 1.2°C (2.1°F) since 1900, with nearly a 1.0°C (1.8°F) increase since 1970.

Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of these “greenhouse gases” are likely to accelerate the rate of climate change. The Intergovernmental Panel on Climate Change (IPCC) has recently completed a comprehensive report assessing the current state of knowledge on climate change, its potential impacts, and options for adaptation and mitigation. In lieu of printing of this report, it is available on the IPCC web site (<http://www.ipcc.ch>). According to this report, global climate change may ultimately contribute to a rise in sea level, destruction of estuaries and coastal wetlands, and changes in regional temperature and rainfall patterns, with major implications to agricultural and coastal communities.

The IPCC has suggested that the average global surface temperature could rise 1 to 4.5 degrees Fahrenheit (°F) in the next 50 years, with significant regional variation. The National Academy of Sciences (2006) has confirmed these findings, but also indicated that there are uncertainties regarding how climate change may affect different regions.

Computer models indicate that such increases in temperature will not be equally distributed globally, but are likely to be accentuated at higher latitudes, such as in the Arctic, where the temperature increase may be more than double the global average. Also, warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. Vulnerabilities to climate change depend considerably on specific geographic and social contexts.

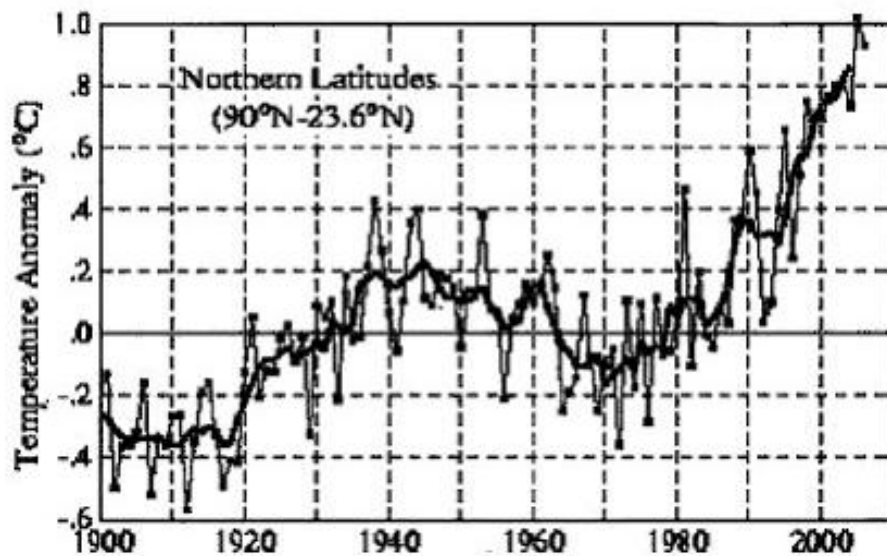


Figure 2. Annual Mean Temperature Change for Northern Latitudes (24-90°N)

Source: GISS (2007)

NPS recognizes the importance of climate change and the potential effects it may have on the natural environment. The drilling for oil and gas process may generate emissions of climate changing pollutants. The five proposed wells contemplated in this assessment would involve the use of vehicles to access operations locations; the use of combustion engines in earth-moving equipment to clear areas to construct oil and gas access roads and wellpads; and the use of combustion engines to drill the wells. Park operations and recreational activities that involve the use of combustion engines would also generate CO₂ and methane. Wind erosion from disturbed areas and fugitive dust from roads along with entrained atmospheric dust has the potential to darken glacial surfaces and snow packs resulting in faster snowmelt. Other activities may help sequester carbon, such as managing vegetation to favor perennial grasses and increase vegetative cover, which may help build organic carbon in soils and function as “carbon sinks”. Anticipated emissions from oil and gas operations as described above Section 1.4.6 are anticipated to be low.

The assessment of climate changing pollutant emissions and climate change is in its formative phase; therefore, it is not yet possible to know with confidence the net impact to climate. However, the Intergovernmental Panel on Climate Change (IPCC 2007) recently concluded that “warming of the climate system is unequivocal” and “most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic [man-made] greenhouse gas concentrations.” The lack of scientific tools designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts. Currently NPS does not have an established mechanism to accurately predict the effect of development activities in this assessment on global climate change (CCSP 2006). However, potential impacts to air quality due to climate change are likely to be varied. For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur due to increased windblown dust from drier and less stable soils.

Cool season plant species' spatial ranges are predicted to move north and to higher elevations, and extinction of endemic threatened/endangered plants may be accelerated. Due to loss of habitat, or due to competition from other species whose ranges may shift northward, the population of some animal species may be reduced. Less snow at lower elevations would be likely to impact the timing and quantity of snowmelt, which, in turn, could impact aquatic species.

Because of the low emissions anticipated from drilling the proposed wells, it is reasonably expected that the proposed action would not have more than a negligible effect on climate change, therefore, this topic was dismissed from further analysis in this assessment.

2.0 ALTERNATIVES

Two alternatives are described and evaluated in this EA, Alternative A, No Action, and Alternative B, Proposed Action, Application as Submitted. Alternatives considered but dismissed from further analysis are described and the reasons for dismissing them are given. Analyses for selecting the environmentally preferred alternative and the NPS preferred alternative are also provided.

2.1 Alternative A, No Action

The No Action Alternative is required under the National Environmental Policy Act (NEPA) and establishes a baseline for comparing the present management direction and environmental consequences of the action alternative. Under No Action, the two surface locations and five wells would not be developed.

2.2 Alternative B, Proposed Action, Application as Submitted

Under Alternative B, Famcor would directionally drill the wells as proposed in their application. Figures 2 and 3 show both wellpads and the 5 laterals in relation to the Unit boundary.

2.2.1 Locations of the Wells

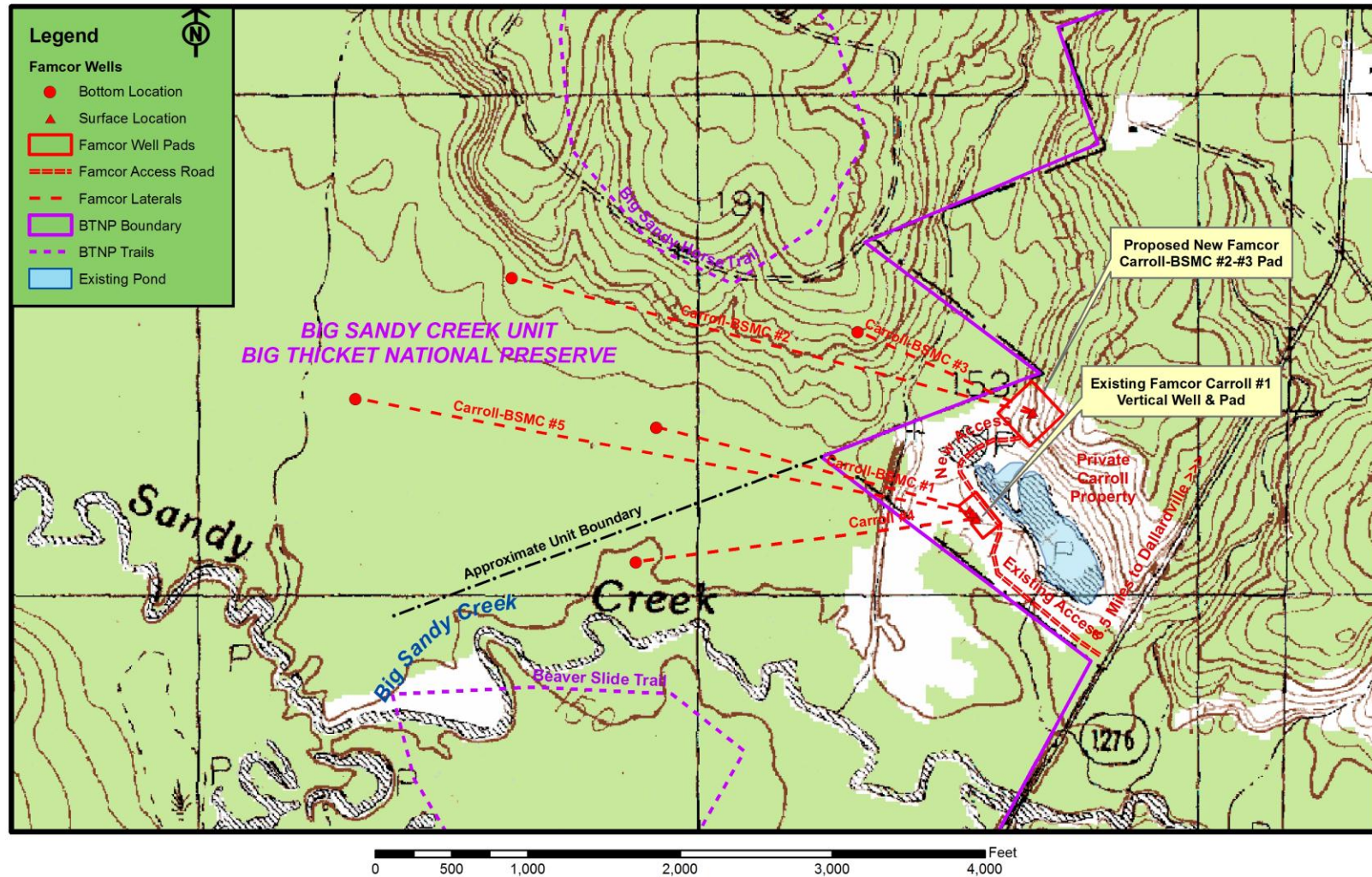
The surface and bottomhole locations for the wells are provided in Table 5, below (U.S. State Plane Coordinate System, NAD 27, Texas, Central Zone).

Table 5. Surface and Bottomhole Geographic Coordinates for the Five Wells

Well Name	Surface Location	Bottomhole Location
Carroll-BSMC #1	Y = 378,674.00 X = 3,793,374.00	Y = 379,077.00 X = 3,791,291.00
Carroll-BSMC #2	Y = 379,328.97 X = 3,793,735.01	Y = 379,996.00 X = 3,790,279.00
Carroll-BSMC #3	Y = 379,341.02 X = 3,793,747.01	Y = 379,790.00 X = 3,792,570.00
Carroll #4	Y = 378,613.93 X = 3,793,420.51	Y = 378,187.00 X = 3,791,214.00
Carroll-BSMC #5	Y = 378,651.10 X = 3,793,395.94	Y = 379,136.00 X = 3,789,307.00

Figure 3. Topographic Map Depicting Famcor's Carroll 2-3 and Carroll 1-4-5 and the Big Sandy Creek Unit.

**Proposed Famcor Oil, Inc. Carroll-BSMC #1, #2, #3, #5 and Carroll #4 Wells
On Private Property Adjacent to The Big Sandy Creek Unit, Big Thicket National Preserve
Mary Thomas League, A-75; Polk County, Texas**



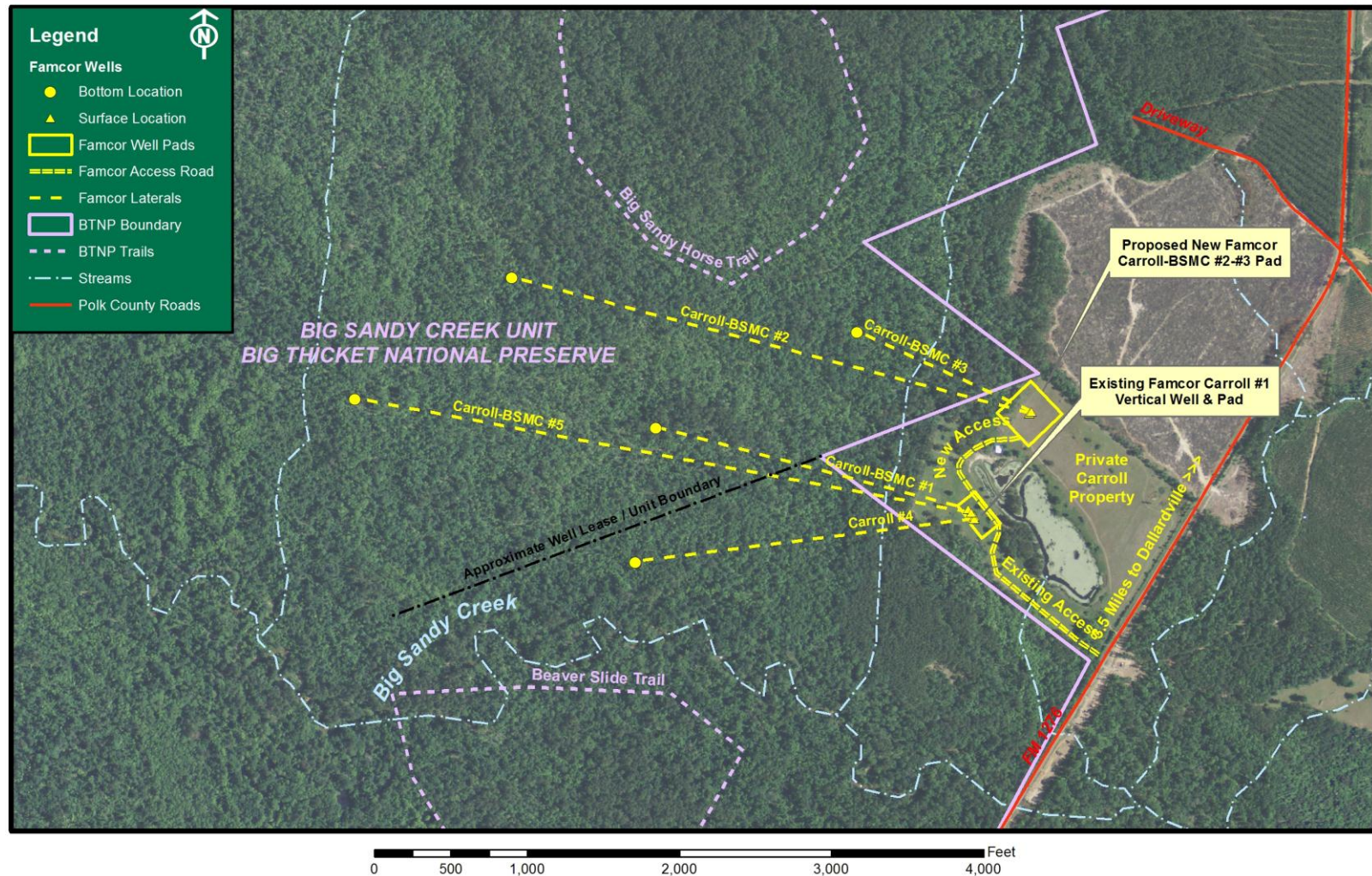
Raven Environmental Services, Inc.

SEGNO USGS 7.5' QUADRANGLE

Joe Hamrick, March 11, 2013 (10,150)

Figure 4. Aerial Image Map Depicting Famcor's Carroll 2-3 and Carroll 1-4-5 wells and the Big Sandy Creek Unit.

**Proposed Famcor Oil, Inc. Carroll-BSMC #1, #2, #3, #5 and Carroll #4 Wells
On Private Property Adjacent to The Big Sandy Creek Unit, Big Thicket National Preserve
Mary Thomas League, A-75; Polk County, Texas**



2.2.2 Access

Access to the Carroll 1-4-5 will be via the existing Carroll #1 Well access road from FM 1276. Access to the proposed Carroll 2-3 will require the construction of an additional 836 foot long by 30 foot wide section of access road (which will also accommodate the Carroll 2-3 flowline) that will connect to the existing Carroll #1 access road and FM 1276.

2.2.3 Wellpads

The proposed new Carroll 2-3 will require the construction of a 300 foot by 300 foot square wellpad that will occupy 2.06 acres. The wellpad would be mechanically cleared by heavy machinery. Gravel would be placed on the wellpad to stabilize the surface and provide work space necessary to drill the well. The northern corner of the wellpad would be sited approximately 10 feet south of the Unit boundary. The northwest corner of the wellpad would be 150 feet from the Unit boundary at the nearest point. A fresh-water well will be drilled on site. Construction of the Carroll 2-3 wellpad would not require fill into waters of the U.S. and, therefore, would not require a § 404 permit from the U.S. Army Corps of Engineers.

2.2.4 Drilling

For the Carroll 2-3 and 1-4-5, Famcor's proposed operations inside the Preserve would consist of drilling an 8 to 9 inch diameter hole through the Unit boundary at a TVD of between 2,000 and 3,080 feet (depending on the well), to target depths of about 5,100 TVD. The wells would then be completed and produced, or plugged and abandoned as a dry hole.

As per the Texas Commission on Environmental Quality, Groundwater Protection Determination, (0051-R Transition Form, Rev. 8/1/2011) for all five wells, the base of usable-quality water that must be protected is estimated to occur at a depth of 1,800 or 1,825 feet below the land surface. Moreover, the interval from the land surface to a depth of 425 or 450 feet, and the freshwater contained in the Jasper aquifer from a depth of 800 or 825 feet to 1,150 or 1,175 feet, must be isolated from the water in underlying and overlying beds.

The proposed drilling period is approximately 14 days and completion an additional 7 days per well. All drilling mud and cuttings would be contained in above-ground metal storage tanks as part of a closed loop system. Disposal of drilling fluids would occur offsite or downhole dependent on Famcor obtaining necessary permits and approval. The layout of the proposed drilling facilities is provided in Figures 6 and 7.

Proposed Road Access
And A

Proposed Surface Location
For The
"Famcor Oil, Inc.,
Carroll-BSMC & Carroll" Wells
In The
MARY THOMAS LEAGUE
Abstract 75
Polk County, Texas

NOTES:
ALL THE HORIZONTAL CONTROL REFERRED TO THE TEXAS STATE PLANE COORDINATE SYSTEM, LAMBERT PROJECTION, CENTRAL ZONE, NAD 27 DATUM. ALL BEARINGS, DISTANCES AND ACRES ARE GRID.

File name: 120415-3 CARROLL SURFACE.dwg **RBJ**
Plot date: 03/22/13 at 10:30
Polk County, Texas

Figure 6. Drilling Layout Plat for the Proposed Carroll 2-3 Wells.

