

U.S. Department of the Interior

Bureau of Land Management

Environmental Assessment
DOI-BLM-NM-040-2014-01-EA
April, 2014

April 2014 Competitive Oil and Gas Lease Sale

*Ellis and Kay Counties, Oklahoma and
Jackson, Sabine, Shelby, and Wise Counties, Texas*

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**DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
OKLAHOMA FIELD OFFICE**

Project: April 2014 Competitive Oil and Gas Lease Sale

EA Log Number: DOI-BLM-NM-040-2014-01-EA

Location: Ellis and Kay Counties, Oklahoma and Jackson, Sabine, Shelby, and Wise Counties, Texas

Finding of No Significant Impact

Based on the analysis of potential environmental impacts contained in the attached Environmental Assessment (EA), I have determined the Proposed Action Alternative is not expected to have significant impacts on the environment.

The impacts of leasing the fluid minerals estate in the areas described within this EA have been previously analyzed in the Oklahoma Resources Management Plan (RMP) (1994), as amended, and the Texas RMP (1996), as amended. and the lease stipulations that accompany the tracts proposed for leasing would mitigate the impacts of future development on these tracts. Therefore, preparation of an Environmental Impact Statement (EIS) is not warranted.

Prepared by:

Melinda Fisher, Natural Resource Specialist

Date

Reviewed by:

Stephen G. Tryon, Oklahoma Field Office Manager

Date

Approved by:

Jesse J. Juen, State Director

Date

1.0 INTRODUCTION

It is the policy of the Bureau of Land Management (BLM) as derived from various laws, including the Mineral Leasing Act of 1920 (MLA), as amended [30 U.S.C. 181 *et seq.*], and the Federal Land Policy and Management of 1976 (FLPMA), as amended, to make mineral resources available for disposal and to manage for multiple resources which include the development of mineral resources to meet national, regional, and local needs.

The BLM New Mexico State Office (NMSO) conducts a quarterly competitive lease sale to offer available oil and gas lease parcels in New Mexico, Oklahoma, Texas, and Kansas. A Notice of Competitive Lease Sale (NCLS), which lists lease parcels to be offered at the auction, is published by the NMSO at least 90 days before the auction is held. Lease stipulations applicable to each parcel are specified in the Sale Notice. The decision as to which public land and minerals are open for leasing and what leasing stipulations are necessary, based on information available at the time, is made during the land use planning process. Surface management of non-BLM administered land overlaying Federal minerals is determined by the BLM in consultation with the appropriate surface management agency or the private surface owner.

In the process of preparing a lease sale the NMSO sends a draft parcel list to any field offices in which parcels are located. Field office staff then review the legal descriptions of the parcels to determine if they are in areas open to leasing; if new information has become available which might change any analysis conducted during the planning process; if appropriate consultations have been conducted of which potential bidders should be made aware. The parcels nominated for this sale, along with the appropriate stipulations from the Resource Management Plan (RMP), the Sabine National Forest (SNF), Sabine River Authority (SRA), and Lyndon B. Johnson National Grasslands (LBJ) are posted online for a two week public scoping period. Comments received are reviewed and incorporated into the environmental assessment (EA).

Once the draft parcel review is completed and returned to the NMSO, a list of nominated lease parcels with specific, applicable stipulations is made available online to the public through the NCLS. On rare occasions, additional information obtained after the publication of the NCLS may result in deferral of certain parcels prior to the lease sale.

This EA documents the review of the fifteen (15) parcels nominated for the April 2014 Competitive Oil and Gas Lease Sale, one (1) parcel which has multiple Surface Management Agencies (SMAs) within the same parcel. Five (5) of the 15 parcels are located on surface estate administered by the SNF, three (3) of the 15 are located on surface estate administered by the SRA, one (1) of the 15 parcels is located on surface estate administered by the Lavaca Navidad River Authority (LNRA), five (5) of the 15 parcels are located on surface estate administered by the LBJ, one (1) of the 15 parcels is located on surface estate administered by the OFO, and one (1) of the 15 parcels is located on split-estate private surface, with the Federal mineral estate under each administered by the Oklahoma Field Office (OFO). It serves to verify conformance with the approved land use plan as well as demonstrates the effectiveness of attaching the lease stipulations to specific parcels. Where the surface is administered by the Forest

Service or SRA and LNRA and the mineral estate is also federally owned, the Forest Service and BLM share the responsibility for enforcing mineral leasing policies and regulations. Forest Service regulations under 36 CFR 228.102(e) allow the agency to authorize the BLM to lease individual, specified areas of land administratively available for lease and include the stipulations determined to be necessary. The Forest Service is responsible for reviewing the effects of leasing the proposed parcels, although the final decision is made by the BLM authorizing official.

The BLM issues and administers oil and gas leases on Forest Service and SRA lands only after the agency authorizes leasing for specific lands. Once a Federal lease is issued on Forest Service lands, the Forest Service has the full responsibility and authority to approve and regulate all surface disturbing activities associated with oil and gas exploration and development through analysis and approval of the surface use plan of operation (SUPO) component of an Application for Permit to Drill (APD). The BLM has the authority and responsibility to provide final approval of all APDs including those for operations on Federal leases on Forest Service lands. Each APD includes a SUPO and a drilling plan. The BLM has the authority and responsibility to regulate all downhole operations and directly related surface activities and use, and provide approval of the drilling plan and final approval of the APD on Forest Service lands (USDA/USDI 2006). On SRA, Bureau of Reclamation (BOR) and split-estate lands, the BLM has the sole responsibility to regulate all surface disturbing activities associated with oil and gas exploration and development.

The parcels and applicable stipulations were posted online for a two-week public scoping period beginning on October 28, 2013. No comments were received. In addition, this EA will be made available for public review and comment for 30 days beginning on November 25, 2013. Comments provided prior to the lease sale will be considered and incorporated into the EA as appropriate.

1.1 Purpose and Need

The purpose is to provide opportunities for private individuals or companies to explore for and develop Federal oil and gas resources through a competitive leasing process.

The need for the action is established by the BLM's responsibility under the MLA, as amended, to promote the exploration and development of oil and gas on the public domain. The MLA also establishes that deposits of oil and gas owned by the United States are subject to disposition in the form and manner provided by the MLA under the rules and regulations prescribed by the Secretary of the Interior, where consistent with the FLPMA, the National Environmental Policy Act (NEPA) of 1969, as amended (Public Law 91-90, 42 USC 4321 *et seq.*), and other applicable laws, regulations, and policies.

The BLM will decide whether or not to lease the nominated parcels and, if so, under what terms and conditions.

1.2 Land Use Plan Conformance

The applicable land use plans for this action are the Oklahoma Resources Management Plan (RMP) (1994), as amended, and the Texas RMP (1996), as amended.

The Oklahoma RMP, as amended, describes specific split estate tracts in Oklahoma and the stipulations that would be attached to each tract if they were offered for lease. These stipulations which include seasonal timing limitations and other controlled surface use stipulations were designed to minimize or alleviate potential impacts to special resource values. All but one Oklahoma parcel under consideration falls within the identified tracts and the applicable stipulations identified in the Oklahoma RMP would be attached to each parcel. If all Oklahoma nominated and RMP identified tracts were leased, leasing the parcel would be in conformance with the Oklahoma RMP. Leasing the parcels would also be consistent with the RMPs goals and objectives for natural and cultural resources. The one parcel not described in the RMP will be deferred until it is analyzed in a Plan Amendment or in an RMP Revision.

The Texas RMP, as amended, does not specifically describe individual tracts of split estate; rather it broadly describes the split estate situation in Texas and includes “all Federal minerals underlying other Federal Surface Management Agencies (SMAs) lands as wells as split-estate (non-federal surface over Federal minerals)” (pg. 1). The RMP identifies the potential stipulations that could be attached to split-estate tracts that are proposed for leasing and states “All new leases and all expired leases that are reissued would be leased with surface resource protection stipulations. Mandatory stipulations would be incorporated into each lease where those stipulations apply. In addition, options stipulations will be included where resource values exist that warrant special protections” (pg. 8). The potential stipulations could include seasonal timing limitations and other controlled surface use stipulations which were designed to minimize or alleviate potential impacts to special resource values. Since the Texas parcels under consideration fall within this planning area and the applicable stipulations identified in the RMP would be attached to the parcels. If all nominated Texas parcels were leased, leasing the parcels would be in conformance with the Texas RMP. Leasing the split-estate parcels would also be consistent with the RMPs goals and objectives for natural and cultural resources.

For SMA parcels, the Oklahoma and Texas RMP state “the SMA is contacted for consent to lease and also for identification of specific agency surface protection stipulations”. The Forest Service was contacted regarding parcels in their jurisdiction. They submitted letters of Consent to Lease, along with specific stipulations to attach to each parcel. Leasing the SMA parcels is consistent with the Oklahoma and Texas RMP.

Pursuant to 40 CFR 1508.28 and 1502.21, this EA is tiered to and incorporates by reference the information and analysis contained in the RMP (1996), as amended. While it is unknown precisely when, where, or to what extent well sites or roads would be proposed, the analysis of projected surface disturbance impacts, should a lease be developed, is based on potential well densities listed in the Reasonable Foreseeable Development (RFD) Scenario included in both RMPs. While an appropriate level of site-specific analysis of individual wells or roads would occur when a lease holder submits an Application for Permit to Drill (APD), assumptions based on the RFD scenarios may be used in the analysis of impacts in this EA.

FLPMA established guidelines to provide for management, protection, development, and enhancement of public lands (Public Law 94-579). Section 103(e) of FLPMA defines public lands as any lands and interest in lands owned by the US, the BLM has no authority over use of the surface by the surface

owner; however, the BLM is required to declare how the federal mineral estate will be managed in the RMP including identification of all appropriate lease stipulations (43 CFR 3101.1 and 43 CFR 1601.0-7(b); BLM Manual Handbook 1601.009 and 1621-1).

1.3 Federal, State, or Local Permits, Licenses or Other Consultation Requirements

Purchasers of oil and gas leases are required to comply with all applicable federal, state, and local laws and regulations, including obtaining all necessary permits required should lease development occur.

OFO biologists reviewed the proposed action and determined it would be in compliance with threatened and endangered species management and consultation guidelines outlined in the Oklahoma and Texas RMP biological assessments (BA). No further consultation with US Fish and Wildlife (USFWS) is required at this leasing stage.

Compliance with National Historic Preservation Act (NHPA) Section 106 responsibilities are adhered to by following the BLM Manual 8100, 36 CFR Part 800, 43 CFR Part 7, and the Cultural Resources Handbook H-8100-1 (for New Mexico, Oklahoma, Kansas, and Texas). When draft parcels locations are received by the OFO, cultural resource staff reviews the location for any known cultural resources on BLM records.

Tribal consultations would be completed when specific locations for proposed projects are received, reviewed by the State Historic Preservation Office (SHPO), the Bureau of Indian Affairs (BIA), and specific Tribes. When particular Tribes respond during consultation, that tribe would be directly involved in negotiations with the BLM to determine if the project should be moved, or other mitigation required.

In Section 1835 of the Energy Policy Act of 2005 (43 USC 1508), Congress directed the Secretary of the Interior to review current policies and practices with respect to management of federal subsurface oil and gas development activities and their effects on privately owned surface. The Split Estate Report, submitted in December 2006, documents the findings resulting from consultation on the split estate issue with affected private surface owners, the oil and gas industry, and other interested parties.

NMSO contacts the surface owners and notifies them of the expression of interest and the date the oil and gas rights would be offered for competitive bidding. The BLM would provide the surface owners with its website address so they may obtain additional information related to the oil and gas leasing process, the imposition of any stipulations on that lease parcel, federal and state regulations, and best management practices (BMPs). The surface owners may elect to protest the leasing of the minerals underlying their surface.

If the BLM receives a protest, the parcel would remain on the lease sale. However, the BLM would resolve any protest prior to issuing an oil and gas lease for that parcel. If the protest is upheld, the BLM would return the payments received from the successful bidder for that parcel. After the lease sale has occurred, the BLM would post the results on its website and the surface owner may access the website to learn the results of the lease sale.

1.4 Identification of Issues

The parcels included the Proposed Action, along with the appropriate stipulations from the RMP and the Sabine National Forest, SRA, and BOR, were posted online at http://www.blm.gov/nm/st/en/prog/energy/oil_and_gas/oil_and_gas_lease.html for a two-week public scoping period beginning October 28, 2013. No comments were received.