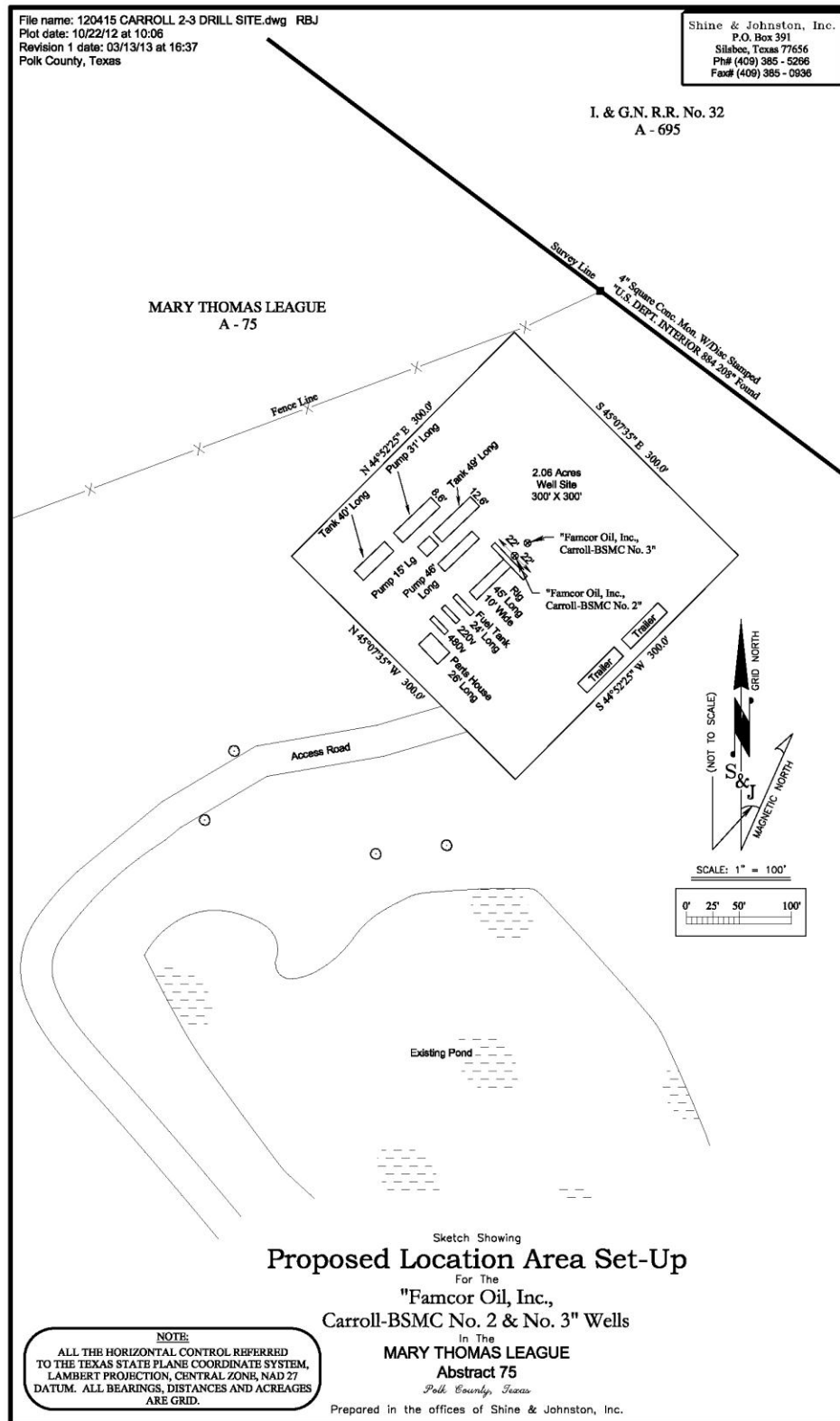
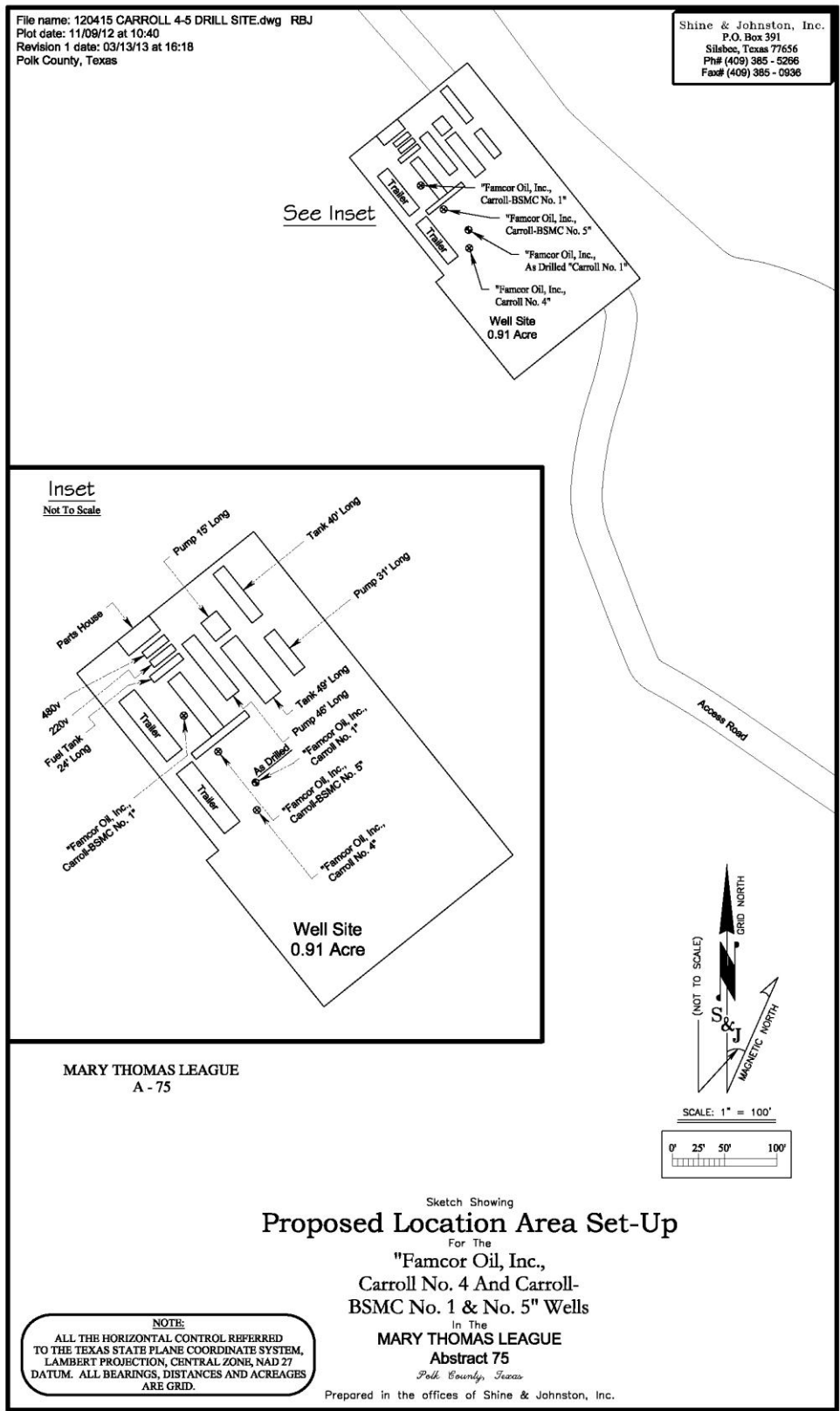


Figure 7. Drilling Layout Plat for the Proposed Carroll 1-4-5 Wells.



2.2.5. Flowlines

Should the Carroll 1-4-5 wells be successful, the existing flowline (constructed for the producing Carroll #1 well) would transport the natural gas to the existing sales point. Should the Carroll 2-3 wells be successful, an underground flowline would be constructed within the new 30 foot access road ROW. This flowline would be connected to the existing Carroll #1 flowline. The newly constructed flowline would be 3 inch diameter, wrapped and welded steel, and would be buried to a minimum depth of 3 feet below the surface.

2.2.6. Production Facilities

If oil and/or gas are discovered at the Carroll 2-3 wells and any proposed well is completed as a producer, production facilities would be constructed as necessary within the areas utilized to drill the wells. The production facility would be developed on the rock pad. Features could include the wellhead “christmas-tree” valve system, line heaters and separation devices, a glycol dehydration unit, a tank battery consisting of a water tank and two (minimum) condensate tanks, a series of flowlines connecting the onsite components, and a gas sales line and meter. The facility would be developed and maintained according to Famcor SPCC Plan and 40 CFR 112.7.

The tank battery would have an earthen fire wall (covered with rock to reduce erosion) surrounding the feature that provides secondary containment with a capacity of 1.5 times the capacity of the single largest tank. The approximate height of the firewall would be 2 feet. The off-load connection would have a safety drip device below it to catch any dripping fluid lost during hook-up and disconnection.

If oil and gas is discovered at the Carroll 1-4-5 wells and the proposed well is completed as a producer, production facilities would be constructed within the areas utilized to drill the wells. The production facility would be developed on the existing rock pad. Features could include the wellhead with a Christmas tree valve system, line heaters and separation devices, a glycol dehydration unit, a tank battery consisting of a water tank and two (minimum) condensate tanks, a series of flowlines connecting the components, and a gas sales line and meter. The facility would be developed and maintained according to Famcor’s SPCC Plan and 40 CFR 112.7. The tank battery would have an earthen firewall (covered with rock to reduce erosion) surrounding the feature that provides secondary containment with a capacity of 1.5 times the capacity of the single largest tank. The approximate height of the firewall would be 2 feet. The off-load connection would have a safety drip device below it to catch any dripping fluid lost during hook-up and disconnection.

All oil and water (storage) lines from the production facilities to the tanks would be buried at a depth of 1 foot below the surface. All oil and water (storage) lines from the production facility to the tanks would be buried at a depth of 1 foot below the surface. The layout of the proposed production facilities is provided in Figures 8 and 9.

Figure 8. Production Layout Plat for the Proposed Carroll 2-3.

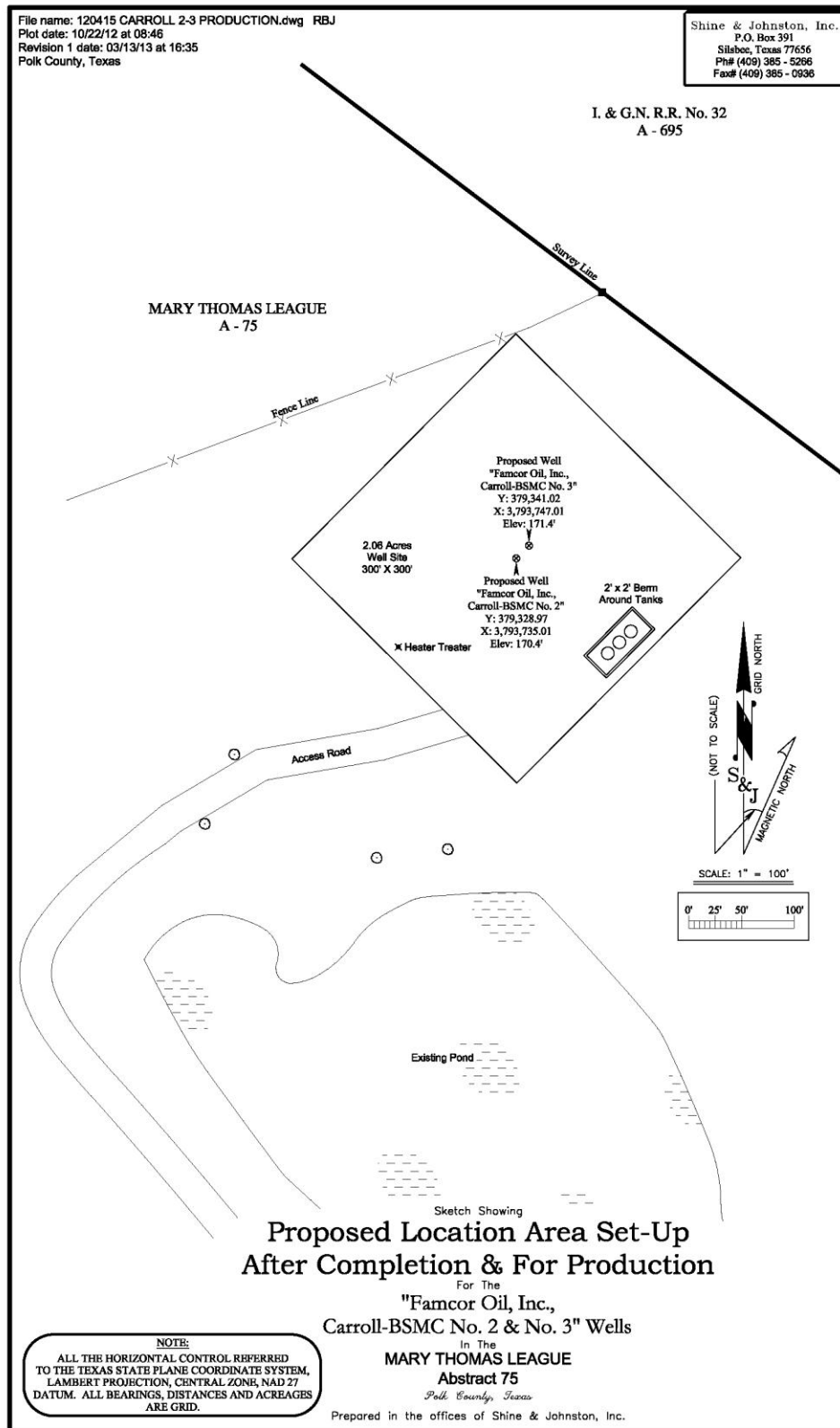
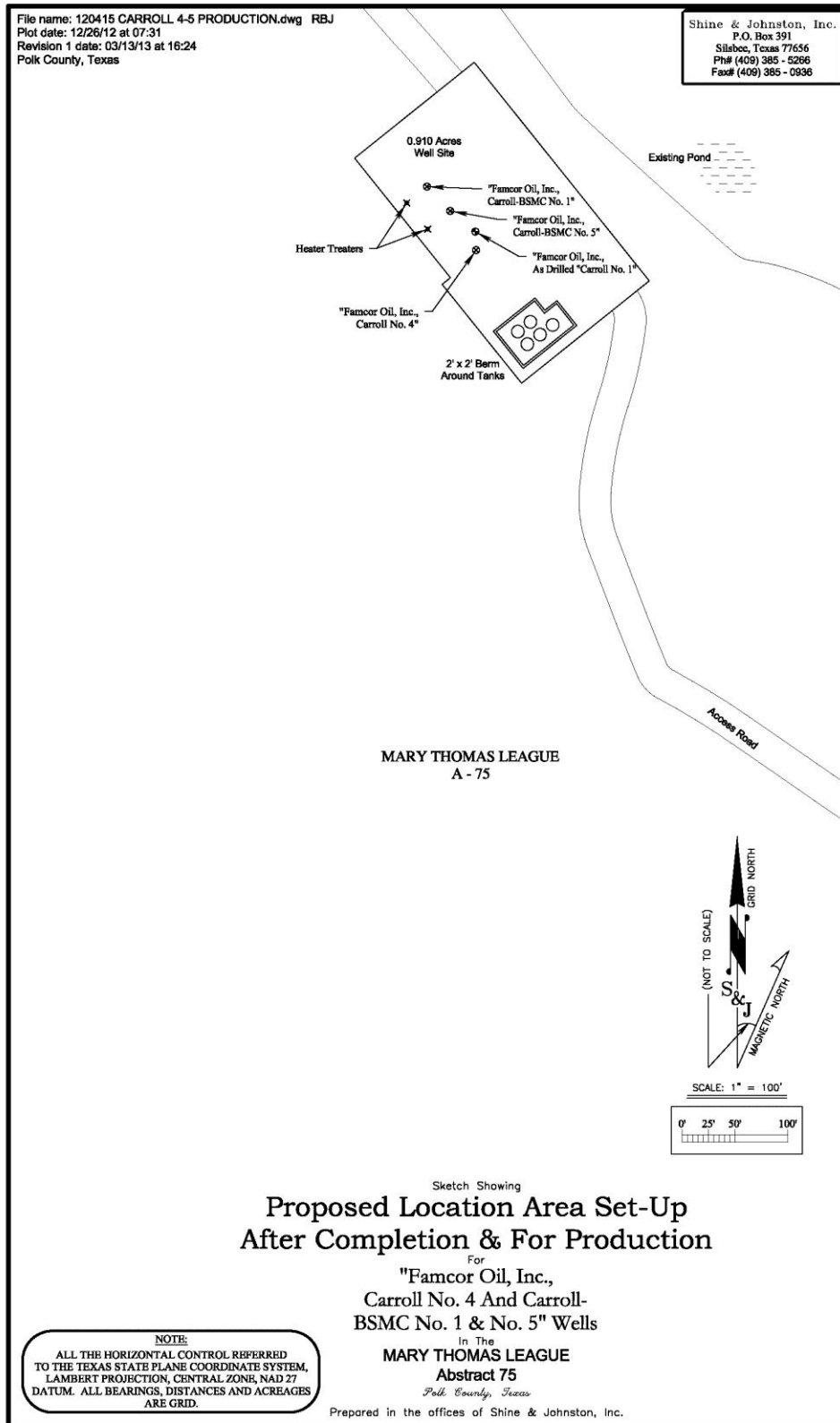


Figure 9. Production Layout Plat for the Proposed Carroll 1-4-5.



2.2.7 Reclamation Plans

For all wells and both wellpads, once drilling and completion operations are finished, or if the well is not productive, the portion of the drill site no longer needed would be reclaimed, and the washout/emergency and water pits would be filled with native soil in accordance with RRC Statewide Rule 8. Upon final abandonment, the equipment and all related materials would be removed, the area returned to its original contour, and the well plugged according to RRC Statewide Rules 13 and 14. The site would be reclaimed in conformance with the surface use agreement between the surface owner and Famcor. The disposal of excess drill fluids and water would occur off-site or downhole depending on Famcor obtaining the necessary permits and approvals.

2.2.8. Mitigation Measures

In order to reduce impacts on the human environment, Famcor has incorporated the following mitigation measures listed in Table 6 as part of their applications for the proposed operations. While many of the mitigation measures are required by other State and Federal requirements, the NPS does not have the regulatory authority per § 9.32(e) to require mitigation under option #1, Exemption without Mitigation.

Table 6. Mitigation Measures for all Wells Under the Proposed Action (Alternative B).

No.	Mitigation Measures - Proposed Action (Alternative B)	Resource(s) Protected	Reference in § 9.32(e) Application	Required or Voluntary
Project Planning and Site Construction				
1	Conduct an archeological “desktop” review of the proposed project area	archeological resources	Section 6	Voluntary
2	Prepare and comply with a Spill Prevention Control and Countermeasure (SPCC) Plan	all natural resources, and human health and safety	Section 6	EPA requirement as per 40 CFR, Chapter 1, Subchapter D, Part 112 – Oil Pollution Prevention
3	Site both wellpads, access roads, flowlines, pipelines and production facilities outside of the Big Sandy Creek Unit boundary.	all natural resources and values in Big Thicket National Preserve	Section 4, p.1; Section 6, p. 1; and Section 7, p. 1	Required to qualify for NPS exemption under 36 CFR § 9.32(e)
4	Use existing openings to the extent possible and use existing roads to minimize construction of access road	soils, water resources, floodplains, wetlands, vegetation	Section 6, pp. 1 & 2	Voluntary

No.	Mitigation Measures - Proposed Action (Alternative B)	Resource(s) Protected	Reference in § 9.32(e) Application	Required or Voluntary
5	Schedule construction to avoid rain events	soils, vegetation	Section 7, p. 1	Voluntary
6	Construct ditch and 2-foot' high ring levee around the wellpads	water resources, vegetation, soils	Section 4, page 6	Voluntary
7	Construct 40-foot x 100-foot washout/emergency pit and line with 12-mil plastic	water resources, soils, vegetation	Section 4, page 1	Construction, design and maintenance of pit in conformance with RRC Statewide Rule 8, liner would be voluntary
Well Drilling				
8	Directionally drill wells so that wellbore intercepts useable quality groundwater outside of the Preserve	groundwater in Preserve	Section 4, drilling diagram	Required to qualify for NPS exemption with no mitigation measures
9	Use a closed-loop containerized mud system	water resources, soils, vegetation	Section 4, pp. 1-2	Voluntary
10	Set surface casing according to State of Texas RRC requirements	groundwater	Section 4, pp. 3 and 4	RRC requirement as per Statewide Rule 13(b)(2)
11	Dispose of drilling mud and well cuttings off-site or downhole	all natural resources located on and adjacent to wellpads	Section 4, pp 1-2	Disposal in accordance with RRC Statewide Rule 8
Production				
12	Reduce size of wellpads after drilling completion and fill in washout/emergency and water pits with native soil in accordance with Statewide Rule 8	soils, vegetation, water resources	Section 4, p. 2	Reduction in wellpad size voluntary, fill in washout/emergency and water pits required by RRC Statewide Rule 8(d)(4)(G)
13	Construct a 2-foot earthen, rock covered firewall around the tank battery with a capacity 1.5 times the largest tank	water resources, soils, vegetation	Section 4, p. 2	EPA requirement as per 40 CFR, Chapter 1, Subchapter D, Part 112.9(c)(2) to construct secondary containment capable of holding the volume of largest tank plus sufficient freeboard to contain precipitation, voluntary to build capacity for holding 1.5 times volume of largest tank

No.	Mitigation Measures - Proposed Action (Alternative B)	Resource(s) Protected	Reference in § 9.32(e) Application	Required or Voluntary
14	Install a safety drip device on the off-load connection	soils	Section 4, p. 2	Voluntary
15	Use mulching, seeding, silt fences, and hay bales	water resources, soils	Section 7, p.1	Voluntary
16	Wind-erosion preventive measures will include watering if dust conditions are determined to be detrimental during construction	air quality, vegetation, water resources	Section 7, p. 1	Voluntary
17	Notify regulatory authorities and Big Thicket Superintendent within 24 hours in the event of a release or spill of hydrocarbon condensate, crude oil, or other contaminating substance exceeding five barrels	all natural resources	Section 4, p. 3	RRC requirement to report well blowout/well control problems or spills exceeding 5 barrels as per Statewide Rules 20 and 91(e), in the event of any condensate spill, operator must consult with RRC as per Statewide Rule 91(b) and any spills of crude oil into water must be reported to the RRC as per Statewide Rule 91(e)(3), spills of other contaminating substances may require reporting to the TCEQ or EPA under a variety of laws and regulations depending on the substance released, the amount, whether or not the release was into soil, water or air, whether the release was ongoing, etc., notification to NPS voluntary
18	Install sound buffers / barriers around noise emitting production equipment if any well is successful and requires such equipment (e.g. compressor)	natural soundscape		Voluntary
Well Plugging				

No.	Mitigation Measures - Proposed Action (Alternative B)	Resource(s) Protected	Reference in § 9.32(e) Application	Required or Voluntary
19	Consult RRC district office regarding well plugging, plug well to isolate each productive horizon and usable water quality strata according to RRC Statewide Rules 13 and 14 and Bureau of Land Management Onshore Oil and Gas Order No. 2, § III.G., Drilling Abandonment Requirements	all natural resources	Section 4, pp. 2 and 4	RRC requirement as per Statewide Rule 14, compliance with Onshore Oil and Gas Order No. 2 voluntary
Reclamation				
20	If wells not produced, equipment and related materials would be removed and the area would be restored to original contours and/or as agreed to with the surface owner.	all natural resources	Section 4, p. 2	RRC requirements as per Statewide Rule 14(d)(12), this section of the Statewide Rules requires an operator to "contour the location to discourage pooling of surface water at or around the facility site," restoration of original contour voluntary
21	Reclamation in conformance with the Land Entry Permit or surface agreement between surface owner and Famcor	all natural resources	Section 4, p. 2	RRC requirements as per Statewide Rule 14(d)(12), required by landowner as per surface use agreement

2.3 Alternatives Considered but Dismissed from Further Analysis

During the scoping process, alternative locations were considered for siting the wells. These alternative locations were discussed in consultation with Famcor, Raven Environmental Services, Inc. (Famcor's contracted consultant), and NPS staff at the Preserve, Regional and Washington Offices. NPS acquisition of the mineral rights that are part of Famcor's proposals was also considered. For the reasons described below, these alternatives were dismissed from further analysis.