An internal review of the Proposed Action, along with the appropriate stipulations from the RMP, the Sabine National Forest and BOR, was conducted by an interdisciplinary team of OFO resource specialists on January 17, 2013, to identify and consider potentially affected resources and associated issues. During the meeting, the interdisciplinary team also identified and subsequently addressed any unresolved issues or conflicts related to the Proposed Action.

- What effect *will* the proposed action have on atmospheric pollutants and contaminants?
- What effect *will* the proposed action have on climate change?
- What effect *will* the proposed action have on the watershed condition?
- What effect *will* the proposed action have on soil loss and contamination?
- What effect *will* the proposed action have on water quality in stream systems?
- What effect *will* the proposed action have on floodplains and the integrity of the floodplains?
- What effect *will* the proposed action have on wetland and riparian areas?
- What effect *will* the proposed action have on prime or unique farmlands?
- What effect *will* the proposed action have on known and newly discovered artifacts or areas of cultural, paleontological, and archeological significance?
- What effect *will* the proposed action have on the spread of non-native species?
- What effect *will* the proposed action have on vegetation loss, fragmentation, and regrowth?
- What effect *will* the proposed action have on federally listed and state-listed species that have the potential to be located on the proposed lease tracts?
- What effect *will* the proposed action have on Migratory Bird species?
- What effect *will* the proposed action have on wildlife and their habitat in general?
- What effect *will* the proposed action have on the management of fluid mineral drilling wastes produced and the potential for contamination in the proposed lease area?
- What effect *will* the proposed action have on locatable minerals management?
- What effect *will* the proposed action have on visual quality?
- What effect *will* the proposed action have on recreation in the recreational areas or on BLM owned lands?
- What effect *will* the proposed action have on state and local economies?
- What effect *will* the proposed action have on minority and low income populations?

Several issues were considered during internal scoping but dismissed from detailed analysis because there would be no potentially significant effects related to the issues resulting from any of the alternatives presented below. The following elements are determined by the IDT, following onsite visits,

review of the Oklahoma RMP (1994), as amended, and Texas RMP (1996), as amended and other data sources, to not be present:

- Areas of Critical Environmental Concern
- Livestock Grazing
- Wild Horse and Burros
- Public Health and Safety
- Rights-of-way
- Wild and Scenic Rivers
- Wilderness and Wilderness Study Areas
- Lands with wilderness characteristics
- Cave and Karst

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 Alternative A—No Action

The BLM NEPA Handbook (H-1790-1) states that for EAs on externally initiated proposed actions, the no action alternative generally means that the action would not take place. In the case of a lease sale, this would mean that an expression of interest to lease (parcel nomination) would be deferred, and the fifteen (15) parcels would not be offered for lease during the April 2014 Competitive Oil and Gas Lease Sale. Surface management and any ongoing oil and gas development on surrounding federal, private, and state leases would continue under current guidelines and practices. The selection of the no action alternative would not prevent these parcels from being nominated in a future lease sale.

2.2 Alternative B—Proposed Action

The Proposed Action would be to lease Federal minerals on fourteen (14) of fifteen (15) nominated lease parcels including:

- One (1) parcel totaling 27.660 acres administered by the BLM Oklahoma Field Office (OFO) and on private surface (split-estate) in Ellis County, OK
- One (1) parcel totaling 1273.760 acres administered by the Lavaca Navidad River Authority in Jackson County, TX.
- A portion of one (1) parcel totaling 35.300 acres administered by the Sabine National Forest in Sabine County, TX;
- Four (4) parcels totaling 754.000 acres administered by the Sabine National Forest in Sabine and Shelby Counties, TX;
- A portion of one (1) parcel totaling 123.700 acres administered by the Sabine River Authority in Sabine County, TX;
- Two (2) parcels totaling 172.000 acres administered by the Sabine River Authority in Sabine County, TX; and
- Five (5) parcels totaling 387.230 acres administered by the Lyndon B. Johnson National Grassland in Wise County, TX,

totaling 2773.650 acres offered for sale in the April 2014 Competitive Oil and Gas Lease Sale with the addition of further stipulations and lease notices to certain parcels administered by the OFO.

Standard terms and conditions as well as stipulations listed in the Oklahoma RMP (1994), as amended, and Texas RMP (1996), as amended, and stipulations identified by the SMAs would apply. A complete description of these parcels, including any stipulations, is provided in Table 1. A description of each stipulation is included in Appendix 1.

Table 1. Alternative B--Proposed Action Parcels

Parcel	Comments	Acres
<p><u>NM-201404-035</u></p> <p>T.0160N, R.0240W, IM PM, Sec. 005 REMAINDER LOT 4 Sec. 005 ACCR & RIP to LOT 4</p> <p>Ellis County, OK</p>	<p><u>Lease with the following Stipulations:</u> ORA-LN-3: Floodplain Management Notice ORA-1: Floodplain Protection ORA-2:Wetland/Riparian Protection ORA-3: Season of Use Stipulation Lesser Prairie Chicken NM-10: Drainage WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	<p>27.660</p>
<p><u>NM-201404-037</u></p> <p>TX 239 TR IC-57, IC-70, TR IC-72-1, IC-72-2, TR IC-73, IC-77-1; TR IC-77-2, IC-78, TR IC-79-1, IC-79-2, TR IC-80, IC-97, TR IC-107-1, TR IC-108, IC-109 TR IC-110, IC-111, TR IC-112-1 TR IC-112-2, TR IC-112-3; TR IC-196-1, TR IC-196-2; TR IC-114-1, IC-115; TR IC-157</p> <p>Jackson County, OK</p>	<p><u>Other Surface Management Agency (SMA):</u> Lavaca Navidad River Authority</p> <p><u>Lease with the following BLM Stipulations:</u> LNRA-GS: Palmetto Bend General Stipulations ORA-1: Floodplain Protection NSO/ND: No surface occupancy, No Drilling on 100% mineral interest (1133.02 acres) WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	<p>1273.760</p>
<p><u>NM-201404-038</u></p> <p>TX 403 TR S-38C, S-1381</p> <p>Sabine County, TX</p>	<p><u>Other Surface Management Agency (SMA):</u> Sabine River Authority</p> <p><u>Lease with the following BLM Stipulations:</u> ORA-1: Floodplain Protection ORA-4: No Surface Occupancy, Directional Drilling Only WO-ESA-7: Threatened & Endangered Species Consultation WO-NHPA: Tribal & Cultural Consultation</p>	<p>122.00</p>

Parcel	Comments	Acres
<u>NM-201404-039</u> TX 403 TR S-1AT Sabine County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Sabine National Forest (35.30 acres) Sabine River Authority (123.70 acres) <u>Lease with the following FS Stipulations (applies to 35.30 acres):</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU-1E: Toledo Bend Lakeshore Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection FS8 (TX) TLS-1B: Bald Eagle Timing Stipulation FS8 (TX) LN-4B: FS-COE Joint Approval Notice <u>Lease with the following BLM Stipulations (applies to 123.70 acres):</u> ORA-1: Floodplain Protection ORA-4: No Surface Occupancy, Directional Drilling Only WO-ESA-7: Threatened & Endangered Species Consultation WO-NHPA: Tribal & Cultural Consultation	159.00
<u>NM-201404-040</u> TX 403 TR S-2U Sabine County, TX	<u>Other Surface Management Agency (SMA):</u> Sabine River Authority <u>Lease with the following BLM Stipulations:</u> ORA-1: Floodplain Protection ORA-4: No Surface Occupancy, Directional Drilling Only WO-ESA-7: Threatened & Endangered Species Consultation WO-NHPA: Tribal & Cultural Consultation	50.000
<u>NM-201404-041</u> TX 403 TR S-1AL Sabine County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Sabine National Forest <u>Lease with the following Stipulations:</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	237.000
<u>NM-201404-042</u> TX 403 TR S-2O Sabine County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Sabine National Forest <u>Lease with the following Stipulations:</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	110.000
<u>NM-201404-043</u> TX 403 TR S-14A Sabine County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Sabine National Forest <u>Lease with the following Stipulations:</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection	305.000

Parcel	Comments	Acres
<u>NM-201404-044</u> TX 419 TR S-1-IX, S-1-XI Shelby County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Sabine National Forest <u>Lease with the following FS Stipulations:</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1A: Streamside Management Zone (floodplain, wetland) Protection FS8 (TX) CSU1-I2: Red-Cockaded Woodpecker Protection FS8 (TX) TLS-1B: Bald Eagle Timing Stipulation (TR S-1-XI) NM-10: Drainage	102.200
<u>NM-201404-045</u> TX 497 TR 672 Wise County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Lyndon B. Johnson National Grasslands <u>Lease with the following FS Stipulations:</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1B: Perennial & Intermittent Stream Protection FS8 (TX) CSU-1K: Flood Prevention & Erosion Control NM-10: Drainage	101.840
<u>NM-201404-046</u> TX 497 TR 609 Wise County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Lyndon B. Johnson National Grasslands <u>Lease with the following FS Stipulations:</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1B: Perennial & Intermittent Stream Protection FS8 (TX) CSU-1K: Flood Prevention & Erosion Control	36.460
<u>NM-201404-047</u> TX 497 TR 390 PARCEL 3 Wise County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Lyndon B. Johnson National Grasslands <u>Lease with the following FS Stipulations:</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1B: Perennial & Intermittent Stream Protection FS8 (TX) CSU-1K: Flood Prevention & Erosion Control NM-10: Drainage	39.930
<u>NM-201404-048</u> TX 497 TR 373 Wise County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Lyndon B. Johnson National Grasslands <u>Lease with the following FS Stipulations:</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1B: Perennial & Intermittent Stream Protection FS8 (TX) CSU-1K: Flood Prevention & Erosion Control NM-10: Drainage	81.430
<u>NM-201404-049</u> TX 497 TR 354 Wise County, TX	<u>Other Surface Management Agency (SMA):</u> U.S. Forest Service (USFS), Lyndon B. Johnson National Grasslands <u>Lease with the following FS Stipulations:</u> FS1 (Lufkin): Secretary of Agriculture Rules and Regulations FS8 (TX) CSU-1B: Perennial & Intermittent Stream Protection FS8 (TX) CSU-1K: Flood Prevention & Erosion Control NM-10: Drainage	127.570

Sabine National Forest stipulations are attached to a portion of 1 parcel (-039) and all acreage of four (4) parcels, including -041 through -044. LBJ stipulations are attached to all acreage of five (5) parcels, including -045 through -049.

The OFO identified stipulations for SRA and split-estate portions of the parcels. ORA-4 would be attached to a portion of parcel -039 and all acreage of parcels -038 and -040, which states no surface occupancy would be permitted on the parcel and only permit directional drilling. These parcels are located within the Toledo Bend Reservoir and currently inundated with water.

LNRA attached Palmetto Bend General Stipulations (LNRA-GS) to proposed parcel -037, which include requirements and stipulations related to pre-drilling condition, safety, drilling pad and reserve pit (if approved), producing and non-producing wells, roads and general practices and LNRA expectations of the lessee.

Proposed parcel -035 occurs within floodplains and would have lease stipulation LN-3 for Floodplain Protection and ORA-1 Floodplain Protection attached. ORA-1 would also be attached to -037, -038, -039 (SRA portion), and -040. The Floodplain Protection Lease Notice informs the lessee and operator that surface occupancy of these areas and surface disturbance within up to 200 meters of the outer edge of the floodplain may not be allowed in order to protect the integrity and functionality of the floodplain and associated watercourse. Furthermore, controlled surface use requiring special mitigation measures may be required and will be developed during the application for permit to drill.

Proposed lease parcel -035 would also have ORA-2 Wetland/Riparian Protection stipulations added. ORA-2 is intended for the protection of wetland and/or riparian areas and states that "Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the BLM. Impacts or disturbance to wetlands and riparian habitats which occur on this lease must be avoided or mitigated."

Proposed parcel -035 is within Lesser Prairie Chicken Habitat and would have ORA-3 stipulations added to it, which states that no surface occupancy of the lease would occur from February 15 to May 15.

Proposed parcel -035, -044, -045, -047, -048 and -049 would have NM-10: Drainage attached. NM-10 informs the lessee that the lease is subject to drainage by well(s) located adjacent to the lease. Additional requirements are required by the lessee to show how they intend to protect the lease from drainage or be assessed a compensatory royalty.