2.3.1 Locate the Wells inside the Preserve

Drilling five vertical wells from surface locations inside the Unit directly over the bottomhole targets was considered. Also considered were directional wells from surface locations within the Unit. This alternative would have entailed access into the Unit and approved plans of operations. There are no existing roads inside the Unit near the

locations considered; therefore, new access roads would have been needed. Access through the Unit would have required crossing and potential development in wetlands and floodplains. Although drilling wells from inside the Unit is technically feasible, this alternative was judged to be unreasonable in terms of economics, logistics, degree of environmental impact, and time required to implement the proposals. Alternative locations for siting the wells within the Unit were dismissed from further analysis because they would not meet the objectives as well as those being evaluated in detail.

2.3.2 NPS Acquisition of the Mineral Rights that are Part of Famcor's Proposal

In the event that a proposed operation cannot be sufficiently modified to prevent the impairment of park resources and values, the NPS may seek to extinguish the associated mineral right through acquisition, subject to the appropriation of funds from Congress. With respect to Famcor's directional drilling proposals, mitigation measures were identified and applied, most notably directional drilling from surface locations outside the Preserve. These mitigation measures substantially reduced the potential for adverse impacts to the Unit's resources and values, visitor use and experience, and public health and safety. As a result, the acquisition of mineral rights was dismissed from further consideration in this EA.

2.4 Environmentally Preferred Alternative

According to the CEQ regulations implementing NEPA (43 CFR 46.30), the environmentally preferable alternative is the alternative "that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative."

The environmentally preferred alternative for drilling and producing a directional well is based on these national environmental policy goals. Under Alternative A, No Action, the wells would not be drilled. Because there would be no new impacts, Alternative A would provide the greatest protection of the area and Unit resources and values, thereby making it the environmentally preferable alternative.

Famcor's Proposal, Alternative B, would have greater effects on the environment because of the drilling and production activities. Although mitigating measures would reduce effects to Unit resources and values, there would still be effects, and, therefore, this alternative would not meet the Park Service's environmental policy goals as well as the No Action Alternative.

2.5 National Park Service Preferred Alternative

The environmentally preferable alternative is Alternative A because it surpasses Alternative B in realizing the full range of national environmental policy goals as stated in

CEQ regulations implementing NEPA (43 CFR 46.30). However, the NPS preferred alternative is Alternative B, Proposed Action, because Famcor holds valid oil and gas lease rights which if developed, would not result in major impacts or an impairment of park resources and values. The NPS believes this alternative would fulfill its park protection mandates while allowing Famcor to exercise their property right interests.

2.6 Summary of Alternatives

The following table assesses the extent to which each alternative meets objectives in taking action.

Table 7. Extent that Each Alternative Meets Objectives

Objectives	Does Alternative A, No-Action, Meet Objective?	Does Alternative B, Proposed Action, Meet Objective?
Avoid or minimize impacts on the Unit's resources and values, visitor use and experience, and human health and safety.	Yes Without drilling the wells, there would be no impacts.	Yes Directional drill from location outside Preserve would avoid or minimize impacts.
Prevent impairment of the Unit's resources and values.	Yes Without drilling the wells, there would be no potential for the Unit's resources and values to be impaired.	Yes Directional drilling below usable quality groundwater within the Units would result in no impairment of the Unit's resources and values.
Provide Famcor, as the lessee of nonfederal oil and gas mineral interests, access to explore for and develop oil and gas resources in a manner which will assure the natural and ecological integrity of the Preserve.	No¹ The wells would not be drilled, precluding Famcor access to develop their nonfederal oil and gas mineral interests.	Yes Famcor would be issued a § 9.32(e) exemption, enabling them to drill and produce the wells.

¹NoAction Alternative is required under NEPA to describe baseline conditions. It is acceptable for the no-action alternative to not meet all of the planning objectives.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Methodology

Based on project scoping and expected impacts, it was determined that the following topics in Table 8 would be carried forward for analysis:

Table 8. Summary of Impacts

Impact Topic	Alternative A No-Action	Alternative B Proposed Action
Natural Soundscapes in and outside the Unit	Under Alternative A, No-Action, the five wells would not be drilled; therefore, there would be no new impacts on the natural soundscape in the Unit. Cumulative impacts on the natural soundscape in and contiguous to the Unit from recreational activities in and outside the Unit, park management functions within the Unit, oil and gas activities in and outside the Unit, and timber management activities adjacent to the Unit boundaries, would result in long-term but intermittent, negligible to moderate, adverse impacts, localized near sources.	Under Alternative B, Proposed Action, cumulative impacts on the natural soundscape in the Unit would be similar to those described under No Action, with vehicle uses, existing and future oil and gas operations in and outside the Unit, maintenance of transpark oil and gas pipelines, routine park operations, recreational activities including hunting in and outside the Unit, and forestry operations adjacent to the Unit. The impacts from these sources, added to the intermittent, short-term, negligible to moderate, adverse impacts from the operations, would result in localized, short- to long-term, negligible to moderate, adverse cumulative impacts to natural soundscapes in the analysis area.
Air Resources in and outside the Unit	Under Alternative A, No-Action, the five wells would not be drilled; therefore, there would be no new impacts on air quality in or outside the Unit. Cumulative impacts on air quality in and contiguous to the Unit from recreational activities in and outside the Unit, park management functions within the Unit, prescribed fires, oil and gas activities in and outside the Unit, timber management activities adjacent to the Unit boundaries, and regional urbanization and industrial sources would result in long-term, minor to moderate, adverse impacts to air quality in the vicinity of the wells.	Under Alternative B, the five wells would be drilled and possibly completed to produce hydrocarbons. Construction of the access roads, flowlines, wellpads; drilling and producing the wells; and eventual plugging and reclamation activities would result in adverse impacts ranging from short- to long-term, and negligible to moderate, with intensities greatest close to the sources. The greatest impacts (moderate effects) would occur during the short-term (but continuous) drilling periods, which are expected to last up to 21 days per well (drilling – 14 days; completion – 7 days). Construction and plugging/reclamation would result in short-term, negligible to minor effects due mainly from use of heavy equipment and vehicles. Production impacts would be considered long-term and minor, due to the continued emissions from ongoing operations and occasional workovers. There would be no impacts on air quality from in-park operations. Cumulative impacts would be similar to

Impact Topic	Alternative A No-Action	Alternative B Proposed Action
		those described under No Action, with long-term, widespread, minor to moderate, adverse impacts.
Lightscapes and Night Sky in and outside the Unit	Under Alternative A, No Action, the five wells would not be drilled, resulting in no new impacts to lightscapes or night sky. Cumulative impacts to lightscapes could occur as a result of development of adjacent properties, oil and gas activities in and outside the Unit, and timber management activities adjacent to the Unit, and are expected to result in long-term, localized to widespread, negligible to moderate, adverse impacts.	Under Alternative B, Proposed Action, the five wells would be drilled and possibly completed to produce hydrocarbons. Construction of the access road, flowline, wellpads; drilling and producing the wells; and eventual plugging and reclamation activities would result in adverse impacts ranging from short- to long-term, and negligible to moderate. Elevated light levels would be greatest during the estimated maximum of 21 days for the drilling and completion phases of each well and localized from the lighting of the drill rig for 24-hour operations, resulting in moderate short-term adverse impacts. Construction and maintenance of the access road, wellpad, and flowline; and plugging and reclamation could result in localized, short-term, negligible impacts from increases in artificial light associated with vehicle traffic and heavy equipment. Production impacts could be long-term but negligible to minor from lighting used for on-going operations and during workovers. There would be no effect from in-park operations. Cumulative effects to Lightscapes/Night Sky are expected to be long-term, localized to widespread, negligible to moderate, and adverse.
Wildlife in and outside the Unit	Under Alternative A, No Action, the five wells would not be drilled, resulting in no new impacts to wildlife in or outside the Units. Cumulative impacts to wildlife could occur as a result of development of adjacent lands, oil and gas activities in and outside the Unit, and timber management activities adjacent to the Unit and are expected to result in long-term, localized to widespread, minor and adverse impacts.	Under Alternative B, Proposed Action, the wells would be drilled and may be produced. Construction of the access road, flowline, wellpad; drilling and producing the wells; and eventual plugging and reclamation activities would result in adverse impacts ranging from short- to long-term, and negligible to moderate on wildlife in and outside the Unit, with more intense impacts localized around the wellpad locations. Construction of the wellpad, access, and flowline would remove relatively low quality wildlife habitat (pasture and a small forested area) from use until reclamation occurred, a long-term, minor, adverse impact. Construction and plugging/reclamation activities would cause

Impact Topic	Alternative A No-Action	Alternative B Proposed Action
		<p>localized and short-term increases in artificial noise and light associated with vehicle traffic and heavy equipment, resulting in short-term, negligible to minor adverse impacts. The greatest impacts (moderate effects) would occur during the short-term (but continuous) drilling periods, which are expected to last up to 21 days per well. Production impacts would be short- to long-term and minor due to the ongoing disturbance at the sites and occasional workovers. There would be no impacts to wildlife from in-park operations. Cumulative effects to wildlife are expected to be long-term, localized to widespread, negligible to moderate, and adverse.</p>
<p>Visitor experience, aesthetic resources in and outside the Unit</p>	<p>Under Alternative A, No Action, the five wells would not be drilled, resulting in no new impacts to visitor experience or aesthetic resources. Cumulative impacts to visitor experience and aesthetics could occur as a result of development of adjacent properties, oil and gas activities outside the Unit, and timber management activities adjacent to the Unit, and are expected to result in long-term, localized to widespread, negligible to moderate, adverse impacts.</p>	<p>Under Alternative B, Proposed Action, the five wells would be drilled and possibly completed to produce hydrocarbons. Construction of the access road, flowline, wellpads; drilling and producing the wells; and eventual plugging and reclamation activities would result in adverse impacts ranging from short- to long-term, and negligible to moderate. Elevated noise levels and light levels would be greatest during the estimated maximum of 21 days for the drilling and completion phases of each well and localized from the drilling noise and lighting of the rig for 24-hour operations, resulting in moderate short-term adverse impacts. Construction and maintenance of the access road, wellpad, and flowline; and plugging and reclamation could result in localized, short-term, negligible impacts from increases in noise and artificial light associated with vehicle traffic and heavy equipment. Production impacts could be long-term but negligible to minor from noise emitted and lighting used for on-going operations and during workovers. There would be no effect from in-park operations. Cumulative effects to visitors experience and aesthetics are expected to be long-term, localized to widespread, negligible to moderate, and adverse.</p>
<p>Adjacent Landowners, Resources and Uses</p>	<p>Under Alternative A, No-Action, the wells would not be drilled; therefore, there would be no new impacts on adjacent land uses and resources outside the Unit. It is expected that existing and</p>	<p>Under Alternative B, Proposed Action, the five wells would be drilled and may be produced. Construction of the Carroll 2-3 access road, flowline, wellpad; drilling and producing all of the wells; and eventual</p>

Impact Topic	Alternative A No-Action	Alternative B Proposed Action
	reasonably foreseeable uses in the analysis area would continue with short to long-term, negligible to moderate, adverse cumulative impacts on geology and soils and vegetation for the Carroll 2-3 wellpad, access road and flowline.	plugging and reclamation activities would result in adverse impacts ranging from short to long-term, and negligible to moderate on adjacent landowners, resources and uses outside the Unit. The effects on geology and soils and vegetation on adjacent lands are expected to be confined to the direct area of impact by the application of mitigation measures at each site. Therefore, the adverse impacts on these adjacent resources are expected to be localized and minor, with long-term impacts during production and lasting until site reclamation restores soils and vegetation cover. There would be no impacts on soils or vegetation from in-park oil and gas operations. Cumulative impacts to these adjacent resources and uses would continue, with long-term, localized, negligible to moderate, adverse cumulative impacts to soils and vegetation outside the Unit.

This section is organized by impact topic. Under each impact topic, the affected environment is described, the methodology for assessing impacts is presented, the impacts under each alternative are described, a cumulative impact analysis is provided, and a conclusion is stated. The conclusion section summarizes all major findings. Impairment analyses are found in Appendix A and are performed only for park resources and values.

This section describes direct, indirect, and cumulative impacts under the two alternatives. Impacts are described in terms of context and duration. The context or extent of the impact may be localized (generally, the footprint for access roads, wellpads, and flowlines, including immediately adjacent lands) or widespread (affecting other areas of the Preserve and/or the project area). The duration of impacts could be short-term, ranging from days to three years in duration, or long-term, extending up to 20 years or longer. Generally, short-term impacts would apply to construction activities and long-term impacts would apply to roads, production operations, and flowlines. The intensity and type of impact is described as negligible, minor, moderate, or major, and as beneficial or adverse. Impact intensity threshold definitions are provided for negligible, minor, moderate and major. Where the intensity of an impact can be described quantitatively, numerical data are presented. However, most impact analyses are qualitative.

The impact analysis under the action alternative (Alternative B, Proposed Action) for each Preserve resource or value describes “in-park operations” and “connected actions.” The analysis of impacts from in-park operations contains the analysis and documentation required under § 9.32(e). The analysis of impacts from connected

actions satisfies a broader NEPA requirement to assess impacts on the human environment.

- In-park Operations would consist of the wellbores crossing into the Unit at substantial depths so as to not cross usable quality groundwater to reach bottomhole targets beneath the Units to extract hydrocarbons and other associated fluids from beneath the Units.
- Connected Actions would consist of activities associated with access road maintenance; construction and maintenance of the wellpad, production facilities and flowline, drilling and completion, hydrocarbon production and transportation and well plugging and surface reclamation outside the Unit.

To clearly describe the potential impacts under the action alternative (Alternative B, Proposed Action), the impact analysis for connected actions is organized under the following headings:

- Construction and upgrading involves the initial construction of access roads (if there is no existing access) and wellpads to drill the wells.
- Drilling involves drilling the wells.
- Production involves the development of production facilities and producing the wells in addition to construction and operation of flowlines to transport products to market.
- Plugging/Reclamation involves plugging the wells and reclaiming the areas that were developed as per agreements with the landowners.

3.2 Cumulative Impacts

This section also assesses cumulative impacts. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7).

The following descriptions of park development and operations, and adjacent land uses provide the basis for analyzing cumulative impacts in this EA. These descriptions should be used in conjunction with the discussion under the "Socioeconomics" discussion in Section 3 of this EA that describes past, present, and reasonably foreseeable oil and gas development in the analysis area.

Park Development and Operations. Park developments that support visitor uses in the Big Sandy Creek Unit include three day use areas, one birding hot spot area, and three hiking trails. These developments are located along the western edge and bottom two-thirds of the Unit. The Big Sandy Creek Horse and Bike Trail is approximately 0.3 miles from the two Carroll wellpads and the Beaver Slide Trail is about 0.47 miles distant at the nearest point. The parking and picnic area for the Horse and Bike Trail is about 3.25 miles from the Carroll 2-3, and the Woodlands Trail parking and picnic area, located in the northernmost end of the BSC Unit is 7.4 miles distant.

There are several fire monitoring/long-term monitoring plots located in the Big Sandy Creek Unit approximately 0.5 mile west of the proposed Carroll wells. The monitoring plots typically measure 10 x 10 meters. Monitoring plots are maintained by the Preserve to monitor and gauge the effects of prescribed fire, and to study how Big Thicket vegetation responds to a variety of ecological processes such as forest succession, non-native species invasion, and response to disturbances such as hurricanes, tornados and global climate change.

Park management functions in the Big Sandy Creek Unit include prescribed fire and facility management of visitor use developments. Prescribed fire is used to maintain the natural environment and manage hazardous fuels in high-risk areas. Particulate matter is the primary pollutant of forest fires (Komarek, 1970) and can affect visibility and public health. As many as nine prescribed burns have been completed in compartments west and northwest of the proposed Carroll wells. These prescribed burns took place from 1983 to 2012 with an average return interval of approximately 3 years.

Adjacent Land Uses. Of the land uses immediately adjacent to the Preserve, commercial and private forestry account for approximately 95 percent of the land area. Additional uses related to timberlands include encroachment onto Preserve lands, public safety concerns regarding hunting clubs on adjacent timberlands, and public use of timber company roads to access the Preserve (Harcombe and Callaway, 1997).

Residential development on lands adjacent to the Preserve is generally rural. Cumulative adjacent uses near Big Sandy Creek include: the community of Livingston and proposed water quality projects in this community; farming and grazing operations on ownerships adjacent to the Preserve; and possible development on the Alabama Coushatta Reservation north of Big Sandy.

Visitor Uses and Developments. Approximately 107,305 visitors came to the Preserve in 2009. (NPS Public Use Statistics Office, 2009) Spring and fall are the primary visitor use seasons. High temperatures limit visitor use during the summer. In creating the Preserve, Congress limited the construction of roads, vehicular campgrounds, employee housing, and other public and administrative facilities in the interest of maintaining the ecological integrity of the Preserve. Therefore, development is limited. There are 26 day-use areas located in 9 Units, 9 hiking trails in 5 Units, 4 canoe routes, and 8 birding hot spots. Hunting is allowed during specific seasons in a total of about 47,400 acres in the Beaumont, Beech Creek, Big Sandy Creek, Lance Rosier, and Neches Bottom and Jack Gore Baygall Units. Trapping is permitted in a total of about 35,000 acres in the Beaumont, Lance Rosier, and Neches Bottom and Jack Gore Baygall Units. Backcountry camping is light (approximately 1,315 overnight stays per year over the last seven years), and must be conducted in designated areas. In addition to visitor uses and developments, there are 3 cemeteries and two inholding homesites located in the Preserve.

3.3 Impacts on Natural Soundscape in and outside the Big Sandy Creek Unit

Background

The natural soundscape is defined as the aggregate of all natural sounds that occur in parks, absent human-caused noise, together with the physical capacity for transmitting the natural sounds (NPS *Management Policies* 2006). It includes all of the sounds of nature, including such “non-quiet” sounds as birds calling, waterfalls, thunder, and waves breaking against the shore. Some natural sounds are also part of the biological or other physical resource components of parks (e.g., noise and sounds made by natural processes such as wind in trees, thunder, running water). It is important to distinguish between the intrinsic value of the soundscape as part of wildlife habitat, as part of cultural (i.e., historic, ethnographic) resource.

In accordance with soundscape policy from NPS mandates, the NPS will preserve to the greatest extent possible, natural soundscapes. Natural sounds occur within and beyond the range of sounds that humans can perceive, and can be transmitted through water, air or solid material. The NPS will restore degraded soundscapes to the natural condition wherever possible, and will protect natural soundscapes from degradation due to noise or inappropriate noise.

Inappropriate sound can adversely impact wildlife in a variety of ways by interfering with or masking sounds important for animal communication, including territory establishment, courtship, nurturing, predation, avoiding predators, migration, and foraging functions. When noise interferes with hearing natural sounds, the noise is said to mask the natural sounds, and this affects the extent of the listening area. Listening area can be defined as the area in which an organism can hear sounds, i.e. the area in which an owl can hear a mouse scurrying across a forest floor. For example, if the ambient sound pressure level is 30dB, and a noise source raises the ambient to 33dB (a 3dB increase), the listening area or auditory horizon for humans (and many birds and mammals) would be reduced by 50%. Increasing the ambient sound pressure level and additional 3dB (to 36dB) would reduce the listening area by half again, to 25% of the initial area.

Certain types and levels of noise can cause animals to use avoidance mechanisms. Avoidance, initiated as it may be by annoyance or stress, can cause individual animals to alter normal behavior, move to less preferred habitats, and to unduly use energy during critical times of the year.

Inappropriate noise can adversely impact park visitor experiences. Managing parks for “visitor experience” provides the opportunity for visitors to enjoy a park's resources and values in a manner appropriate to the park's purpose and significance, and supports the Park's resource protection goals. Visitors usually have expectations about the experience being offered in National Park System units. The impacts of inappropriate noise on visitor experience can be especially evident when visitor expectations include solitude, serenity, tranquility, contemplation, or a completely natural or historic environment. Many visitors have great expectations for national parks in this regard, since daily life for many people consists of high and constant levels of noise in urban/suburban settings.