Two lease notices, WO-ESA-7 and WO-NHPH, would also be attached to these parcels as well as to parcels -035 and -037 – -040. These notices would notify the lease holder that the BLM reserves direction to modify, if necessary, any action proposed on the lease to ensure:

- Threatened, endangered, or other special status species, and their habitats (WO-ESA-7) and

- Historic properties and/or resources protected under the National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders (WO-NHPH)

would not be adversely affected. Under the Endangered Species Act (ESA) of 1973, as amended, Section 7 Consultation with the USFWS would occur if development is proposed on a lease containing habitat suitable for these special status species. Under the National Historic Preservation Act (NHPA) and other authorities, the BLM would undergo consultation with the State Historic Preservation Officer and any interested or affected tribes prior to approving any development activities.

Once sold, the lease purchaser would have the exclusive right to use as much of the leased lands as would be necessary to explore and drill for oil and gas within the lease boundaries, subject to stipulations attached to the lease; restrictions deriving from specific, nondiscretionary statutes; and such reasonable measures as may be required by the authorized officer to minimize adverse impacts to other resource values, land uses or users not addressed in the lease stipulations at the time operations are proposed (43 CFR 3101). Oil and gas leases are issued for a 10-year period and continue for as long thereafter as oil or gas is produced in paying quantities. If a lease holder fails to produce oil and gas, does not make annual rental payments, does not comply with the terms and conditions of the lease, or relinquishes the lease, exclusive right to develop the leasehold reverts back to the federal government and the lease can be reoffered in another lease sale.

Reasonably Foreseeable Development

At the leasing stage, it is uncertain if Applications for Permit to Drill on leased parcels would be received, nor is it known if or to what extent development would occur. Such development may include constructing a well pad and access road, drilling a well using a conventional pit system or closed-loop system, hydraulically fracturing the well, installing pipelines and/or hauling produced fluids, regularly monitoring the well, and completing work-over tasks throughout the life of the well. In Oklahoma and Texas, typically, all of these actions are undertaken during development of an oil or gas well; it is reasonably foreseeable that they may occur on leased parcels. See Appendix 3 for a complete description of the phases of oil and gas development.

Drilling of wells on a lease would not be permitted until the lease owner or operator secures approval of a drilling permit and a surface use plan as specified under Onshore Oil and Gas Orders (43 CFR 3162). A permit to drill would not be authorized until site-specific NEPA analysis is conducted.

Standard terms and conditions, stipulations listed in the Oklahoma and Texas RMPs, and any new stipulations would apply as appropriate to each lease. In addition, site specific mitigation measures and BMPs would be attached as Conditions of Approval (COAs) for each proposed exploration and development activity authorized on a lease.

2.3 Alternatives Considered But Eliminated From Detailed Analysis

The OFO considered one alternative that would lease all fifteen (15) parcels but it was eliminated from further analysis because one parcel (Table 2) was not described in the 1994 Oklahoma RMP or analyzed

in the FEIS and is thus not in conformance with the RMP. The parcel will be deferred until an RMP Amendment or RMP Revision is completed.

Table 2. Proposed Action—Parcels Deferred

Parcel	Comments	Acres
<u>NM-201404-036</u> T.0160N, R.0240W, IM PM, Sec. 005 REMAINDER LOT 4 Sec. 005 ACCR & RIP to LOT 4 Ellis County, OK	Not analyzed in the Oklahoma RMP	5.00

3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

This section describes the environment that would be affected by implementation of the alternatives described in Section 2. Aspects of the affected environment described in this section focus on the relevant resources and issues. Only those elements of the affected environment that have potential to be significantly impacted are described in detail.

The one private surface parcel, one LNRA parcels, and three SRA parcels will be analyzed in detail in this EA. The SNF and LBJ analyzed the environmental effects associated with leasing their portions of the 10 Forest Service surface parcels identified in this document. After a review conducted by the OFO staff in the fall of 2013, the OFO concluded that there have not been any changed circumstances that would render these analyses invalid. Hence, the following resource analysis tiers to and incorporates by reference the information and analysis contained in the U.S. Forest Service EIS.

Ellis County, Oklahoma (Parcel -035)

Proposed lease parcel -035 is along the southern boundary of Ellis County at an elevation of about 2,050 feet above sea level. Ellis County is L-shaped, bounded on the north by Harper County; on the east by Woodward and Dewey Counties; on the south by Roger mills County (across the Canadian River); and on the west by the state of Texas. The county has a total area of 1,232 square miles (788,480 acres), of which 3 square miles (1,920 acres) is water.

Ellis County is served by four U.S. Highways (60, 270, 283 and 412) and four State Highways (3, 15, 46, and 51), and numerous county and private roads. Some of the county roads have been surfaced and are suitable for all-weather travel.

Jackson County, Texas (Parcel -037)

The proposed parcel is north central part of Jackson County at an elevation ranging from 35 to 60 feet above sea level. Jackson County is bordered to the north by Colorado County; by Wharton County to the northeast; Matagorda County to the southeast; Calhoun County to the south; Victoria County to the southwest; and Lavaca County to the northwest. Jackson County covers an area of 548,480 acres (857 square miles), of which 530,560 acres (829 square miles) is land (96.7%) and 17,920 acres (28 square miles) is water (3.3%).

Several hard-surfaced federal and state highways pass through Jackson County, including U.S. Highway 59 and two state highways (SH 111 and 172). Several hard-surfaced and gravel county and private roads are kept in passable condition throughout the year. The roads are generally in good condition.

Sabine County (Parcels -038, -039, and -040)

The proposed parcels are along the eastern boundary of Sabine County underlying the Toledo Bend Reservoir. Sabine County is bordered to the east by the Toledo Bend Reservoir, which adjoins Louisiana; to the southeast by Newton County; to the southwest by Jasper County; to the west by San Augustine; and to the north by Shelby County. The nearly level to very steep topography of Sabine County covers an

area of 314,489 acres (491 square miles), of which 267,001 acres (416.8 square miles) is land (84.9%) and 47,487 acres (74.2 square miles) is water (14.9%).

Several hard-surfaced federal and state highways pass through Sabine County, including U.S. Highway 96 and three state highways (SH 21, 87, and 103). Several hard-surfaced and gravel county and private roads are kept in passable condition throughout the year. The roads are generally in good condition.

3.1 Air Resources

Air quality and climate are components of air resources which may be affected by BLM applications, activities, and resource management. Therefore, the BLM must consider and analyze the potential effects of BLM and BLM-authorized activities on air resources as part of the planning and decision making process. Much of the information referenced in this section is incorporated from the Air Resources Technical Report for BLM Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas (Air Resources Technical Report)(BLM 2013). This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

3.1.1 Air Quality

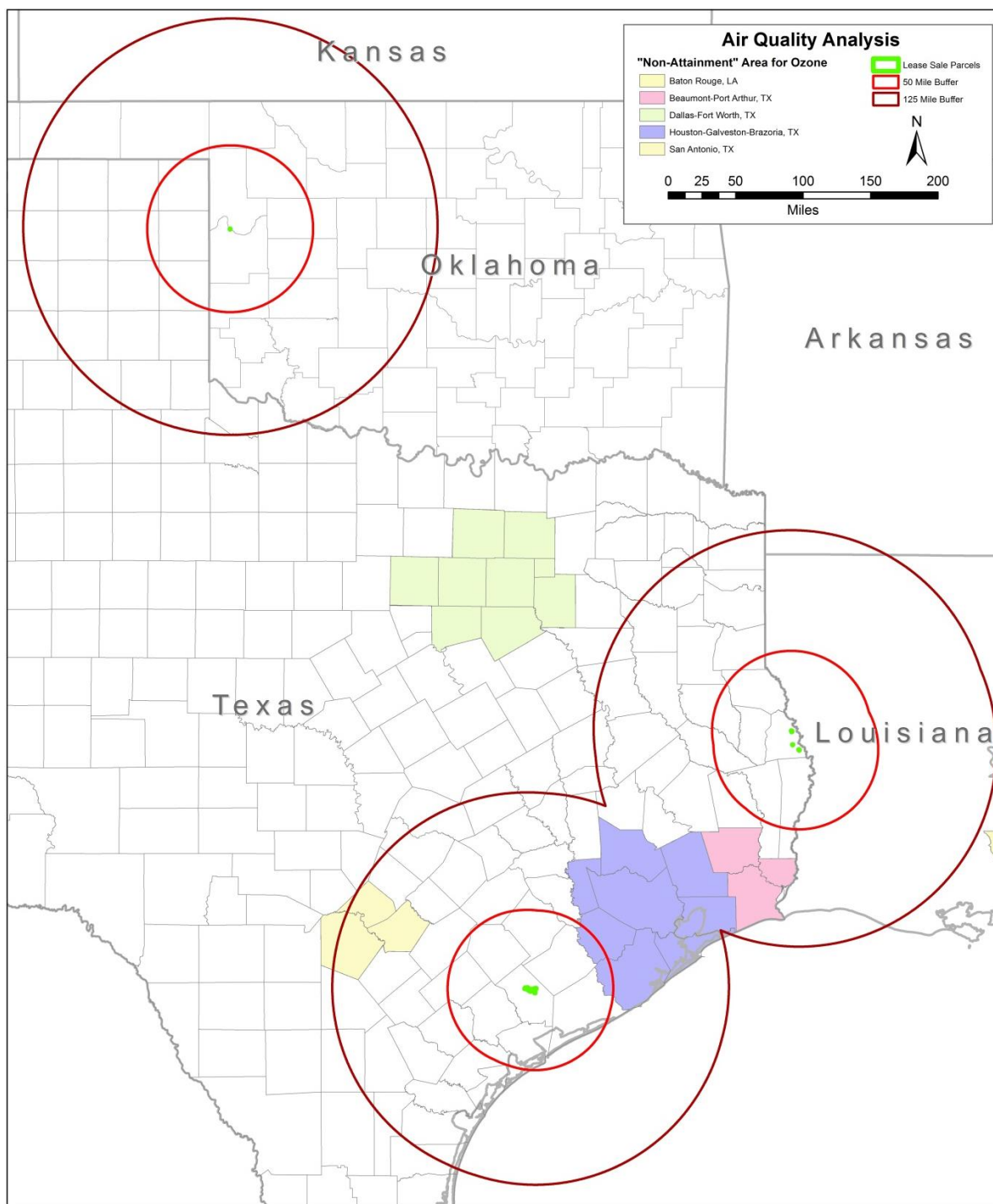
The Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality nationwide, including six “criteria” air pollutants. These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM₁₀ & PM_{2.5}), sulfur dioxide (SO₂) and lead (Pb). EPA has established National Ambient Air Quality Standards (NAAQS) for criteria air pollutants. The NAAQS are protective of human health and the environment. EPA has approved Texas’ State Implementation Plan and the state enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands.

The area of the analysis is considered a Class II air quality area by the EPA. There are three classifications of areas that attain national ambient air quality standards, Class I, Class II and Class III. Congress established certain national parks and wilderness areas as mandatory Class I areas where only a small amount of air quality degradation is allowed. All other areas of the U.S. are designated as Class II, which allow a moderate amount of air quality degradation. No areas of the U.S. have been designated Class III, which would allow more air quality degradation. The primary sources of air pollution are dust from blowing wind on disturbed or exposed soil, exhaust emissions from motorized equipment, oil and gas development, agriculture, and industrial sources.

Proposed parcel -035 in Oklahoma is greater than 200 miles from the nearest “non-attainment” area and greater than 70 miles from a Class I designated area. All Texas proposed parcels are less than 75 miles from at least one EPA designated “non-attainment” area (O₃) while five “non-attainment” areas were identified less than 200 miles from the Texas proposed parcels. Proposed parcel -037 is less than 50 miles west of the Houston-Galveston-Brazoria, TX “non-attainment” area; less than 100 miles east of the San Antonio, TX “non-attainment” area; and less than 170 miles west of the Beaumont-Port Arthur, TX “non-attainment” area. All parcels in Sabine County (-038--040) are less than 100 miles north of the

Beaumont-Port Arthur, TX and Houston-Galveston-Brazoria, TX “non-attainment” areas; less than 175 miles northwest of the Dallas-Ft. Worth “non-attainment” area; and less than 160 miles northwest of the Baton Rouge, LA “non-attainment” area (Figure 1). All Texas parcels are greater than 200 miles south of the nearest Class I designated area.

Figure 1. “Non-attainment” areas near the proposed lease parcels (50 mile and 125 mile buffers around parcels).