Another value that can be adversely impacted by noise is any resource, location, or structure having cultural, historic, or religious significance. In the same way that visitor experience or natural resources can be affected, cultural, historic or religious sites are

impacted by noise out of character for the resource. Maintaining the context also benefits the visitor who wishes to engage in and appreciate these resources.

Guiding Laws, Regulations and Policies

Certain types and levels of noise can cause animals to use avoidance mechanisms. Avoidance, initiated as it may be by annoyance or stress, can cause individual animals to alter normal behavior, move to less preferred habitats, and to unduly use energy during critical times of the year.

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Another value that can be adversely impacted by noise is any resource, location, or structure having cultural, historic, or religious significance. In the same way that visitor experience or natural resources can be affected, cultural, historic or religious sites are impacted by noise out of character for the resource. Maintaining the context also benefits the visitor who wishes to engage in and appreciate these resources.

Affected Environment

The Preserve is crossed by, or adjacent to, many roads, pipelines and power lines of varying size. The lands adjacent to the Preserve are mostly commercial timberlands, but residences and some commercial development are also located near the Preserve boundary. There are also a few residences inside the boundary or surrounded by NPS lands. Improvements inside the Preserve related to visitor experience are limited, for the most part, to trails, parking and picnic areas, information kiosks and boat ramps. There are two cemeteries located within the Preserve boundary or surrounded by Preserve lands. Hunting and trapping are allowed within some Units of the Preserve. Improvements related to Preserve administration within the Preserve consist of seasonal employee housing and several radio tower installations. The main visitor contact and administrative facilities are outside of the Preserve proper due to a recent boundary expansion. They are adjacent to the Big Sandy Creek Corridor Unit. Preserve management involves the use of on and off-road vehicles, boats, aircraft, heavy equipment and prescribed fire, and potentially involves firearms. Several oil and gas production facilities exist within the Preserve, and many more are located just outside the boundary.

A reasonable amount of noise from the proposed operations is considered to be appropriate to the operations area, as the exercise of nonfederal mineral rights is provided for in the enabling legislation of the Preserve. Following the Preserve's *General*

Management Plan (1980), areas within the Unit boundaries that could be affected by elevated noise generated by the proposed drilling and production of the directional wells would be part of the exploration/mining subzone for the duration of operations. Park managers recognize that soundscapes in the exploration/mining subzone could be affected by continuous noise during drilling operations and well production.

The primary reason for the discussion of noise impacts is the potential effects of noise on visitor use and experience and wildlife. A study of the desired experiences of Preserve visitors determined that the desire to “escape the crowd/noise” was very important. (Gulley, 1999)

Sources of noise within the Preserve are generally localized and/or seasonal in duration and include maintenance vehicles and equipment, firearms (during hunting season), hikers, and other visitors. Noise in surrounding areas includes trucks and automobiles, aircraft, boat motors, motorcycles, all-terrain vehicles, various types of equipment (e.g., tractors, log skidders and feller bunchers, chainsaws, lawn mowers, oil and gas separation and treatment vessels, compressors, etc.), power lines/transformers and firearms.

Sound levels are measured in decibels (dB), and most noise levels are weighted based on thresholds of human hearing (dBA). L90 is a percentile representing the sound level where sounds exceed the value 90% of the time. This number is usually considered to be analogous to the natural ambient sound level. The natural ambient is the sound level generated only by natural sound sources in the absence of human caused noise. According to NPS Management Policies, “the natural ambient sound level- that is, the environment of sound that exists in the absence of human-caused noise- is the baseline condition, and the standard against which current conditions in a soundscape will be measured and evaluated.”

The natural soundscape of the Preserve was studied in the spring of 1998 by Foch (1999) to determine ambient sound levels. Sound levels were measured at 11 locations Preserve-wide during this study, and both short and long-term data were collected. The specific natural ambient of the Beech Creek Unit was measured by the NPS Natural Sounds Program in March 2009. Long-term sound level data (taken in one location for 28 days) were collected in the Beech Creek Unit of the Preserve in March 2009 in an area that would be representative of the less developed areas surrounding the proposed well locations. The range of sound levels for the time period that long-term data was collected (March 20, 2009 – April 17, 2009) was between 25.0 and 43.5 dBA, 80% of the time (NPS 2010). The NPS is using the data collected in the Beech Creek Unit for this analysis because the vegetative and topographical composition of the Beech Creek Unit and the Big Sandy Creek Unit is relatively similar. Figure 9 compares sound levels recorded in various Units in the Preserve by the 1999 Foch study with other common sounds.

Figure 9. Sound Level Comparison Chart*

Equivalent Sounds	Decibels	Sound Levels at Various Locations in the BTNP
Large caliber rifles	140-160	
.22 caliber weapon	130-140	
Air compressor @ 20 ft. Garbage trucks and city buses Power Lawnmower	100	
Diesel truck @ 25 ft.		
Steady flow of freeway traffic	90	
10 HP outboard motor Bulldozer or grader at 50'		
Near drilling rig Automatic dishwasher Muffled jet ski @ 50 ft. Vacuum cleaner	80	
Window air conditioner outside @ 2 ft.	70	
Window air conditioner in room	60	
Normal conversation		
Quiet home in evening	50	
Bird calls		
Library	40	Big Sandy Creek along Big Sandy Horse Trail Neches Bottom and Jack Gore Baygall Unit Lance Rosier Unit--end of Church House Rd Turkey Creek Unit on Turkey Creek Trail and at NPS Ranch House Beech Creek Unit along Beech Woods Trail
Soft whisper	30	
In a quiet house at midnight Leaves rustling	20	
*Modified from Final Environmental Impact Statement Miccosukee 3-1 Exploratory Well, Broward County, Florida (U.S. Department of the Interior).		

For the comparison, Table 9 summarizes sound level values that relate to human health and speech, as documented in the scientific literature. Human responses can serve as a proxy for potential impacts to other vertebrates because humans have more sensitive hearing at low frequencies than most species (Dooling and Popper, 2007, p. 5).

Table 9. Explanation of Sound Level Values	
Sound Levels (dBA)	Relevance
35	Blood pressure and heart rate increase in sleeping humans (Haralabidis et al., 2008)
45	World Health Organization's recommendation for maximum noise levels inside bedrooms (Berglund, Lindvall, and Schwela, 1999)
52	Speech interference for interpretive programs (U.S. Environmental Protection Agency, 1974)
60	Speech interruption for normal conversation (U.S. Environmental Protection Agency, 1974)

Table 10 reports the percent of time that measured levels in the Beech Creek Unit were above the values in Table 9. The top value in each cell focuses on frequencies affected by transportation noise whereas the lower values use the conventional full frequency range.

Table 10. Percent time above metrics									
Site	Frequency (Hz)	% Time above sound level: 0700 to 1900				% Time above sound level: 1900 to 0700			
		35 dBA	45 dBA	52 dBA	60 dBA	35 dBA	45 dBA	52 dBA	60 dBA
Beech Creek Unit	100-800	59.82	22.95	1.78	0.16	98.72	88.36	54.78	0.04
	12.5-20,000	13.41	0.98	0.15	0.02	3.07	0.26	0.02	0.00

Exceedence levels (L_x) are metrics used to describe acoustical data. They represent the level of sound exceeded x percent of the time during the given measurement period (e.g. L_{90} is the level that has been exceeded 90% of the time). Table 11 reports the Daytime (700-1900) and Nighttime (1900-700) L_{90} , L_{50} , and L_{10} values for the site(s) measured in the Beech Creek Unit of the Preserve.

Table 11. Exceedence Levels for Existing Conditions							
Site	Frequency (Hz)	Exceedence levels (dBA): 700 to 1900			Exceedence levels (dBA): 1900 to 700		
		L_{90}	L_{50}	L_{10}	L_{90}	L_{50}	L_{10}
Beech Creek Unit	100-800	28.4	32.2	36.8	20.7	24.3	29.9
	12.5-20,000	32.3	37	43.5	25	29	34.9

Figure 10 plots the dB levels for 33 one-third octave band frequencies over the day and night periods at Beech Creek Unit location. The gray area represents sound levels outside of the typical range of human hearing. The frequency levels for transportation, conversation and songbirds are presented on the figure as examples for interpretation of the data. These ranges are estimates and are not species-, habitat-, or vehicle- specific.

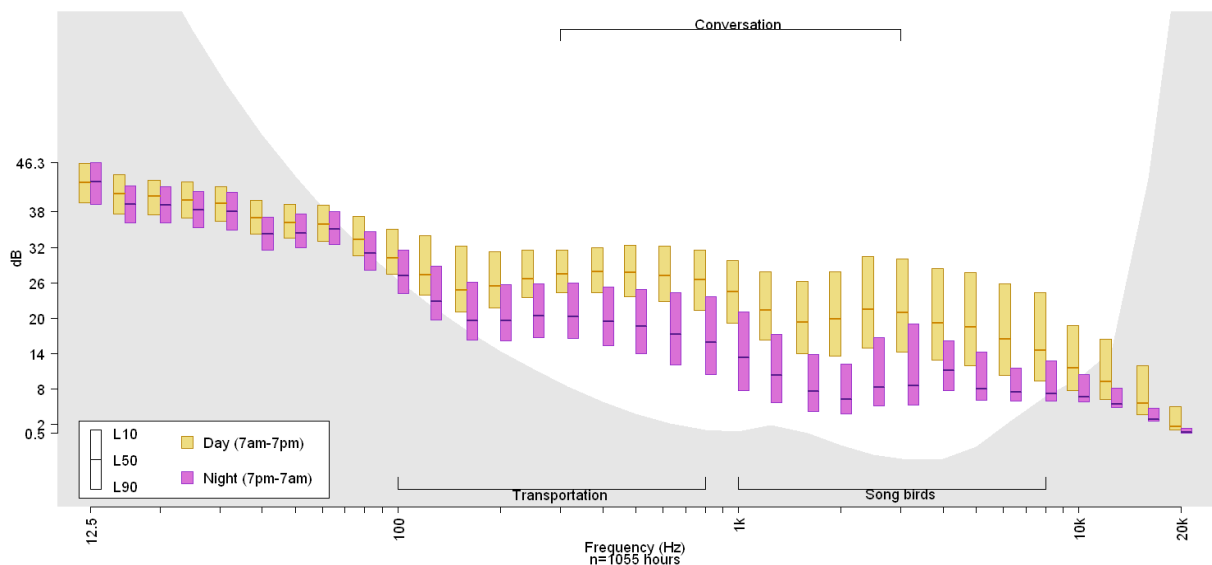


Figure 10. Day and Night dB Levels for 33 One-third Octave Bands in the Beech Creek Unit of the BTNP

In July, 2008 the Natural Sounds Program monitored a gas production site (Ergon Energy Partners LP's Mason 1 site) and an operating drilling rig (Unit Texas Drilling Company Rig #237). The Mason #1 site is a production site, without a drilling rig (post-platform). There were high and low-pressure separators, a dehydrator, and heater treator. A compressor was the main noise source. Production specifications for this site were 700 barrels of oil per day, 100 million cubic feet of natural gas per day, and 400 barrels each per holding tank. Unit Texas Drilling Company Rig #237 was drilling the Bluff #1 well. There were a large number of noise sources, but noise levels were dominated by 3 diesel powered generator packages, which operate concurrently. Using the resulting data, noise models were produced to estimate the impact of the above listed oil and gas equipment within the Preserve boundary.

The sites for the Carroll 2-3 and the Carroll 1-4-5 wells would be located approximately 10 feet and 245 feet from the Preserve boundaries respectively on private pastureland. The well pads would be located in an area where there are other existing oil and gas operations within two miles.

Environmental Consequences

Area of Analysis. The area of analysis for soundscapes is defined as the well operations area plus the area within 2,000 – 4,000 feet of the wellpads, since drilling noise is expected to decrease to about the background level recorded for quiet areas in similar areas of the Preserve (Beech Creek Unit) at that distance.

Methodology and Assumptions. After reviewing all of the results of the Foch study, the NPS Natural Sounds Program study, and considering adjacent land uses, BTNP visitor use and management activity, as well as the existing legislative, regulatory and policy

framework for the BTNP, the NPS developed the following impact intensity thresholds for soundscapes:

- Negligible:** Impacts on natural soundscapes would result in a negligible change, but natural sounds would prevail; unnatural noise would be very infrequent or absent.
- Minor:** Natural sounds would predominate in areas where management objectives call for natural processes to predominate, with infrequent noise. In areas where noise is consistent with park purpose and objectives, noise could be heard frequently throughout the day and natural sounds could be heard occasionally. Mitigation measures if needed to offset adverse effects, would be simple and successful.
- Moderate:** In areas where management objectives call for natural processes to predominate, natural sounds would predominate, but noise could occasionally be present. In areas where noise is consistent with park purpose and objectives, noise would predominate and natural sounds could still be heard occasionally. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.
- Major:** In areas where noise is inconsistent with park purpose and objective, noise would persistently dominate the soundscape. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

Impacts on Natural Soundscapes in and outside the Unit under Alternative A, No Action

Under Alternative A, Famcor would not drill the Carroll 2-3 and Carroll 1-4-5 wells, resulting in no new impacts on natural soundscapes.

Cumulative Impacts under Alternative A, No Action

Under Alternative A, cumulative impacts to natural soundscapes would result from vehicle traffic in and outside the Unit, development (including oil and gas activity) in and outside the Unit, recreational activities, including ORV use outside the Unit and motorized boat use in the Unit, and commercial timber activities outside the Unit boundary.

Elevated noise from existing activities would include the use of vehicles; chainsaws, log skidders, tractors, and prescribed fires used as part of commercial timber activities; as well as aircraft and firearms. The use of chainsaws during clear cutting of the timber and the discharge of firearms in the land adjacent to the Unit would introduce elevated noise levels that could potentially reach up to 140 decibels (dBA) within the analysis area (please see Figure 9).

Noise levels from all the sources of noise mentioned above would range from 41 dBA (around 9dBA higher than the baseline daytime ambient sound levels and 16 dBA higher than the baseline nighttime ambient levels per the L90 that was measured in the Beech Creek Unit in 2008) up to 160 dBA (for gunfire). As a result of these various existing and future activities, cumulative impacts on natural soundscape within and contiguous to the Units are anticipated to result in long-term but intermittent, negligible to moderate,

adverse impacts on the natural soundscape in and outside the Units, localized near sources.

Conclusion for Alternative A, No Action

Under Alternative A, No Action, the Carroll 2-3 and the Carroll 1-4-5 wells would not be drilled, resulting in no new impacts to natural soundscapes. Existing vehicle use, park maintenance activities, recreational uses (including hunting), oil and gas activities in and outside the Unit, and farm management activities adjacent to the Unit would result in localized, short-term, negligible to moderate, adverse impacts. Cumulative impacts to natural soundscapes to the Unit from recreational uses (including hunting), park maintenance activities, oil and gas activities in and outside the Unit, and farm management activities adjacent to the Unit would be short- to long-term, localized to widespread, negligible to moderate, adverse impacts.

Impacts on Natural Soundscapes in and outside the Unit under Alternative B, Proposed Action

Under Alternative B, the Carroll 2-3 and the Carroll 1-4-5 wells would be drilled and may be completed to produce hydrocarbons. Existing impacts on the natural soundscape within the Unit would be similar to Alternative A, No Action, with localized, short-term, negligible to moderate, adverse impacts.

Impacts from In-Park Operations. In-park operations would consist of 1) the five wellbores from the Carroll 2-3 and the Carroll 1-4-5 wellpads located on private property crossing the subsurface Unit boundary at a TVD of between 2,000 and 3,080 feet, and penetrating to a target depth of about 5,100 feet TVD below the Unit; 2) extracting hydrocarbons and associated fluids from beneath the Unit. There would be no impact to the natural soundscape in the Unit from in-park operations.

Impacts from Connected Actions. Elevated noise would be generated by the connected actions, which would consist of construction and/or maintenance of the well/production pad and the sales/transportation pipelines, the drilling and completion of the well, hydrocarbon production and transportation, and well plugging and reclamation outside the Unit. These activities would result in localized and short-term increases in noise associated with vehicle traffic, heavy equipment, and ground-disturbing activities. Elevated noise would be greatest during the short-term (approximately 14 day) drilling period. Drilling is a 24-hour, 7-day a week operation, so noise would be continuous during the drilling periods. The drilling rig generates noise levels reaching approximately 96 dBA (NPS 2009), while some diesel trucks have been reported at 88 dBA at 50 feet from the source (FHWA 2007). Sound dissipates with distance from the source, with noise levels reaching near background levels at 2,000 feet. Elevated noise during the drilling phase would result in localized, short-term, minor to moderate, adverse impacts on natural soundscapes within 2,000 feet of the drilling rig. Utilizing data from studies performed in similar areas of the Preserve (NPS 2010), noise levels are expected to be slightly less than 96 dBA at the Preserve boundary during drilling operations. This increased sound level would result in short-term moderate adverse impacts to the natural soundscape of the Preserve. If the wells were productive and required noise

emitting production equipment (i.e. compressor), sound buffers/barriers would be installed to mitigate the increased noise.

Cumulative Impact under Alternative B, Proposed Action

Under Alternative B, cumulative impacts to natural soundscapes in the Unit would be similar to those described for Alternative A. Noise sources would include existing and future oil and gas operations in and outside the Unit, routine park maintenance operations, recreational activities including hunting in and outside the Unit, and farming operations adjacent to the Unit, which would result in localized, short- to long-term, negligible to moderate, adverse cumulative impacts to natural soundscapes.

Conclusion for Alternative B, Proposed Action

Under Alternative B, Proposed Action, the Carroll 2-3 and the Carroll 1-4-5 wells would be drilled and may be produced. Use and maintenance the well/production pad and drilling and producing the well, and eventual plugging and reclamation activities would result in short- to long-term, localized, negligible to moderate, adverse impacts on natural soundscapes in the Unit. Cumulative impacts would be similar to those described for Alternative A, with short-to long-term, localized to widespread, negligible to moderate, adverse impacts.

3.4 Impacts on Air Quality in and outside the Big Sandy Creek Unit

Background

NPS air resource management policy has been developed in conjunction with requirements in the Clean Air Act (CAA) and the Environmental Protection Agency's regulations. The level of protection afforded some park resources and values by the CAA may be the determining factor when deciding whether air quality impacts are acceptable. Air pollution sources within park boundaries, must, by law, comply with all Federal, State, and local regulations. Air pollution sources outside park boundaries are subject to varying Federal, State and local regulations depending upon the land ownership and type and size of pollution source. Impairment determinations are not linked to exceeding the national ambient air quality standards (NAAQS), but mitigation measures would likely be required under the CAA if emissions from an activity caused or contributed to a NAAQS violation.

Guiding Laws, Regulations, and Policies

The CAA established national ambient air quality standards to protect the public health and welfare from air pollution. The act also established the prevention of significant deterioration (PSD) of air quality program to protect the air in relatively clean areas – i.e. those areas that are in attainment with the NAAQS. One purpose of the PSD program is to protect public health and welfare, including natural resources, from adverse effects that might occur even though NAAQS are not violated. Another purpose is to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic or historic value (42 U.S.C. 7401 *et seq.*). The PSD program includes a classification approach for controlling air pollution.

Big Thicket is a Class II area and the Clean Air Act allows only moderate air quality deterioration in these areas. In no case, however, may pollution concentrations violate any of the national ambient air quality standards.

Areas that do not meet the NAAQS for any pollutant are designated as “non-attainment areas.” Areas that were once designated non-attainment, but are now achieving the NAAQS are termed “maintenance areas.” In non-attainment areas, states must develop plans to reduce emissions and bring the area back into attainment of the NAAQS, and proposed actions must “conform” to the State Implementation Plan (SIP), which establishes *de minimis* values for certain pollutants which cannot be exceeded, so as to limit pollution and reach attainment. Once the area has met attainment and been approved as a “maintenance area” the state may revise the SIP as needed.

Under the Clean Air Act, § 176, the NPS is prohibited from permitting any activity that does not conform to the State of Texas’ implementation plan. The general conformity *de minimis* levels established by the state implementation plan within Hardin County are 100 tons per year of volatile organic compounds, and 100 tons per year of nitrogen oxides, which are both precursors to ozone formation. In addition, the TCEQ administers a permitting program for new or modified facilities or sources of air pollution with greater than 100 tons of emissions per year, the PSD program.

Under its *Management Policies* 2006 the National Park Service will seek to perpetuate the best possible air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas (sec. 4.7.1).

The *Management Policies* 2006 further state that the National Park Service will assume an aggressive role in promoting and pursuing measures to protect air quality related values from the adverse impacts of air pollution. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the National Park Service “will err on the side of protecting air quality and related values for future generations.”

Affected Environment

Big Thicket National Preserve is located generally north of the Beaumont/Port Arthur airshed and northeast of the Houston airshed. “The primary pollutants transported from airsheds affecting the Preserve are volatile organic compounds (VOCs), and nitrogen oxides (NO_x). Other air pollutants that could affect the Preserve include carbon monoxide (CO), sulfur dioxide (SO₂), and particulate matter (PM) (including heavy metals and lead)” (NPS, 2006b). Industrial activities and urbanization account for the majority of impacts to air quality in the Preserve when compared to nonfederal oil and gas operations or Preserve management activity. (Ibid.)

The Preserve is designated a Class II area under the PSD provisions of the CAA. Polk County is in an attainment area subject to PSD requirements. The PSD permitting program is administered by the Texas Commission on Environmental Quality and applies to defined categories of new or modified sources of air pollution with emissions greater than 100 tons per year and all other sources greater than 250 tons per year. (Ibid.)

PSD requirements do not apply directly to oil and gas wells, but the regulatory thresholds are relevant benchmarks to consider in impact analysis.

Portions of the Preserve lie within three Texas counties (Hardin, Jefferson, and Orange) that were designated as “maintenance areas” for eight-hour ozone on November 19, 2010. The Preserve also lies within one Texas county (Liberty) that is not in compliance for eight-hour ozone, and is designated as “severe non-attainment”. Ground-level ozone (sometimes referred to as smog) is formed by the reaction of VOCs and NO_x in the atmosphere in the presence of sunlight. These two pollutants, often referred to as ozone precursors, are emitted by many types of pollution sources, including on-road and off-road motor vehicles and engines, power plants and industrial facilities, and smaller sources, collectively referred to as area sources. Like many areas in Texas, the ozone season in the Houston/Brazoria non-attainment area is typically eight months long, lasting from March through October with peak high ozone events occurring generally late August and September. (Ibid.) Regulatory standards inside severe non-attainment areas for ozone precursors are 25 tons per year (TPY) of VOCs, and 25 TPY of NO_x. (TCEQ, 2010).

Other values may be affected by air quality. These are referred to as “air quality-related values” and include such things as vegetation that may be sensitive to a variety of air pollutants, especially ozone; visibility; and fish and wildlife resources that can be affected by air quality and effects of pollutant deposition in water. The analysis in this document focused on the emissions of ozone precursors that can affect Preserve vegetation, as well as emissions of sulfur compounds that may affect plant growth and species composition and water quality by acidifying surface waters. Since it is difficult to relate these effects to a single oil and gas operation, and because the actual impacts to air quality related values depends on their chronic exposure to air affected by many industrial activities and urbanization in the area, a specific analysis of these values is not included, but the potential effects can be indirectly assessed by an analysis of emissions and impact levels.

Air quality in the region is influenced by activities occurring in the Beaumont/Port Arthur/Orange and Houston/Galveston airsheds. Industrialization and urbanization in these airsheds are major sources of emissions. The primary pollutants transported by the Beaumont/Port Arthur/Orange airshed are VOCs and NO_x. Other air pollutants that could affect the Unit and public health include CO, SO₂, hydrogen sulfide (H₂S), and particulate matter.

Environmental Consequences

Area of Analysis. The area of analysis for air quality impacts includes the immediate location of the proposed wellsites, access routes, and flowline corridors and the surrounding area where air pollutants may accumulate in and outside the Units.

Methodology and Assumptions. To assess air quality impacts resulting from a given management alternative, the following methods and assumptions were used:

1. The national ambient air quality standards and state regulatory emissions thresholds in both non-attainment and attainment areas were examined. The State implementation plan was reviewed.
2. Air quality designations for the subject areas were determined. The Carroll 2-3 and the Carroll 1-4-5 wells are proposed in an attainment area subject to PDS requirements (Polk County).
3. The air quality impacts of the alternatives were assessed by considering the existing air quality levels and using the estimated ozone precursor emissions from the operation of the drilling rig and existing point and area sources in Polk County, Texas. Drilling rig ozone precursor emissions were estimated based on work by Russell and Pollack (2005) and Pollack et al. (2006) which used survey information from oil and gas operators in Wyoming and New Mexico to estimate oil and gas emissions in reference oil and gas fields. These reference values may be used along with well depth and drilling duration estimates provided by applicants to establish a range of application specific, per-well, emissions factors for VOCs and NO_x using the equation:

$$EF_A = EF_{San\ Juan\ Basin} \times \left(\frac{D_A}{D_{San\ Juan\ Basin}} \right) \times \left(\frac{T_A}{T_{San\ Juan\ Basin}} \right)$$

where EF is the emissions factor, D is the drilling depth (measured depth) and T is the drilling duration. Subscript A refers to the application, and subscript San Juan Basin refers to the Blanco-Mesa Verde Field in northwestern New Mexico. Emissions factors regarding both NO_x (1.484 tons/well) and VOCs (0.042 tons/well) are available for the San Juan Basin. The average depth of wells drilled in this area is 5,436 feet according to data from the Oil and Gas Division of the New Mexico Energy, Minerals and Natural Resources Department (Pollack, 2007). The average drilling duration reported by oil and gas producers was 12 days in this field. (Ibid.) No information of this kind from oil and gas fields in southeast Texas was available at the time of research. By using data from the San Juan Basin, the NPS has assumed that similar rigs would be used to drill the wells.

4. Impacts from emissions of other pollutants of concern were addressed qualitatively, with reference made to typical emissions reported by operators or in the literature as appropriate.
5. For cumulative impacts, the assessment was completed qualitatively. Other sources of air pollutants in the area were also considered in the cumulative analysis through a review of the state implementation plan, annual NO_x and VOC emissions for existing point (2004) and area sources (2001) in Hardin and Polk Counties (as summarized by the NPS Air Resources Division) using data made available by the TCEQ and EPA. (NPS, ARD, 2007), and the use of best professional judgment.

Impact intensity thresholds used for the air quality analysis are defined below:

- Negligible:** Impacts would result in a change to local air quality, but the change would be so slight that it would not be of any measurable or perceptible consequence. These changes would not affect the attainment status of the airshed, and would be consistent with the airshed designation at the park. Emissions would be substantially less than any applicable or relevant air emissions regulatory thresholds.
- Minor:** Impacts would result in a detectable change to local air quality, but the change would be small and of little consequence. These changes would not affect the attainment status of the airshed, and would be consistent with the airshed designation at the park. Emissions would be considerably less than any applicable or relevant air emissions regulatory thresholds. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
- Moderate:** Impacts would result in a change to local air quality that would be readily detectable. Emissions could approach applicable or relevant air emissions regulatory thresholds, could affect the attainment status of the airshed, and could be inconsistent with the airshed designation at the park. Mitigation measures could be required, and would likely be successful.
- Major:** Impacts would result in a change(s) to regional air quality that would be severe. These changes would cause exceedences of applicable or relevant air emissions regulatory thresholds, would affect the attainment status of the airshed, and/or be inconsistent with the airshed designation at the park. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

Impacts on Air Quality in and outside the Big Sandy Creek Unit under Alternative A, No Action (All Wells)

Under Alternative A, No Action, the wells would not be drilled, resulting in no new impacts on the natural soundscape either in or outside the subject Units.

Cumulative Impacts. Impacts on air quality from other sources would continue as the result of vehicle use on lands in and outside of the Unit, recreational activities in and outside of the Unit (including use of all-terrain vehicles, and burning of campfires), park facility management and prescribed fires in the Unit, oil and gas activities in and outside the Units, and farming activities and commercial timber activities occurring adjacent to the Unit. The use of vehicles and other combustion engines, and fires would emit PM, NO_x, CO, CO₂, and SO₂. An analysis of the cumulative effect of drilling and producing the up to 40 wells projected in the RFD scenario was performed in the Preserve's *Oil and Gas Management Plan Environmental Impact Statement*. (NPS, 2005) No "major" adverse impacts were identified for this impact topic. However, the primary source of cumulative impacts to air quality in the analysis area would be contaminants from the Beaumont/Port Arthur/Orange airshed, as well as from the Houston/Brazoria and Lake Charles, Louisiana airsheds. Various industrial facilities, pipelines, and vehicular traffic

in these airsheds are major sources of emissions. All of these sources would result in long-term, minor to moderate adverse cumulative impacts to air quality in the study area.

Conclusion. Under Alternative A, No-Action, the five wells would not be drilled; therefore, there would be no new impacts on air quality in or outside the Units. Cumulative impacts on air quality in and contiguous to the Units from recreational activities in and outside the Units, park management functions within the Unit, prescribed fires, oil and gas activities in and outside the Units, timber management activities adjacent to the Unit boundaries, and regional urbanization and industrial sources would result in long-term, minor to moderate, adverse impacts to air quality in the vicinity of the wells.

Impacts on Air Quality in and outside the Big Sandy Creek Unit Under Alternative B, Proposed Action (All Wells)

Impacts from In-Park Operations. Under the Proposed Action, the five wells would be drilled from 2 wellpads located outside the Unit boundaries. In-park operations consist of the directionally drilling wellbores into the plane of the Units at several thousand feet below the surface and extracting hydrocarbons and other fluids from beneath the Unit. These subsurface actions would have no impact on the surface air quality regardless of what methods and materials Famcor use to drill, case, cement, or plug and abandon the section of the holes inside the Units. Therefore, there would be no impact to the air quality in or outside the Units from in-park operations.

Impacts from Connected Actions. Impacts are described by phase of activity, below.

Construction. Ground disturbing activities associated with construction and maintenance of access roads, wellpads, and flowlines would result in increased emissions of particulates in the vicinity of the activities. Greater use of motor vehicles during construction of the access roads and pads would increase particulate matter from vehicle exhaust and dust from paved and unpaved surfaces. Exhaust from machinery and equipment used intermittently during construction would also contribute to an increase in PM, as well as emissions of hydrocarbons (HC), NO_x, and CO. Prevailing winds would carry some pollutants into the Unit and the surrounding adjacent lands. Construction would result in short-term, negligible to minor adverse effects on air quality in and outside the Unit, localized near the wellsite.

Drilling. The use of vehicles and other machinery used to drill the wells would result in increased particulates in the vicinity of the activities. Emissions of particulate matter, NO_x, CO, CO₂, and SO₂ would be greatest during the short-term (14 days) drilling operations due to increased use of vehicles and large gasoline and diesel engines used to power the drill rig, pumps, and auxiliary equipment during the entire period of drilling. Large diesel engines which are used to power the drill rig, pumps, and auxiliary equipment emit NO_x, and smaller amounts of CO and HC. Some SO₂ would be emitted due to the burning of gasoline and diesel fuels (which contain minor amounts of sulfur). The amount of engine emissions would depend on the drill rig size, percent sulfur in the fuel used, gallons of fuel burned per hour, the hours per day, number of days the rig operate, and the use of any emissions control devices.

Hydrogen sulfide could be encountered and released during drilling operations. Past operations in the Preserve have not encountered H₂S bearing zones. Texas RRC Statewide Rule 36 applies to operations in H₂S areas. The rule does not apply where concentrations in the system are less than 100 ppm, and the amount projected is much less than this limit. For all wells, if zones containing H₂S under pressure are encountered, the drilling mud system is adjusted to prevent the release of H₂S and drilling is discontinued until the pressure is stabilized and there is no gas entering the hole. The small amount of gas that could reach the surface is vented and flared.

Depending on atmospheric conditions, the effects to air quality from the proposed operation could travel beyond the analysis area and affect the air quality in the Unit or other surrounding areas. Therefore, the effects from drilling are expected to be short-term, localized, to widespread, negligible to moderate (depending on each well's characteristics), and adverse. These impacts are not expected to exceed NAAQS established under the Clean Air Act.

Production. If the wells are placed in production, emissions would continue but at much reduced levels due to the operation of separation and treatment vessels, truck to transport fluids from the sites and possibly gas compression equipment with localized, long-term, negligible, adverse impacts on air quality in the Unit. Routine maintenance activities during production would result in increased particulates in the vicinity of the activities. Emissions of PM, NO_x, CO, CO₂, and SO₂ would occur during workover operations (1-2 weeks) due to increased use of vehicles and large gasoline and diesel engines used to power the drill rig, pumps, and auxiliary equipment, with localized, short-term, minor, adverse impacts on air quality in and outside the Unit.

Plugging/Reclamation. Plugging/abandonment/reclamation of the wells would result in increases in particulate matter during ground-disturbing activities, and the use of vehicles and other machinery, resulting in localized, short-term, negligible to minor, adverse impacts on air quality in and outside the Unit.

Cumulative Impacts. Similar to the effects discussed above under Alternative A, cumulative impacts to air quality in the area of analysis would result primarily from contaminants from the Beaumont/Port Arthur/Orange airshed, as well as from the Houston/Brazoria and Lake Charles, Louisiana airsheds. Industrialization and urbanization in these airsheds are major sources of emissions. Vehicle use, recreational activities, development (including the proposed action and other oil and gas activity), commercial timber activities, and farming activities would also contribute to air quality impacts in the analysis area. All of these existing and reasonably foreseeable activities/pollution sources, in combination with the emissions expected from well development under the proposed action, would result in long-term, widespread, minor to moderate, adverse cumulative impacts on air quality.

Conclusion. Under Alternative B, the five wells would be drilled and possibly completed to produce hydrocarbons. Construction of the access roads, flowlines, wellpads; drilling and producing the wells; and eventual plugging and reclamation activities would result in adverse impacts ranging from short- to long-term, and negligible to moderate, with intensities greatest close to the sources. The greatest

impacts (moderate effects) would occur during the short-term (but continuous) drilling periods, which are expected to last up to 14 days per well. Construction and plugging/reclamation would result in short-term, negligible to minor effects due mainly from use of heavy equipment and vehicles. Production impacts would be considered long-term and minor, due to the continued emissions from ongoing operations and occasional workovers. There would be no impacts on air quality from in-park operations. Cumulative impacts would be similar to those described under No Action, with long-term, widespread, minor to moderate, adverse impacts.

3.5 Impacts on Lightscapes/Night Sky in and outside the Big Sandy Creek Unit

Background

Light, visible electromagnetic radiation streaming through the atmosphere, has a tremendous amount of natural variation. The spectrum from the brightest day to the darkest night spans over 8 orders of magnitude. (NPS, NRPC, 2003) Disruption of this cycle can have significant ecological effects. Darkness is an important habitat component, providing cover, security, navigation, or predatory advantage to both nocturnal and diurnal species. Light pollution, defined as stray unwanted light outside the range and timing of natural variation, is not only an ecological disrupter, but also adversely affects the natural scenery of the night. The NPS mission to “conserve scenery” extends to night and the sky above. The ability to view a pristine night sky where thousands of stars are visible has diminished with increasing development. The loss of this resource represents a direct reduction in enjoyment for park visitors who regularly stargaze. It will also reduce the integrity of other resources by a loss in context.

Light pollution has been documented over 200 miles from the light source. (Ibid.) The cumulative effect of multiple artificial light sources at varying distance brightens the sky background, drowning out stars and astronomical objects by contrast reduction, and increasing the illuminance of the ground surface. Particularly dark skies are most prone to a degradation of their scenic potential, showing a large reduction in the number of visible stars with a small amount of light pollution. Night skies already brightened by artificial light show a lessening degradation with each incremental increase in light pollution. Within this response function may be embedded thresholds whereupon certain species, ecological processes, or key scenic resources will be affected.

Individual point sources of light can impact Preserve resources, even if they contribute relatively little to overall skyglow. Artificial lights punctuating the landscape can detract from the natural and historic character of the scenery. They can interfere with human dark adaptation and are documented as affecting certain wildlife.

The degree of impact of artificial light is highly dependent on the distance and the type and brightness of the light fixture. Atmospheric characteristics such as humidity and particulates further influence the apparent effect of artificial light. Distance is the most influential, because the brightness of sky glow from a given light sources decreases 6 times for every doubling of distance (point light sources decrease 4 times for every doubling of distance). (Moore, 2007) Whether the light fixture is fully shielded is also important; fully shielded fixtures can greatly decrease the creation of both point and

diffuse source light pollution. The perception of light pollution will vary from one location to another caused by differences in vegetation cover, sight lines and horizon visibility, and even the color of the ground. Atmosphere of greater clarity tends to amplify distant light sources and attenuate nearby light sources, while more humid and polluted air tends to amplify close light sources, especially those within 10 km (6.2 miles) of an observer. (Ibid.)

Both the generally flat topography of the Big Thicket area and the prevalence of canopy layer vegetation in most of the Preserve naturally limit the experience of vistas in which a substantial portion of the night sky could be observed. This is especially true at the horizon, the part of the sky in which lightscape impacts are first noted. Air quality considerations can also play a role in the context of lightscape impacts, because the presence of air pollution can increase light scattering. However, visibility as an air quality related value of concern was dismissed from consideration in this EA because of the lack of opportunities to view landscape or other features over long distances at the Preserve.

Guiding Laws Regulations and Policies

NPS *Management Policies* 2006 (§ 4.10) emphasize the protection of natural lightscapes not only for the enjoyment and experience of visitors, but also for protection of ecological integrity. Mitigation strategies are identified, including restricting the use of artificial lighting only where necessary, utilizing minimum impact techniques, and shielding lights to prevent unwanted light scatter.

Affected Environment

The existing lightscape surrounding the proposed project areas represents an increase in artificial light of 33-99% from natural conditions between zenith and 45° for the Carroll 2-3 and Carroll 1-4-5 wells. (Cinzano, et al., 2001, See Figure 11).

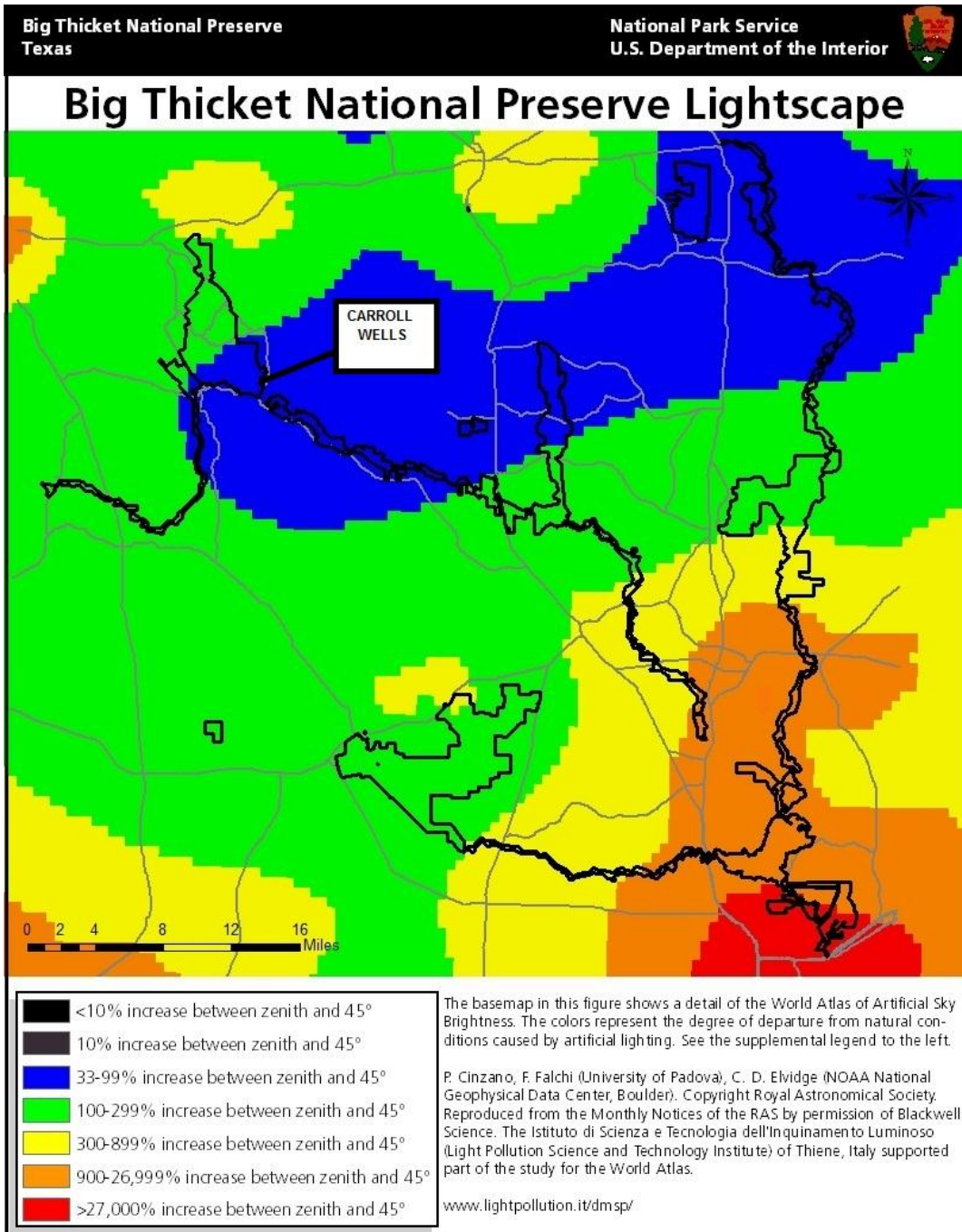


Figure 51. Existing lightscape surrounding on the Big Thicket National Preserve and in the vicinity of the Carroll 2-3 and Carroll 1-4-5 well site locations.