Current Pollution concentrations

“Design Concentrations” are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. Several of the pollutant concentrations are not expected to be elevated in rural areas, thus there is no available data or no monitoring conducted within 100 miles of the Ellis County, OK and Sabine County, TX parcels for several pollutants. The 2012 design concentrations of criteria pollutants are listed in Table 3.

Table 3. 2012 Design Concentrations of Criteria Pollutants (EPA 2013)

Pollutant	Design Value (County)*	Averaging period	NAAQS
O ₃	0.073 ppm (Dewey, OK)	8-hour	0.075 ppm ¹
	0.069 ppm (Victoria, TX)		
	0.074 ppm (Orange and Harrison, TX)		
PM _{2.5}	No data available (Caddo, OK) ⁺	Annual	12.0 µg/m ^{3,2}
	12.1 µg/m ³ (Harris, TX)		
	No data available (Orange, TX)		
PM _{2.5}	No data available (Caddo, TX)	24-hour	35 µg/m ^{3,3}
	24 µg/m ³ (Harris, TX)		
	No data available (Orange, TX)		
PM ₁₀	No data available (Caddo, OK)	24-hour	150 µg/m ^{3,5}
	0 exceedances/ year (Harris, TX)		
	0 exceedances/ year (Harrison, TX)		
Pb	No data available (OK)	Rolling 3-month average	0.15 µg/m ³
	0.01 µg/m ³ (Harris, TX)		
	No data available (TX)		
NO ₂	No data available (OK)	Annual	53 ppb
	4 ppb (Brazoria, TX)		
	5 ppb/4 ppb (Orange/Harrison, TX)		
NO ₂	No data available (OK)	1-hour	100 ppb ³
	20 ppb (Brazoria, TX)		
	32 ppb/24 ppb (Orange/Harrison, TX)		
SO ₂	No data available (OK)	Annual	30 ppb ⁶
	1 ppb (Galveston and Harris, TX)		
	1 ppb (Jefferson, TX)		
SO ₂	No data available (OK)	1-hour	75 ppb ⁶
	26 ppb/38 ppb (Galveston/Harris, TX)		
	51 ppb (Jefferson, TX)		
CO	No data available (OK)	8-hour	9 ppm ⁴
	0.3 ppm/1.9 ppm (Travis/Harris, TX)		
	No data available (TX)		
CO	No data available (OK)	1-hour	35 ppm ⁴
	0.7 ppm/2.3 ppm (Travis/Harris, TX)		
	No data available (TX)		

* Nearest County to proposed parcels with monitoring

⁺ Incomplete data or no monitoring stations within 100 miles

¹ Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years

² Annual mean, averaged over 3 years

³ 98th percentile, averaged over 3 years

⁴ Not to be exceeded more than once per year

⁵ Not to be exceeded more than once per year on average over 3 years

⁶ 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

Air quality in a given region can be measured by its Air Quality Index (AQI) value. The AQI is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into six categories: good (AQI<50), moderate (50-100), unhealthy for sensitive groups (100-150), unhealthy (>150), very unhealthy and hazardous. The AQI is a national index, the air quality rating and the associated level of health concern is the same everywhere in the country. The AQI is an important indicator for populations sensitive to air quality changes.

Mean AQI values in or near the proposed lease parcels were generally in the good range (AQI<50) in 2012. Ninety-seven percent of the days in 2012 were classified as “good” in Ellis County, OK and Victoria County, TX, while 84 percent of the days were classified as “good” in Orange County, TX. Two and one half percent of the days in Ellis County, TX and Victoria County, TX were classified as “moderate” and 15 percent of the days in Orange County, TX were classified as “moderate.” Ellis and Victoria Counties did not have any days classified as “unhealthy for sensitive groups,” while Orange County had 4 days classified as “unhealthy for sensitive groups.” The median AQI was 25 in Ellis County, OK; 28 in Victoria County, TX; and 37 in Orange County, TX; all considered “good.” The maximum AQI was 59 in Ellis County, OK; 84 in Victoria County, TX, and 133 in Orange County, TX. The air quality index near the Texas parcels annually reach “unhealthy for sensitive groups” on a number of days each year, while the Oklahoma parcel county has not reached “unhealthy for sensitive groups” in nearly a decade. Over the past decade, there appears to be a trend toward improved air quality, with fewer “very unhealthy” and “unhealthy” days and a downward trend in the total number of “unhealthy for sensitive groups” days in the past decade (Table 4). Recent years’ improvement in the air quality index may be due to reduced air pollution resulting from local, state and national regulations aimed at reducing ozone and particulate matter concentrations.

Table 4. Number of Days classified as “unhealthy for sensitive groups” or worse (EPA 2013a). Unhealthy for sensitive groups/unhealthy/very unhealthy

County	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Ellis, OK	1/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Victoria, TX ⁺	9/1/2	5/1	15/0/1	10/2	7/1	3/0	0/0	4/0	8/0	9/0
Orange, TX ⁺⁺	12/1	5/1	10/0	7/0	3/0	1/0	2/0	6/0	5/0	4/0

⁺Proxy for Jackson County

⁺⁺Proxy for Sabine County

*ND: No Data

3.1.2 Climate

Oklahoma's climate ranges from humid subtropical in the east to semi-arid in the west. Warm, moist air moving northward from the Gulf of Mexico often exerts much influence, particularly over the southern and eastern portions of the state, where humidity, cloudiness and precipitation are resultantly greater than in the western and northern sections. Summers are long and usually quite hot. Winters are short and less severe than those of the more northern Plains states. Periods of extreme cold are infrequent, and those lasting more than a few days are rare.

Texas lies within both "cool" and "warm" parts of the Temperate Zone of the northern hemisphere. There are three major climatic types which are classified as Continental, Mountain, and Modified Marine. There are no distinct boundaries which divide these climate types. Most of the State, climatologically, has a Modified Marine climate which is classified and named "subtropical" with four subheadings. A marine climate is caused by the predominant onshore flow of tropical maritime air from the Gulf of Mexico. The onshore flow is modified by a decrease in moisture content from east to west and by intermittent seasonal intrusions of continental air. The four subheadings of Subtropical—humid, subhumid, semi-arid and arid—account for the changes in moisture content of the northward flow of Gulf air across the State (Larkin and Bomar 1983).

Jackson and Sabine Counties, TX lie within the subtropical humid climate region of Texas. Subtropical humid climate is characterized by hot, humid summers and generally mild to cool winters, with evenly distributed precipitation throughout the year.