Environmental Consequences

Area of Analysis. The area of analysis for lightscapes/night sky includes the immediate location of the proposed wellsites and about 1,500 feet into the surrounding area (both inside and outside the Units) where impacts from lighting would be more noticeable.

Methodology and Assumptions. NPS has developed the following impact thresholds for lightscapes, based on effects on visitor experience, ecological disruption, and general park context (relation to cultural or historic setting, etc).

Negligible: Light conditions cycle as they would within the range of existing variability. The night sky is unchanged by artificial light, leaving the current amount of stars, astronomical objects, and atmospheric phenomena visible. No visible change in light pollution, either bright stationary point source lights, or sky glow from cities would be noticeable (although change may be detectable by a trained observer or instrument).

Minor: The cycle of light and dark is largely similar to existing conditions. Changes in the lightscape are visible along the horizon, but are unnoticed at higher angular altitudes. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: The cycle of light and dark is modified over existing conditions. Changes in lightscape are obvious, and extend perceptibly overhead. Mitigation measures would be extensive and likely successful.

Major: The cycle of light and dark is clearly altered from existing conditions. Changes in lightscape are conspicuous overhead. The sky background is noticeably brighter and more colored in appearance. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

Impacts on Lightscapes/Night Sky in and outside the Big Sandy Creek Unit under Alternative A, No Action (All Wells)

Under Alternative A, the five wells would not be drilled, resulting in no new impacts on lightscapes or night sky in or outside the Units.

Cumulative Impacts. Under Alternative A, cumulative impacts to lightscape would result from a variety of light sources in the area of analysis for cumulative impacts, including new development, commercial timber activities, roadway vehicle traffic outside the Unit, and existing oil and gas operations and industrial facilities both inside and outside the Unit. Light from these sources would vary considerably in intensity, wavelength, duration, and hours of operation, but the numerous light sources have increased the background skyglow levels to various extents in the vicinity of the preserve. An analysis of the cumulative effect of drilling and producing the up to 40 wells projected in the RFD scenario was performed in the Preserve's *Oil and Gas Management Plan Environmental Impact Statement*. (NPS, 2005) No major adverse

impacts were identified for this impact topic which was analyzed under the heading “Visitor Use and Experience.” As a result of all the potential light sources mentioned, cumulative impacts to the lightscape within the analysis area are anticipated to be long-term, localized to widespread, negligible to moderate, and adverse.

Conclusion. Under Alternative A, No Action, the five wells would not be drilled, resulting in no new impacts to lightscapes or night sky. Cumulative impacts to lightscapes could occur as a result of development of adjacent properties, oil and gas activities in and outside the Unit, and farm management activities adjacent to the Unit, and are expected to result in long-term, localized to widespread, negligible to moderate, adverse impacts.

Impacts on Lightscapes/Night Sky in and outside the Big Sandy Creek Unit under Alternative B, Proposed Action (All Wells)

Impacts from In-park Operations. Under Alternative B, Proposed Action, all wells would be directionally drilled and the wellbores would cross into the Unit at substantial depths and extract hydrocarbons and other fluids from beneath the Unit. There would be no impacts on the Unit’s lightscapes from the subsurface oil and gas operations in the Unit.

Impacts from Connected Actions. Impacts are described by phase of activity, below.

Construction. Construction of the access roads and wellpads, flowlines, and production activities could result in localized and short-term increases in artificial light associated with vehicle traffic and heavy equipment, although there would not be extensive or constant nighttime lighting. The areas of the proposed well locations have little or no artificial lighting. There are no overnight camping facilities near the wells. The Big Sandy Creek Horse and Bike Trail is approximately 0.3 miles from the two Carroll wellpads and the Beaver Slide Trail is about 0.47 miles distant at the nearest point. The distance between the wellpad perimeters, access roads and flowlines, where construction would occur, and the Unit boundary is relatively small – between 10 feet and 245 feet. While the light from construction activities would easily travel the distance between the wellpads and the Unit boundary, the Unit itself is heavily vegetated between the boundary and both trails, and there is very little elevation change over this distance. The vegetation would have the effect of blocking most if not all of the light from the construction activities before it reaches either trail. Therefore, construction lighting would be expected to cause short-term, localized, negligible, adverse impacts to the lightscape and night sky in the analysis area.

Drilling. Elevated light levels would be greatest during the short-term drilling and completion periods estimated for each well (21 days) from the lighting of the drill rig to allow for 24-hour operations. During the drilling of the wells, lighting on the derrick, rig floor, and drill site would be necessary for drilling at night to provide for worker safety. The introduction of artificial lighting during the drilling phase would be more pronounced in the area immediately surrounding the wellhead on the lands adjacent to the Units; but would be substantially reduced with distance into the Units and surrounding land. The introduction of artificial light on the dark night sky in the Units

during the short-term drilling phase would result in localized, short-term, but moderate adverse impacts since the lighting would be continuous.

Production. During the long-term production life of the wells there could be smaller artificial lighting installed at the drilling/production sites. Construction of the flowlines and production activities, as well as maintenance of the existing access roads, wellpads, flowlines, and production activities, could result in localized and short-term increases in artificial light associated with vehicle traffic and heavy equipment. Also, occasional workovers on the wells could occur at 5 to 10-year intervals and take 1 to 2 weeks to complete. Workover rigs could introduce artificial lighting as well, but are expected to be at lower levels relative to the initial drilling operations and would not operate at night. Lighting from these various sources during the production phase would be expected to cause short- and long-term, localized, negligible to minor adverse impacts to the lightscape and night sky in the analysis area

Plugging and Reclamation. Plugging and reclamation would involve the use of heavy equipment and trucks to remove production equipment, plug wells, and recontour the wellpads in preparation for reseeding. Light sources would include lights on earthmoving equipment and trucks and lighting would be needed only intermittently for the period of plugging and reclamation preparation, usually a period of only a few days, with no nighttime lighting required. Similar to the initial construction phase, these activities would cause short-term, localized, negligible, adverse impacts to the lightscape and night sky in the analysis area.

Cumulative Impacts. Under Alternative B, cumulative impacts to Lightscares/Night Sky in the Units would be similar to those described for Alternative A. Potential impacts to lightscares in the area of analysis would result from development of adjacent private properties, vehicle traffic, existing oil and gas operations both inside and outside the Unit, the routine maintenance of transpark oil and gas pipelines, and recreational activities in and outside the Unit. As a result of these activities and the light contributed by the five wells, cumulative impacts to the lightscape within the analysis area are anticipated to be long-term, negligible to moderate, localized to widespread, and adverse.

Conclusion. Under Alternative B, Proposed Action, the five wells would be drilled and possibly completed to produce hydrocarbons. Construction of the access roads, flowlines, wellpads; drilling and producing the wells; and eventual plugging and reclamation activities would result in adverse impacts ranging from short- to long-term, and negligible to moderate. Elevated light levels would be greatest during the estimated 21 day drilling/completion phase of each well and localized from the lighting of the drill rig for 24-hour operations, resulting in moderate short-term adverse impacts. Construction and maintenance of the existing access roads, wellpads, and flowlines; and plugging and reclamation could result in localized, short-term, negligible impacts from increases in artificial light associated with vehicle traffic and heavy equipment. Production impacts could be long-term but negligible to minor from lighting used for on-going operations and during workovers. There would be no effect from in-park operations. Cumulative effects to Lightscares/Night Sky are expected to be long-term, localized to widespread, negligible to moderate, and adverse.

3.6 Impacts on Visitor Experience and Aesthetics in and outside the Big Sandy Creek Unit

Background and Guiding Laws Regulations and Policies

According to the NPS's *Management Policies 2006*, the enjoyment of park resources and values by people is part of the fundamental purpose of all park units. The National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and would maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. Further, the National Park Service would provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. The *Management Policies 2006* also state that scenic views and visual resources are considered highly valued associated characteristics that the National Park Service should strive to protect. The Preserve offers many visitor use options, ranging from very active recreational pursuits to more passive enjoyment of nature.

NPS *Management Policies 2006* (§ 4.10) also emphasize the protection of natural lightscapes not only for the enjoyment and experience of visitors, but also for protection of ecological integrity. Mitigation strategies are identified, including restricting the use of artificial lighting only where necessary, utilizing minimum impact techniques, and shielding lights to prevent unwanted light scatter.

Affected Environment

The Preserve's primary visitor contact point, the Visitor Center, is located 19 miles (straight-line) southeast of the proposed action at the intersection of Hwy 69 and FM 420. The Preserve's administrative and maintenance facilities are located next door. The Preserve's secondary visitor contact point, the Visitor Information Station or Environmental Education Center, is located 1.6 miles further along FM 420 and at the southern end of the Turkey Creek Unit (TCU).

Approximately 107,305 visitors came to the Preserve in 2009. (NPS Public Use Statistics Office, 2009). Specific data detailing how many total visits (for all users) to the Big Sandy Creek Unit is unavailable because the Preserve does not track visits to the individual Units, except those generated from hunting surveys. Visitors primarily use this Unit for overnight camping, canoeing, hiking, bird watching, hunting, and fishing.

There are two picnic areas located at two trailheads: the Big Sandy Trail in the southeast and the Woodlands Trail in the far north. The Beaver Slide Trail is also located in the extreme southeast corner, and south of Big Sandy Creek, but has no picnic facility. The Big Sandy Creek Horse and Bike Trail is approximately 0.3 miles from the two Carroll wellpads and the Beaver Slide Trail is about 0.47 miles distant at the nearest point. The parking and picnic area for the Horse and Bike Trail is about 3.25 miles from the Carroll 2-3, and the Woodlands Trail parking and picnic area, located in the northernmost end of the BSC Unit is 7.4 miles distant. The 1.5 mile Beaver Slide Trail is one of the best places to see several ponds formed by old beaver dams and does not provide parking or a picnic area. The 18 mile Horse and Bike Trail is the longest in the Preserve where horses

and mountain bikes are allowed.

Hunting is permitted within portions of the Big Sandy Creek Unit from the opening date of the Texas fall hunting season through (normally) the second Sunday in January. An extended hunting season for feral hogs runs until the end of February. During the 2011-2012 hunting season, with 256 surveys regarding this Unit returned, 1,649 hunting trips to the Big Sandy Creek Unit were reported. Noise from either Carroll wellpad could indirectly affect visitor experience, particularly those using the Horse and Bike Trail, the Beaver Slide Trail, or who might be boating on Big Sandy Creek which is located 0.3 miles from the Carroll 1-4-5 wellpad at the nearest point.

Research was conducted (through questionnaires filled out on-site at the Preserve Visitor Information Station in the TCU and at a department store in located in Woodville, Texas) by Gulley (1999) to examine characteristics, desired experiences, and knowledge of a sample of visitors and non-visitors to the Preserve. Most participants in the research were current or previous Preserve visitors, but a small number (8%) indicated that they had never visited the Preserve, and 58% of the participants lived within a 2.5-hour drive of the Preserve's Visitor Information Station. This study indicated that the desired experiences rated most important were enjoying nature, wildlife viewing and escaping the crowd/noise. An objective of this same research *"was to determine attitudes of [Preserve] visitors regarding solitude; i.e., the degree to which visitors and potential visitors valued solitude, and the degree to which visitors to [the Preserve] were satisfied with the solitude experienced while hiking."* (Gulley, 1999) *"Most respondents did not place a high value on solitude."* (Ibid.). The researcher speculated that this response was not particularly surprising because the recreational opportunities provided in Southeast Texas were not the "wilderness type recreation" whose enthusiasts might place a high value on solitude (Ibid.). Most respondents to the survey indicated that the number of people they encountered while hiking in the Preserve was "about right" (Ibid.).

Effects to the lightscape and the soundscape as a result of this proposed action are the two phenomenon most likely to impact visitor experience and aesthetics. For the Affected Environment discussion on Natural Soundscape please see Section 3.3. For the Affected Environment discussion on Lightscape, please see Section 3.5.

Environmental Consequences

Area of Analysis. The impacts of the proposed action on each resource vary both spatially and temporally, and therefore the interaction of these impacts with past, present, and reasonably foreseeable actions does as well. Spatial and temporal boundaries were set for each impact topic using the potential impacts of the proposed action to define an area of analysis for cumulative effects.

The spatial boundary of the area of analysis for visitor use and recreation is defined as the operations area plus 1,000 feet outside of the Preserve. It is anticipated that noise associated with the proposed operations would decrease to ambient background levels documented within the preserve at that distance. The temporal boundary of analysis is defined as the length of the proposed action including reclamation activities, which may be up to two years.

Methodology and Assumptions. The assessment of potential impacts on visitor use and experience is based on best professional judgment, Preserve records of visitor use, and discussions with staff from the NPS. The NPS maintains records of visitor use through the visitor center, as well as through hunting permits, which are issued for areas within the Preserve that are open to hunting, and hunter surveys. In addition, a graduate student at Stephen F. Austin State University prepared a paper on the characteristics, desired experiences, and knowledge of visitors and potential visitors to the Big Thicket National Preserve. This information was used in the analysis of potential impacts of proposed action on visitor use and experience. Famcor has incorporated measures into operations to minimize impacts on visitor use and experience, including sound buffers / barriers around noise emitting production equipment if any well is successful and requires such equipment (e.g. compressor). These measures were also taken into account in the assessment of impacts.

The following data and information were used to predict impacts of each alternative on the Visitor Use and Experience and Recreation in the Preserve:

- *Final, Oil and Gas Management Plan, Environmental Impact Statement, Big Thicket National Preserve* (USDI, NPS, 2006).
- *Characteristics, Desired Experiences, and Knowledge of Visitors and Potential Visitors to the Big Thicket National Preserve* (Gulley, 1999).

The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Impacts would be barely detectable and/or would affect few visitors.

Minor: Impacts would be slightly detectable and/or would affect few visitors.

Moderate: Impacts would be measurable and/or would affect some visitors.

Major: Impacts would be severely adverse or exceptionally beneficial and/or would affect many visitors.

Impacts on Visitors Experience/Aesthetics in and outside the Big Sandy Creek Unit under Alternative A, No Action (All Wells)

Under Alternative A, the five wells would not be drilled, resulting in no new impacts on lightscapes, night sky and soundscapes in or outside the Units. Continued implementation of NPS current legal and policy requirements would result in protecting visitor use and experience on a case-by-case basis. Existing impacts on visitor use and experience within the Preserve would continue because of weather, noise disturbance, Preserve operations, and would range from negligible to moderate over the short term and long term in localized areas.

The main factor that affects visitor use in the Preserve is weather conditions. Visitor use is high in the spring and declines in the summer months, when temperatures get hotter. Factors that could directly and indirectly adversely affect visitor use and experience in the Preserve are highway traffic, forestry operations (e.g., chainsaws, log skidders and feller-bunchers, etc.), ATV use, aircraft, oil and gas operations, farm machinery, lawn mowers, and firearms, as they may create noise, emit pollutants or create visual impacts that would decrease the quality of the visitor experience. Most of these sources of impacts would only occur on adjacent lands, but others, like oil and gas operations, aircraft overflights or vehicle traffic, occur within the Preserve. Some Preserve management practices could interfere with visitor enjoyment of the Preserve by temporarily closing areas, as in wildfire suppression, or creating similar impacts as those on adjacent lands by the use of on and off-road vehicles, chainsaws and the like.

Cumulative Impacts. The cumulative impact on visitor use and experience in the Preserve takes into account weather conditions and sources of noise both in the Preserve and on adjacent private lands in the project area. Hurricanes and other tropical storms can adversely affect the visitor experience and recreational values due to losses of habitat caused by these storms, destruction of infrastructure within the Preserve, as well as restricting use of the Preserve for potential safety concerns. Noise can adversely affect visitor experience, especially for those seeking solitude or a quiet natural experience. Illegal ATV use does and increased traffic could increase noise levels within the Preserve, thus adversely affecting the visitor experience and the Preserve's recreational values. Crime can also adversely affect the visitor experience at the Preserve and could potentially occur. Drought conditions in the future could result in the loss of vegetation communities that provide aesthetic and visual appeal to Preserve visitors. Cumulative adverse impacts on visitor use and experience in the Preserve are expected to continue over the short term and long term and range from negligible to moderate in intensity.

Conclusion. Under Alternative A, No Action, Famcor would not drill the five proposed wells, resulting in no new impacts on visitor use and experience within the proposed project area. Weather and noise disturbances from highway traffic, forestry operations, ATVs, aircraft, oil and gas operations, farm machinery, lawn mowers, and firearms would continue to affect visitor use and experience in the analysis area resulting in localized to widespread, short- to long-term, negligible to moderate, adverse impacts. Cumulative effects from the same sources are expected to cause short- to long-term, localized to widespread, negligible to moderate, adverse impacts on visitor use and experience in and outside the Unit.

Impacts on Visitors Experience/Aesthetics in and outside the Big Sandy Creek Unit under Alternative B, Proposed Action (All Wells)

Impacts from In-park Operations. Under Alternative B, Proposed Action, all wells would be directionally drilled and the wellbores would cross into the Unit at substantial depths and extract hydrocarbons and other fluids from beneath the Unit. There would be no impacts on the Unit's visitor use and experience or aesthetics as a result of the subsurface oil and gas operations in the Unit.

Impacts from Connected Actions. Impacts are described by phase of activity, below.

Construction. Construction of the wellpad, access road and flowline for the Carroll 2-3, could result in localized and short-term increases in artificial light associated with vehicle traffic and heavy equipment, although there would not be extensive or constant nighttime lighting. The areas of the proposed well locations have little or no artificial lighting. There are no overnight camping facilities near the wells. The Big Sandy Creek Horse and Bike Trail is approximately 0.3 miles from the two Carroll wellpads and the Beaver Slide Trail is about 0.47 miles distant at the nearest point. The distance between the wellpad perimeters, access roads and flowlines, where construction would occur, and the Unit boundary is relatively small – between 10 feet and 245 feet. While the light and noise from construction activities would easily travel the distance between the wellpads and the Unit boundary, the Unit itself is heavily vegetated between the boundary and both trails, and there is very little elevation change over this distance. The vegetation would have the effect of blocking most if not all of the light and noise from the construction activities before it reaches either trail, and also Big Sandy Creek and any boaters / recreationists there. Therefore, construction lighting and noise would be expected to cause short-term, localized, negligible, adverse impacts in the analysis area.

Drilling. Elevated noise levels would be greatest during the short-term drilling / completion periods estimated for each well to be about 21 days, but would occur continuously (24 hours per day) during that period. During drilling and completion of the wells, lighting on the derrick, rig floor, and drill site would be necessary at night to provide for worker safety. The introduction of artificial lighting during the drilling phase would be more pronounced in the area immediately surrounding the wellhead on the lands adjacent to the Unit; but would be substantially reduced with distance into the Units and surrounding land. The introduction of artificial light on the dark night sky in the Unit, and also the introduction of above-ambient noise levels, during the short-term drilling and completion phase would result in localized, short-term, but moderate adverse impacts since these affects would be continuous.

Production. During the long-term production life of the wells there could be smaller artificial lighting installed at the drilling/production sites. Construction of the flowline and production activities, as well as maintenance of the existing access roads, wellpads, flowlines, and production activities, could result in localized and short-term increases in artificial light and noise associated with vehicle traffic and heavy equipment. Also, occasional workovers on the wells could occur at 5 to 10-year intervals and take 1 to 2 weeks to complete. Workover rigs could introduce artificial lighting and noise as well, but are expected to be at lower levels relative to the initial drilling operations and would not operate at night. To increase well pressure, it might be necessary to install a compressor at one or both wellpads. Famcor will install concrete barriers to buffer noise emissions as mitigation to lessen noise emissions. Effects from these various sources during the production phase would be expected to cause short- and long-term, localized, negligible to minor adverse impacts to the lightscape and night sky in the analysis area.

Plugging and Reclamation. Plugging and reclamation would involve the use of heavy equipment and trucks to remove production equipment, plug wells, and recontour the wellpads in preparation for reseeding. Light sources would include lights on earthmoving equipment and trucks and lighting would be needed only intermittently for the period of plugging and reclamation preparation, usually a period of only a few days,

with no nighttime lighting required. Noise levels would also be increased. Similar to the initial construction phase, these activities would cause short-term, localized, negligible, adverse impacts within the analysis area.

Cumulative Impacts. Under Alternative B, cumulative impacts to visitors experience and aesthetics in the Unit would be similar to those described for Alternative A. Potential impacts to lightscapes and increased noise in the area of analysis would result from development of adjacent private properties, vehicle traffic, existing oil and gas operations both inside and outside the Unit, the routine maintenance of transpark oil and gas pipelines, and recreational activities in and outside the Unit. As a result of these activities and the light and noise contributed by the five wells, cumulative impacts within the analysis area are anticipated to be long-term, negligible to moderate, localized to widespread, and adverse.

Conclusion. Under Alternative B, Proposed Action, the five wells would be drilled and possibly completed to produce hydrocarbons. Construction of the access road, flowline, and wellpad; drilling, completing and producing the wells; and the eventual plugging and reclamation activities would result in adverse impacts ranging from short- to long-term, and negligible to moderate. Elevated light levels and noise levels would be greatest during the estimated 21 day drilling/completion phase of each well would result in moderate short-term adverse impacts. Construction and maintenance of the existing access roads, wellpads, and flowlines; and plugging and reclamation could result in localized, short-term, negligible impacts from increases in light and noise associated with vehicle traffic and heavy equipment. Production impacts could be long-term but negligible to minor from on-going operations and during possible future workovers. There would be no effect from in-park operations. Cumulative effects to visitor experience and aesthetics are expected to be long-term, localized to widespread, negligible to moderate, and adverse.

3.7 Impacts on Wildlife in and outside of the Big Sandy Creek Unit

Background and Guiding Laws, Regulations and Policies

The NPS Organic Act, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the NPS to mean that native animal life should be protected and perpetuated as part of the Preserve's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible; otherwise they are protected from harvest, harassment, or harm by human activities except where provided for by individual park statute. According to NPS *Management Policies* 2006, the restoration of native species is a high priority (§ 4.1). Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and the ecological integrity of plants and animals. At Big Thicket National Preserve, the enabling legislation provides for the hunting of game species and the trapping of fur bearing species under a permit system administered by the NPS.

Affected Environment

The abundant and diverse vegetation of the Preserve supports terrestrial habitats for a variety of wildlife. Wildlife species in the area “are typical deciduous forest assemblages from the eastern and southeastern United States and resemble in some degree wildlife in sub-tropical forest communities. The diverse wildlife assemblages of this region are a result of numerous factors including topography, climate, hydrologic regimes, soil type, and physiography” (Frasier Group, 1998). Between about fifty and sixty species of mammals are either documented or believed to inhabit the Preserve. (Cooper, et al. 2004) Birds are the most visible and diverse group of vertebrate fauna found in the Preserve. Currently, while no comprehensive survey of avifauna has been conducted, 176 species have been documented in the Preserve. (Ibid) Approximately 85 species of reptiles and amphibians could inhabit the Preserve (NPS, 2005).

At all wellsites, all areas of proposed activity would be situated in areas with a history of extensive land disturbance, including agriculture and commercial forest management. Due to the decreased diversity of vegetation in species, spatial and temporal composition, periodic clearing, lack of high quality food in the understory, and lack of aquatic habitat, it is anticipated that the project areas adjacent to the Preserve would support a low diversity of wildlife. The process of cutting and regrowth provides opportunities for some species, such as edge or grassland dependent species during the initial years after harvest, while detracting from the habitat of others. Schmidly *et al.* (1979) noted this phenomenon in small mammals at the Preserve, and also observed that the practice of clearcutting during harvest reduced diversity in those taxa. Typical species that inhabit these areas include such large mammals as common raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), common gray foxes (*Urocyon cinereoargenteus*), eastern cottontail rabbits (*Sylvilagus floridanus*), Virginia opossum (*Didelphis virginiana*), coyotes (*Canis latrans*), beaver (*Castor canadensis*) and white-tailed deer (*Odocoileus virginianus*), which are often found in relatively disturbed or urbanized settings and are generally distributed throughout the State of Texas.

At both wellpads, areas immediately adjacent and within the Unit would support a more diverse wildlife community, as the Preserve has been protected from commercial timber harvest and agriculture for some time and provides a variety of natural habitats. Animals that inhabit the outer boundaries of the Preserve, however, have become somewhat accustomed to nearby disturbances and noise, since forestry operations, agriculture and other uses occur in close proximity to the Preserve.

Environmental Consequences

Area of Analysis. The area of analysis for wildlife includes the immediate location of the proposed wellsites and about 1,500 feet into the surrounding area (both inside and outside the Units) where impacts from disturbance (lights, noise, human presence, etc.) would be more likely to affect wildlife species.

Methodology and Assumptions. The assessment of impacts to wildlife was based on staff knowledge of the areas and habitat conditions, the Preserve’s *Oil and Gas Management Plan* (2006), and information gathered from the field visits conducted by the applicants. NPS developed the following thresholds for impacts to wildlife:

Negligible: Impacts would result in a change to a population or individuals of a species or a resource, but the change would be well within the range of natural fluctuations.

Minor: An action that would affect a few individuals of a wildlife species or have very localized impacts upon their habitat. The change would have barely perceptible consequences to the species or habitat function. Sufficient habitat would remain functional to maintain viability of all species. Impacts would be outside of critical reproduction periods for sensitive species. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: An action that would cause measurable effects on: (1) a relatively small percentage of the population of a wildlife species, (2) the existing dynamics between multiple species (e.g., predator-prey, herbivore-forage, vegetation structure-wildlife breeding habitat), or (3) a relatively large habitat area or important habitat attributes. A wildlife population or habitat might deviate from normal levels under existing conditions, but would remain indefinitely viable within the preserve. Response to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, or other factors impacting short-term population levels. Sufficient habitat would remain functional to maintain variability of all native wildlife species. Some impacts might occur during critical periods of reproduction or in key habitat for sensitive native species. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

Major: An action that would have drastic and permanent consequences for a wildlife species population, dynamics between multiple species, or almost all available unique habitat. A wildlife population or its habitat would be permanently altered from normal levels under existing conditions, and the species would be at risk of extirpation from the preserve. Frequent responses to disturbance by some individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in population levels. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Impacts on Wildlife in and outside the Big Sandy Creek Unit under Alternative A, No Action (All Wells)

Under Alternative A, No Action, the wells would not be drilled, resulting in no new impacts on the wildlife either in or outside the Units.

Cumulative Impacts. Vehicle uses, existing and future oil and gas operations in and outside the Unit, maintenance of transpark oil and gas pipelines, routine park operations, recreational activities including hunting in and outside the Unit, forestry operations adjacent to the Unit, and residential, commercial, and industrial development, with the associated clearing of vegetation and long-term loss of habitat,

would result in minor, adverse impacts on wildlife in the area of analysis. An analysis of the cumulative effect of drilling and producing the up to 40 wells projected in the RFD scenario was performed in the Preserve's *Oil and Gas Management Plan Environmental Impact Statement* (NPS, 2005) and up to minor adverse impacts were identified from all actions that could affect wildlife in the cumulative impacts analysis area. Other actions taken within the area of analysis to protect wildlife resources of the Preserve and on adjacent lands through planning and/or permitting requirements are expected to maintain or improve some habitat for certain species, with cumulative beneficial effects. As a result of all these actions, cumulative impacts to wildlife within the analysis area are anticipated to be long-term, localized to widespread, minor, and adverse.

Conclusion. Under Alternative A, No Action, the five wells would not be drilled, resulting in no new impacts to wildlife in or outside the Unit. Cumulative impacts to wildlife could occur as a result of development of adjacent lands, oil and gas activities in and outside the Unit, and timber management activities adjacent to the Unit and are expected to result in long-term, localized to widespread, minor and adverse impacts.

Impacts on Wildlife in and outside the Big Sandy Creek Unit under Alternative B, Proposed Action (All Wells)

Impacts from In-Park Operations. Under Alternative B, Proposed Action, all wells would be directionally drilled and the wellbores would cross into the Units at substantial depths and extract hydrocarbons and other fluids from beneath the Unit. There would be no impacts on the wildlife either inside or outside the Unit from the subsurface oil and gas operations in the Unit.

Impacts from Connected Actions. Impacts are described by phase of activity, below.

Construction. Construction of the Carroll 2-3 wellpad and required access and flowline would have direct adverse impacts on wildlife in the area of the pad outside the Unit boundaries due to the removal of vegetation on the site, including 0.25 acres of timber with the remainder being improved pastureland. This would result in the loss and fragmentation of wildlife habitat.

Removal of this habitat on the wellpad could increase predation in open areas, increase edge effects, and result in avoidance of the area by wildlife due to increased noise, lighting, and human presence. Elevated noise, as described under the Natural Soundscape discussion, could extend into the Unit and displace wildlife that occupies habitat near the oil and gas facilities. Displaced wildlife could increase competition with other wildlife in adjacent areas over the short-term. Construction and clearing of the site could directly harm or kill the wildlife species that are present, displace wildlife into adjacent habitat, or disrupt wildlife feeding, denning, nesting, and spawning / reproduction, thereby altering wildlife species and composition. The potential for leaks and spills exists for all phases of oil and gas activities; however, the proposed mitigation measures that would be implemented, including an SPCC Plan requirement, are anticipated to confine any impacts to the wellsite.

All the areas affected directly by construction are considered marginal quality habitat due to the past land management practices. Impacts to wildlife in the Unit, where habitat

is more diverse and of higher quality, would be limited to intermittent disturbance due to noise and artificial lighting, and the presence of people, but most wildlife would be expected to return after becoming acclimated to some noise disturbance. Therefore, impacts to wildlife from construction would be short-term and long-term (clearing effects), negligible to minor, and localized both inside and outside the Unit.

Drilling. The greatest impact to wildlife in and outside the Units would occur during the drilling and completion phase, since noise, artificial lighting, and disturbance would occur continually for up to 21 days, until drilling and completion is completed. Elevated noise could displace wildlife or disrupt wildlife feeding, denning, nesting, and spawning/reproduction, even within the Units, but most displaced wildlife is expected to return after becoming acclimated to some noise disturbance. Displaced wildlife could increase competition in adjacent areas over the short-term. Because dense vegetation and flat terrain occur in the portion of the Unit potentially affected by the proposed wells, light and noise from the connected actions at the proposed drilling/production locations is expected to be partially reduced by the vegetation. As discussed under soundscapes, noise levels would decrease to a quiet background level within 2,000-4,000 feet of the drilling operations. These impacts on wildlife in the Unit would be localized, short- to long-term, minor to moderate, and adverse.

Artificial lighting, particularly during drilling of the wells and possible workovers, would also affect wildlife. “Animals can experience increased orientation or disorientation from additional illumination and are attracted to or repulsed by glare, which affects foraging, reproduction, communication, and other critical behaviors. Artificial light disrupts interspecific interactions evolved in natural patterns of light and dark.” (Longcore and Rich, 2004)

The potential for leaks and spills exists for all phases of oil and gas activities; however, the proposed surface casing and cementing program, site location, site design, and mitigation measures that would be implemented during the drilling activities are anticipated to confine impacts to the wellsite. The potential for release and transport of oil or gas, brine water, and other contaminating or hazardous substances would be unlikely, as previously described in Section 1.

Based on the lack of high quality habitat in the area of the proposed action, the short-term nature of high noise drilling operations, and the low potential for leaks or spills to migrate offsite to surrounding habitats, impacts to wildlife inside and outside the Unit would be localized, short- term, minor to moderate, and adverse.

Production. Impacts to wildlife would be reduced during the production phase, which has the potential to be long-term. There would be minor impacts from the clearing of the flowline needed to carry the product, but this would be a loss confined to a small linear corridor. Any wetland areas crossed would not be disturbed, because the flowline would be installed using directional drilling under the small wetland areas.

Elevated noise, particularly during any workover operations could displace wildlife, as described under Drilling. However, these would be very sporadic and most wildlife is expected to return after becoming acclimated to some noise disturbance. The potential for leaks and spills exists for all phases of oil and gas activities; however, the mitigation

measures (plastic liners, berms, etc.) that would be implemented during production phase are anticipated to confine impacts to the wellpads. The potential for release and transport of oil or gas, brine water, and other contaminating or hazardous substances would be unlikely as previously described in Section 1.

Based on the lack of high quality habitat in the area of the proposed actions, the short-term nature of high noise operations during production, and the low potential for leaks or spills to migrate offsite to surrounding habitats, impacts to wildlife in and outside the Unit would be localized, short- to long-term, minor, and adverse.

Plugging and Reclamation. Plugging and reclamation operations and site preparation during reclamation would involve the use of heavy equipment and have similar impacts as construction, but over a shorter period of time (a few days), with very short-term, minor effects. The long-term effect of the reclamation phase is to return the areas to natural conditions, which would bring wildlife back into the area. The potential for leaks and spills exists for all phases of oil and gas activities; however, the mitigation measures that would be implemented (plastic liners, berms etc.) would confine impacts to the wellpads, and reclamation would include cleanup of any remaining site contamination.

Cumulative Impacts. Cumulative impacts would be as described for Alternative A, with adverse effects from vehicle uses, existing and future oil and gas operations in and outside the Unit, maintenance of transpark oil and gas pipelines, routine park operations, recreational activities including hunting in and outside the Unit, development outside the Unit boundary, and forestry operations adjacent to the Unit, resulting in localized, minor, adverse impacts on wildlife. Considering the small amount of habitat that would be directly impacted (a total of about 2.7 acres for all wellpads, access roads, and flowlines), the type of habitat loss and the reclamation that would occur after the sites are no longer used, the effects of the proposed actions would not contribute more than minor adverse impacts to the overall cumulative impact of all these actions in the region, and cumulative impacts on wildlife would remain long-term, localized to widespread, minor, and adverse.

Conclusion. Under Alternative B, Proposed Action, the wells would be drilled and may be produced. Construction of the access road, flowline, wellpad; drilling and producing the wells; and eventual plugging and reclamation activities would result in adverse impacts ranging from short- to long-term, and negligible to moderate on wildlife in and outside the Unit, with more intense impacts localized around the wellpad locations. Construction of the wellpad, access, and flowline would remove relatively low quality wildlife habitat from use until reclamation occurred, a long-term, minor, adverse impact. Construction and plugging/reclamation activities would cause localized and short-term increases in artificial noise and light associated with vehicle traffic and heavy equipment, resulting in short-term, negligible to minor adverse impacts. The greatest impacts (moderate effects) would occur during the short-term (but continuous) drilling periods, which are expected to last from 21 days per well for drilling and completion. Production impacts would be short to long-term and minor due to the ongoing disturbance at the sites and occasional workovers. There would be no impacts to wildlife from in-park operations. Cumulative effects to wildlife are expected to be long-term, localized to widespread, negligible to moderate, and adverse.

3.8 Impacts on Adjacent Landowners, Resources, and Uses

Background and Guiding Laws, Regulations and Policies

This section addresses impacts on adjacent landowners and resources, with emphasis on certain resources on the property outside the Unit that could be affected by the proposed operations at noticeable levels. Those resources include soils and geology and vegetation at the Carroll 2-3 only, which will require construction of a wellpad, access road and flowline. The Carroll 1-4-5 well will not require any clearing or disturbance of soils and geology and vegetation because both laterals will be drilled from the existing wellpad for the producing vertical well named the Famcor Carroll #1 well.

Affected Environment

Surface Owners and Land Uses.

The surface location of the existing pad and the proposed pad is entirely within private property. The current land use for this location is small-scale cattle ranching, improved pasture grass hay production, and outdoor recreation. Dallardsville, Texas (estimated population of 350) is the nearest town and is located 3.5 miles north of the proposed wells.

Geology and Soils.

The soils beneath approximately 90% of the Carroll 2-3 wellpad are described as Stringtown-Bonwier association (STE), which occur on 5% to 15% slopes, are well drained, are not hydric with no frequency of flooding, and have a depth of more than 80 inches to the water table. The remaining soil which represents approximately 5% of the wellpad and 100% of the access road and flowline is classified as Pinetucky loamy fine sand (PaB), which occur on 1% to 5% percent slopes, are moderately well drained, are not hydric with no frequency of flooding, and have a depth of more than 80 inches to the water table (U.S. Department of Agriculture, Soil Conservation Service, 1983).

The geology and soils within the Preserve adjacent to the existing Carroll 1-4-5 wellpad (or the as drilled Carroll #1 vertical well) and access road were examined to determine if more than negligible effects could occur from either in-park or connected actions. The soils and characteristics of the areas surrounding the well and access road are described below:

The existing Carroll 1-4-5 wellpad, access rod and flowline are located entirely within the Pinetucky loamy fine sand (PaB), which occur on 1% to 5% percent slopes, are moderately well drained, are not hydric with no frequency of flooding, and have a depth of more than 80 inches to the water table (U.S. Department of Agriculture, Soil Conservation Service, 1983).

Vegetation.

Constructing the Carroll 2-3 wellpad will require clearing 2.06 acres, of which, ~0.25 acres will be within a timber stand and the remaining 1.82 acres will be within an existing improved pasture. Vegetation removal within the timber stand will include: loblolly pine (*Pinus taeda*), southern magnolia (*Magnolia grandiflora*), redbay (*Persea borbonia*), willow oak (*Quercus phellos*), Chinese privet (*Ligustrum sinense*), sweetgum (*Liquidambar styraciflua*), yaupon holly (*Ilex vomitoria*), American holly (*Ilex opaca*), and American beautyberry (*Callicarpa americana*). The 1.82 acres of improved pasture that will be cleared is primarily bahiagrass (*Paspalum notatum*) with some scattered ragweed (*Ambrosia artemisiifolia*), Chinese tallowtree (*Triadica sebifera*) and southern dewberry (*Rubus trivialis*). The existing 0.94 acres Carroll 1-4-5 wellpad has been stabilized with a 4 to 6 inch thick layer of caliche rock, and is essentially devoid of vegetation. The existing 1.03 acre Carroll 1-4-5 access road and flowline ROW has also been stabilized with a layer of rock and is also essentially devoid of vegetation.

Environmental Consequences

Area of Analysis. The area of analysis for this topic is limited to the private adjacent lands outside the Units in the immediate vicinity of the well locations.

Methodology and Assumptions. The assessment of potential impacts on adjacent land uses and resources was based on best professional judgment and was developed through discussions with staff from the NPS, review of relevant literature, and field observations. Thresholds of change of the intensity of impacts to adjacent landowners, resources, and uses are defined as follows:

- Negligible:** Impacts would result in a change to land uses or resources, but the change would be so slight that it would not be of any measurable or perceptible consequence.
- Minor:** Operations would cause limited localized change to land uses or resources. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
- Moderate:** Impacts would have measurable impacts to adjacent land uses or resources that would be consequential, but would be relatively local. Mitigation measures, if needed, to offset adverse effects occurring outside the Preserve, would likely succeed.
- Major:** Operations would cause substantial alteration to land uses or resources on a regional scale. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

Impacts on Adjacent Landowners, Resources and Uses under Alternative A, No Action (All Wells)

Under Alternative A, No Action, the wells would not be drilled, resulting in no new impacts on adjacent land uses and resources outside the subject Unit.

Cumulative Impacts. Cumulative impacts on geology and soils and vegetation outside the Units outside the Units would result primarily from land development, including oil and gas operations, as well as from leaks and spills from oil and gas operations and transpark pipelines, timber management, prescribed burns, and use of vehicles off of roadways. These activities could increase surface runoff; increase soil erosion, rutting and compaction; affect the permeability of soils (and other soil characteristics); and could directly and indirectly affect the growth and regeneration of vegetation. It is expected that existing and reasonably foreseeable uses in the analysis area would continue with long-term, negligible to moderate, adverse cumulative impacts on geology and soils and vegetation, localized near these uses. Cumulative impacts on cultural resources in the analysis area are expected to continue primarily as the result of ground disturbing activities, where surveys are not performed so sites can be avoided, or impacts mitigated by data recovery programs, associated with vehicle use on and off developed roads, recreational activities, development (including oil and gas activity), and commercial timber activities adjacent to the Unit. Overall, it is expected that existing uses in the analysis area would continue, with long-term, localized, negligible to moderate, adverse cumulative impacts to cultural resources.

Conclusion. Under Alternative A, No-Action, the wells would not be drilled; therefore, there would be no new impacts on adjacent land uses and resources outside the subject Unit. It is expected that existing and reasonably foreseeable uses in the analysis area would continue with short to long-term, negligible to moderate, adverse cumulative impacts on geology and soils and vegetation.

Impacts on Adjacent Landowners, Resources and Uses under Alternative B, Proposed Action (All Wells)

Impacts from In-Park Operations. Under the Proposed Action, all wells would be directionally drilled into the Preserve at substantial depths under the land surface, as described under “Geology and Soils”, above. Therefore, there would be no impacts on adjacent landowners, resources, or uses outside the Preserve Unit from the in-park subsurface oil and gas operations proposed for any of the wells.

Impacts from Connected Actions. Impacts are described by phase of activity, below.

Construction. As outlined in the Wildlife section above, wellpad and access road construction would result in the direct disturbance to site geology and soils and vegetation. To construct the access road and wellpad, the area would be mechanically cleared and leveled. Rock would be imported to cover the pad. The proposed oil and gas activities would locally affect soil characteristics, including some prime farmland soils, by decreasing permeability and increasing erosion and surface runoff. Soils compacted by foot or vehicle use could reduce soil permeability, change surface drainage patterns, and hinder the penetration of plant roots. Disturbance of the site could lead to the unintentional spread of non-native plant species transported to the site on equipment used to drill and develop the well. Impacts to soils and vegetation at each well would be short-term, (except for the long-term clearing effects over the life of the well), minor, localized, and adverse.

Drilling. The release of hydrocarbons or other contaminating and hazardous substances from vehicles, equipment, or flowlines during drilling operations could alter the chemical and physical properties of the soil in the vicinity of oil and gas activities. Changes in soil properties could result directly from contact with contaminants on site, or indirectly, via runoff from contaminated areas. Mitigation measures to protect soils and vegetation during the drilling (and production) activities include complying with a SPCC Plan, constructing a ditch and levee around the wellpad, constructing a washout/emergency pit lined with 12-mil plastic, using a closed-loop containerized mud system, disposing of drilling mud and well cuttings off-site, constructing a 2-foot firewall around the tank battery with a capacity 1.5 times the largest tank, installing a safety drip device on the off-load connection, and following RRC Statewide Rules for surface casing and well plugging. After drilling the well, the washout/emergency and water pits would be filled. These measures are intended to minimize and contain any spilled substances. If the well does not go into production, the area would be reclaimed, resulting in localized, short-term, minor adverse impacts on geology and soils on adjacent lands.

Production. If the Carroll 2-3 well is produced, additional acreage would be disturbed for construction of the flowline needed to carry the product. Wetland areas crossed would not be disturbed, because the flowline would be installed using horizontal directional drilling under the small wetland areas.

The trenching and boring operations used to install the proposed flowline would directly impact the reported acreages of soils and vegetation, resulting in short-term, minor localized adverse impacts, given the size of the area disturbed and the type of vegetation in these areas. Potential impacts to soils and vegetation on the wellpad from compaction and possible releases (see Drilling, above) would continue during production, until the well is plugged and abandoned.

Plugging and Reclamation. Plugging and reclamation operations and site preparation during reclamation would involve the use of heavy equipment and have similar impacts as construction, but over a much shorter period of time (a few days), with very short-term, minor, localized effects. The long-term effect of the reclamation phase is to return the areas to natural conditions, which would restore soils and vegetation on the sites. The potential for leaks and spills exists for all phases of oil and gas activities; however, the mitigation measures (plastic liners, berms, etc.) that would be implemented would confine impacts to the wellpads, and reclamation would include cleanup of any remaining site contamination.

Cumulative Impacts. Cumulative impacts would be similar to those described for alternative A. Land development, including existing and future oil and gas operations, maintenance of transpark oil and gas pipelines, and forestry operations adjacent to the Units could contribute to cumulative impacts on soils and vegetation. Considering the amount of acreage that would be directly impacted, the type of vegetation loss (mainly pine plantation), and the reclamation/replanting that would occur after the sites are no longer used, the effects of the proposed actions would not contribute more than minor adverse impacts to the overall cumulative impact of all these actions in the region.

Conclusion. Under Alternative B, Proposed Action, the five wells would be drilled and may be produced. Construction of the access road, flowline, wellpad; drilling and

producing the wells; and eventual plugging and reclamation activities would result in adverse impacts ranging from short- to long-term, and negligible to moderate on adjacent landowners, resources , and uses outside the Unit. The expected effects on geology and soils and vegetation on adjacent lands are expected to be confined to the direct area of impact by the application of mitigation measures at each site. Therefore, the adverse impacts on these adjacent resources are expected to be localized and minor, with long-term impacts during production and lasting until site reclamation restores soils and vegetation cover. Ground disturbing activities associated with the construction of the proposed drilling/production pads and flowlines, unless avoided or mitigated, could result in long-term, localized, negligible to moderate, adverse impacts to cultural resources on adjacent lands. There would be no impacts on soils, vegetation, or cultural resources from in-park oil and gas operations. Cumulative impacts to these adjacent resources and uses would continue, with long-term, localized, negligible to moderate, adverse cumulative impacts to soils, vegetation, and cultural resources outside the Unit.

4.0 CONSULTATION AND COORDINATION

Following the 30-day external scoping and comment period, NPS received and considered the written comments from the following:

- Lonestar Chapter and Houston Regional Group of the Sierra Club- requesting that an EIS be prepared in lieu of this EA and commenting on NPS policies. No comments were made for alternatives or impacts not discussed in this EA.

4.1 Individuals and Agencies Consulted

The following were consulted or contributed information during preparation of this environmental assessment:

Alabama-Coushatta Tribe of Texas
Famcor Oil, Inc.
Kelly Vasquez, Environmental Coordinator
National Park Service
Big Thicket National Preserve, Beaumont, TX
Railroad Commission of Texas, Oil and Gas Division, District 3
Texas Historical Commission
Texas Commission on Environmental Quality
Texas Parks and Wildlife Department
U.S. Fish and Wildlife Service

4.2 List of Document Recipients

During the public review and comment period, a copy of this environmental assessment will be sent to each of the following agencies, organizations, and businesses.

Tribal Government

Bryant Celestine, Alabama-Coushatta Tribe of Texas

Federal Government

National Park Service
Linda Dansby, Regional Minerals Coordinator, Intermountain Region, Santa Fe, NM
Chris Turk, Regional Environmental Quality Coordinator, Intermountain Region, Denver, CO
Lisa Norby, Chief, Branch of Planning, Evaluation and Permits, Geologic Resources Division, Lakewood, CO
Bruce Bennett, North Evaluation Unit Leader, U.S. Army Corps of Engineers, Galveston District, Galveston, TX
Charrish Stevens, Fish and Wildlife Biologist, U. S. Fish and Wildlife Service, Clear Lake Field Office, Houston, TX

State Government

Guy Grossman, Director, Railroad Commission of Texas, District 3, Houston, TX
Marie Archambeault, Archeologist, State Historic Preservation Office, Austin, TX
Amy Turner, Texas Parks and Wildlife Department

Oil and Gas Industry and Consultants

Kelly Vasquez, Environmental Coordinator, Famcor Oil, Inc.

Joe Hamrick, Raven Environmental Services, Inc.

Organizations and Businesses

Bruce Drury, President, Big Thicket Association

Kevin Cronin, Cronin Appraisal Services, Beaumont, TX

Phyllis Dunham, Regional Director, Sierra Club, Austin, TX

Brandt Mannchen, Chair, Big Thicket Committee, Sierra Club, Lone Star Chapter
and Houston Regional Group, Houston, TX

Janice Benzanson, Executive Director, Texas Conservation Alliance

4.3 List of Preparers

Joe Hamrick, Consultant, Raven Environmental Services, Inc., Huntsville, TX

Stephanie Burgess, Biologist, Oil & Gas Program Manager, Big Thicket National
Preserve

5.0 BIBLIOGRAPHY

- Baker Hughes Incorporated. 2007. *Rig Counts 1992-Present*. Available Online: <http://www.bakerhughes.com/investor/rig/>. Accessed June 1, 2007.
- Berglund, B., Lindvall, T., & Schwela, D.H. (Eds.). 1999. *Guidelines for community noise*. World Health Organization, Geneva.
- Cinzano, P., F. Falchi and C.D. Elvidge. 2001. 'The First World Atlas of Night Sky Brightness.' *Monthly Notices of the Royal Astronomical Society*. Vol. 328, pp. 689-707.
- Climate Change Science Program. 2006. *Our Changing Planet: The U.S. Climate Change Science Program for FY2006*.
- Cooper, Robert J., Cederbaum, Sandra B., and Gannon, Jill J. 2004. *Natural Resources Summary for Big Thicket National Preserve (BITH) Final Report*.
- Council on Environmental Quality. 1997. *Environmental Justice Guidance Under the National Environmental Policy Act*.
- Dixie Environmental Services Company and National Park Service. 2003. *Environmental Assessment of a Proposed 3-D Seismic Survey within the Big Sandy Creek, Menard Creek Corridor, and Hickory Creek Savannah Units of the Big Thicket National Preserve*.
- Dixie Environmental Services Company (DESCO). 2004. *Red-Cockaded Woodpecker Survey of Seismic Assistants Ltd.'s Knight Phase II 3-D Project Area*.
- Dooling, R., & Popper, A. (2007). *The effects of highway noise on birds*. Rockville, MD: Environmental BioAcoustics LLC.
- Famcor Oil, Inc. 2010. *Application for Directionally Drilling Three Wells from Two Surface Locations Outside the Big Thicket National Preserve*.
- Federal Highway Administration (FHWA). 2007. *Effective Noise Control During Nighttime Construction*. Available online at : <http://ops.fhwa.dot.gov/wz/workshops/accessible/Schexnayderpaper.htm>.
- Foch, James D. 1999. *Ambient Sound Levels at Big Thicket National Preserve during March-June 1998*. Prepared for the National Park Service, Big Thicket National Preserve.
- Frasier Group, Inc. 1998. *Plan of Operations and Environmental Assessment of a Proposed Three Dimensional Seismic Survey within the Big Thicket National Preserve in Hardin and Jasper Counties, Texas*.
- Goddard Institute for Space Studies (GISS). 2007. *Annual Mean Temperature Change for Three Latitude Bands*. Datasets and Images. GISS Surface

- Temperature Analysis, Analysis Graphs and Plots. New York, New York.
- Gulley, Gerald Lynn. 1999. *Characteristics, Desired Experiences, and Knowledge of Visitors and Potential Visitors to Big Thicket National Preserve*.
- Haralabidis, A, Dimakopoulou, K., Vigna-Taglianti, F., Giampaolo, M., Borgini, A., Dudley, M., Pershagen, G., Bluhm, G., Houthuis, D., Babisch, & others. 2008. *Acute effects of night-time noise exposure on blood pressure in populations living near airports*. European Heart Journal 29:658-664.
- Harcombe, P. A. and Glenda Callaway. 1997. *Management Assessment of the Water Corridor Units of the Big Thicket National Preserve*. Prepared for the National Park Service, Big Thicket National Preserve, under Cooperative Agreement with Rice University, Houston, Texas.
- Intergovernmental Panel on Climate Change (IPCC). 2007. *Climate Change 2007: Synthesis Report*. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)].
- Komarek, E. V. 1970. *Controlled Burning and Air Pollution: An Ecological Review*. Proc. Tall Timbers Fire Ecol. Conf. 10: 141-173.
- Longcore, Travis and Catherine Rich. 2004. 'Ecological Light Pollution.' *Frontiers in Ecology and the Environment*. Vol. 2(4), pp. 191-198.
- Moore, Chad. 2007. Personal Communication on April 27, 2007.
- Pollack, A., et al. 2006. *Ozone Precursors Emission Inventory for San Juan and Rio Arriba Counties, New Mexico*. Report for New Mexico Environment Department.
- Pollack, Alison. 2007. Personal Communication on June 27, 2007.
- Railroad Commission of Texas. 2010 and 2011.
<http://www.rrc.state.tx.us/divisions/og/statistics/wells/wellcount/oilwlct0906.pdf>
<http://www.rrc.state.tx.us/divisions/og/statistics/wells/wellcount/gaswlct0906.pdf>
<http://www.rrc.state.tx.us>
<http://www.rrc.state.tx.us/divisions/og/blowouts-mm/allblowouts06-10.html>
<http://www.rrc.state.tx.us/divisions/og/h8s/h82006/h82006.html>
<http://www.rrc.state.tx.us/divisions/og/h8s/h82005/h82005.html>
- Russell, J. and A. Pollack. 2005. *Oil and Gas Emission Inventories for the Western States*. Report for Western Governors' Association.
- Schenk, C.J., R. Charpentier and J.W. Schmoker. 1999. *Remaining Oil and Gas Resources Beneath Big Thicket National Preserve Assessment Methodology*.

- Schmidly, D.J., B.R. Barnett, and J.A. Read. 1979. *The Mammals of Big Thicket National Preserve and East Texas*.
- Stynes, Daniel J. 2006. *National Park Visitor Spending and Payroll Impacts Fiscal Year 2005*.
- Texas Commission on Environmental Quality. 2010. *Houston-Galveston-Brazoria Attainment Demonstration State Implementation Plan Revision for the 1997 Eight-Hour Ozone Standard*.
- U.S. Census Bureau. 2006-2008. *American Community Survey 3 year-Estimates* for Polk and Liberty Counties, Texas.
- U.S. Department of Agriculture, Natural Resources Conservation Service. 2004. *Soil Survey Geographic (SSURGO) Database for Hardin County, Texas*.
- U.S. Department of Agriculture, Soil Conservation Service. 1983. *Soil Survey for Polk and San Jacinto Counties, Texas*.
- U.S. Department of the Interior, Bureau of Land Management. 1994. *Final Environmental Impact Statement: Miccosukee 3-1 Exploratory Well, Broward County, Florida*. Prepared with the assistance of Dames and Moore and in cooperation with the Bureau of Land Management and Bureau of Indian Affairs.
- U.S. Department of the Interior, National Park Service. 1980. *General Management Plan*, Big Thicket National Preserve.
- U.S. Department of the Interior, National Park Service. 2004. *Draft Oil and Gas Management Plan Environmental Impact Statement for Big Thicket National Preserve*.
- U.S. Department of the Interior, National Park Service. 2005. *Final Oil and Gas Management Plan Environmental Impact Statement for Big Thicket National Preserve*.
- U.S. Department of the Interior, National Park Service. 2006. *Management Policies*.
- U.S. Department of the Interior, National Park Service, Air Resources Division (NPS, ARD). 2007. *Ozone Precursor Emissions Summary for Point and Area Sources, Hardin and Polk Counties, Texas*.
- U.S. Department of the Interior, National Park Service, Natural Resources Program Center (NPS, NRPC). 2003. *Interim Final Guidance on Assessing Impacts and Impairment to Natural Resources*.

U.S. Department of the Interior, National Park Service, Social Science Program, Public Use Statistics Office (NPS, Public Use Statistics Office). 2009. *Statistical Abstract 2009*.

U.S. Department of the Interior, National Park Service, Natural Resources Program Center (NPS, NRPC). 2010. *Big Thicket National Preserve- Beech Creek Unit Oil and Gas Noise Level Modeling Summary Report*.

U.S. Environmental Protection Agency. 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*.

**APPENDIX A – Federally listed threatened, endangered or candidate
species in Polk County, Texas.**

POLK COUNTY FEDERALLY LISTED SPECIES (n=2)				
Common Name	Scientific Name	Group	Description	State Status
Red-cockaded Woodpecker	<i>Picoides borealis</i>	Bird	Cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly	E
Texas trailing phlox	<i>Phlox nivalis ssp texensis</i>	Plant	Texas endemic; relatively open fire-maintained pine or pine-hardwood forests on soils with a deep, sandy surface layer and clayey subsurface layers; flowering late March-early April (- May)	E

APPENDIX B – State listed threatened and endangered species in Polk County, Texas.

POLK COUNTY STATE LISTED SPECIES (n=37)				
Common Name	Scientific Name	Group	Description	State Status
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Bird	Year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.	T
Arctic Peregrine Falcon	<i>Falco peregrinus tundrius</i>	Bird	Migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.	S
Bachman's Sparrow	<i>Aimophila aestivalis</i>	Bird	Open pine woods with scattered bushes and grassy understory in Pineywoods region, brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, grassy orchards; remnant grasslands in Post Oak Savannah region; nests on ground against grass tuft or under low shrub	T
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Bird	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	T

POLK COUNTY STATE LISTED SPECIES (n=37)				
Common Name	Scientific Name	Group	Description	State Status
Henslow's Sparrow	<i>Ammodramus henslowii</i>	Bird	Wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking	S
Peregrine Falcon	<i>Falco peregrinus</i>	Bird	Both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.	T
Piping Plover	<i>Charadrius melodus</i>	Bird	Wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats	T
Red-cockaded Woodpecker	<i>Picoides borealis</i>	Bird	Cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly	E
Sprague's Pipit	<i>Anthus spragueii</i>	Bird	Only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.	C
Swallow-tailed Kite	<i>Elanoides forficatus</i>	Bird	Lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees	T

POLK COUNTY STATE LISTED SPECIES (n=37)				
Common Name	Scientific Name	Group	Description	State Status
Wood Stork	<i>Mycteria americana</i>	Bird	Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960	T
American eel	<i>Anguilla rostrata</i>	Fish	Coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally	S
Creek chubsucker	<i>Erimyzon oblongus</i>	Fish	Tributaries of the Red, Sabine, Neches, Trinity, and San Jacinto rivers; small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks	T
Orangebelly darter	<i>Etheostoma radiosum</i>	Fish	Red through Angelina River basins; just headwaters ranging from high gradient streams to more sluggish lowland streams, gravel and rubble riffles preferred; eggs buried in gravel and riffle raceways, post-larvae live in quiet water, move into progressively faster water as	S

POLK COUNTY STATE LISTED SPECIES (n=37)				
Common Name	Scientific Name	Group	Description	State Status
			they mature, young feed mostly on copepods and cladocerans, adults on mayfly and fly larvae, spawn late February through mid-April in eastern Texas	
Paddlefish	<i>Polyodon spathula</i>	Fish	Prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir	T
Black bear	<i>Ursus americanus</i>	Mammal	Bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear (LT, T), treat all east Texas black bears as federal and state listed Threatened	T
Louisiana black bear	<i>Ursus americanus luteolus</i>	Mammal	Possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas	T
Plains spotted skunk	<i>Spilogale putorius interrupta</i>	Mammal	Catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie	S
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>	Mammal	Roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures	T
Red wolf	<i>Canis rufus</i>	Mammal	Extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	E
Southeastern myotis bat	<i>Myotis austroriparius</i>	Mollusk	Roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures	S

POLK COUNTY STATE LISTED SPECIES (n=37)				
Common Name	Scientific Name	Group	Description	State Status
Creeper (squawfoot)	<i>Strophitus undulatus</i>	Mollusk	Small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins	S
Fawnsfoot	<i>Truncilla donaciformis</i>	Mollusk	Small and large rivers especially on sand, mud, rocky mud, and sand and gravel, also silt and cobble bottoms in still to swiftly flowing waters; Red (historic), Cypress (historic), Sabine (historic), Neches, Trinity, and San Jacinto River basins.	S
Little spectaclecase	<i>Villosa lienosa</i>	Mollusk	Creeks, rivers, and reservoirs, sandy substrates in slight to moderate current, usually along the banks in slower currents; east Texas, Cypress through San Jacinto River basins	S
Louisiana pigtoe	<i>Pleurobema riddellii</i>	Mollusk	Streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins	T
Sandbank pocketbook	<i>Lampsilis satura</i>	Mollusk	Small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River	T
Southern hickorynut	<i>Obovaria jacksoniana</i>	Mollusk	Medium sized gravel substrates with low to moderate current; Neches, Sabine, and Cypress river basins	T
Texas heelsplitter	<i>Potamilus amphichaenus</i>	Mollusk	Quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins	T
Texas pigtoe	<i>Fusconaia askewi</i>	Mollusk	Rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas River basins, Sabine through Trinity rivers as well	T

POLK COUNTY STATE LISTED SPECIES (n=37)				
Common Name	Scientific Name	Group	Description	State Status
			as San Jacinto River	
Wabash pigtoe	<i>Fusconaia flava</i>	Mollusk	Creeks to large rivers on mud, sand, and gravel from all habitats except deep shifting sands; found in moderate to swift current velocities; east Texas River basins, Red through San Jacinto River basins; elsewhere occurs in reservoirs and lakes with no flow	S
Wartyback	<i>Quadrula nodulata</i>	Mollusk	Gravel and sand-gravel bottoms in medium to large rivers and on mud; Red, Sabine, Neches River basins	S
Alligator snapping turtle	<i>Macrochelys temminckii</i>	Reptile	Perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October	T
Louisiana pine snake	<i>Pituophis ruthveni</i>	Reptile	Mixed deciduous-longleaf pine woodlands; breeds April-September	T
Timber/Canebrake rattlesnake	<i>Crotalus horridus</i>	Reptile	Swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto	T
Panicled indigobush	<i>Amorpha paniculata</i>	Plant	A stout shrub, 3 m (9 ft) tall that grows in acid seep forests, peat bogs, wet floodplain forests, and seasonal wetlands on the edge of Saline Prairies in East Texas. It is distinguished from other <i>Amorpha</i> species by its fuzzy leaflets with prominent raised veins underneath, and the flower	S

POLK COUNTY STATE LISTED SPECIES (n=37)				
Common Name	Scientific Name	Group	Description	State Status
			panicles, which are 8 to 16 inches long and slender, held above the foliage.	
Texas screwstem	<i>Bartonia texana</i>	Plant	In and around acid seeps in Pine-Oak forests on gentle slopes and baygall shrub thickets at spring heads; often on clumps of bryophytes at tree bases, on roots, and on logs; flowering September-November, can be identified in mid to late October when its in fruit	S
Texas trailing phlox	<i>Phlox nivalis ssp texensis</i>	Plant	Texas endemic; relatively open fire-maintained pine or pine-hardwood forests on soils with a deep, sandy surface layer and clayey subsurface layers; flowering late March-early April (-May)	E
STATUS CODE: E = Endangered, T = Threatened, C = Candidate, S = Sensitive, DL = Delisted, DM = Delisted and Monitored				