Table 5. Summary of climate components that could affect air quality in the region.

Climate Component	Ellis County, OK	Jackson County, TX	Sabine County, TX
Mean maximum summer temperatures	98.1°F	42.8°F	92.1°F
Mean minimum winter temperatures	23.2°F	93.4°F	37.9°F
Mean annual temperature	56.2°F	69.6°F	65.3°F
Total annual precipitation	25.98 inches	43.25 inches	54.92 inches
Total annual snowfall	13.41 inches	0.05 inches	0.2 inches
Mean annual wind speed	14.01 mph	14.82 mph	16.01 mph
Prevailing Wind Direction	South/southwest	South	South

In addition to the air quality information in the Oklahoma and Texas RMPs, new information about greenhouse gases (GHGs) and their effects on national and global climate conditions has emerged since the RMP was prepared. Global mean surface temperatures have increased nearly 0.8°C (1.4°F) from 1880 to 2012 (Goddard Institute for Space Studies, 2013). However, observations and predictive models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Without additional meteorological monitoring and modeling systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs are likely to accelerate the rate of climate change.

GHGs that are included in the US GHG Inventory are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). CO₂ and CH₄

are typically emitted from combustion activities or are directly emitted into the atmosphere. On-going scientific research has identified the potential impacts of GHG emissions (including CO₂, CH₄, N₂O; and several trace gases) on global climate. Through complex interactions on regional and global scales, these GHG emissions cause a net warming effect of the atmosphere (which make surface temperatures suitable for life on Earth), primarily by decreasing the amount of heat energy radiated by the Earth back into space. Although GHG 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. Increasing CO₂ concentrations may also lead to preferential fertilization and growth of specific plant species.

In 2007, the Intergovernmental Panel on Climate Change (IPCC) predicted that by the year 2100, global average surface temperatures would increase 1.4°C to 5.8°C (2.5°F to 10.4°F) above 1990 levels. The National Academy of Sciences (2006) supports these predictions, but has acknowledged that there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increase in daily minimum temperatures are more likely than increases in daily maximum temperatures. It is not, however, possible at this time to predict with any certainty the causal connection of site specific emissions from sources to impacts on the global/regional climate relative to the proposed lease parcel and subsequent actions of oil and gas development.

A 2007 US Government Accountability Office (GAO) Report on Climate Change found that, “federal land and water resources are vulnerable to a wide range of effects from climate change, some of which are already occurring. These effects include, among others: 1) physical effects such as droughts, floods, glacial melting, and sea level rise; 2) biological effects, such as increases in insect and disease infestations, shifts in species distribution, and changes in the timing of natural events; and 3) economic and social effects, such as adverse impacts on tourism, infrastructure, fishing, and other resource uses.”

A number of activities contribute to the phenomenon of climate change, including emissions of GHGs (especially CO₂ and CH₄) from fossil fuel development, large wildfires, activities using combustion engines, changes to the natural carbon cycle, and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs will have a sustained climatic impact over different temporal scales due to their differences in global warming potential (described above) and life span of the atmosphere.

3.2 Soils

The varied climate and topography of Oklahoma and Texas have combined to produce broad differences in state soils. In the eastern part of the state, soils have been developed where leaching is intense and conditions are humid. These conditions produce soils low in phosphorous and potassium, while at the same time being moderately to strongly acidic.

The Natural Resource Conservation Service (NRCS) has surveyed the soils in the proposed parcels. Only three soil types were identified in one parcel; the remaining parcels were classified as water (Table 6).

The NRCS has assigned a wind erodibility index value to each soil type. The value indicates the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. The higher the value indicates higher susceptibility and more tons per acre lost per year from wind, with the highest value being 330. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion. Six index values were identified from the proposed parcels ranging from 48 to 180 tons per year (Table 6). In proposed parcel -035 and -037, the soil becomes more susceptible to wind erosion as the topography slopes towards the water and where there is a higher percentage of sand in the soil.

The NRCS has also assigned an erosion Factor K, which indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised USLE to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. Seven values ranging from 0.17 to .48 were identified for the proposed lease parcels (Table 6) indicating moderate to high susceptibility to soil loss by sheet and rill erosion.

Table 6. Soil properties of the proposed lease parcels.

Parcel	Soil Name	Soil Symbol	Acres in Area	% in area	Erosion K Factor	Wind Erodibility Index	Farmlands, Prime or Unique *
-035	Lincoln fine sandy loam, 0 to 1 percent slopes, occasionally flooded	LnnA	14.9	67.6	.20	86	N
	Sweetwater silt loam, 0 to 1 percent slopes, frequently flooded	Sw	3.8	17.2	.28	38	N
	Water	W	3.3	15.2	-	-	N
-037	Chicolete clay, frequently flooded	Ch	63.4	UNK	.32	86	N
	Dacosta sandy clay loam, 0 to 1 percent slopes	DaA	49.5	UNK	.32	48	Y
	Dacosta sandy loam, 1 to 3 percent slopes	DaB	162.1	UNK	.32	48	Y
	Fordtran loamy fine sand, 0 to 2 percent slopes	FaB	4.8	UNK	.48	134	N
	Ganado clay, frequently flooded	Ga	672.4	UNK	.32	86	N
	Inez fine sandy	InB	8.7	UNK	.37	86	Y

	loam, 0 to 2 percent slopes						
	Kury sand, 1 to 5 percent slopes	KuC	10.3	UNK	.17	180	N
	Laewest clay, 0 to 1 percent slopes	LaA	7.3	UNK	.32	86	Y
	Laewest clay, 1 to 3 percent slopes	LaB	57.7	UNK	.32	86	Y
	Laewest clay, 3 to 8 percent slopes, eroded	LaD3	0.2	UNK	.32	86	N
	Marcado sandy loam, 3 to 8 percent slopes	MaC	149.9	UNK	.32	56	N
	Milby sand, 0 to 2 percent slopes	MbB	3.4	UNK	.17	180	N
	Texana-Cieno complex, 0 to 1 percent slopes	TxA	13.5	UNK	.43	86	YD
	Water	W	935.0	--	--	--	N
-038	Water	W	122.0	100	--	--	--
-039	Water	W	123.7	100	--	--	--
-040	Water	W	50.0	100	--	--	--

*N: Not prime or unique farmland; Y: Prime Farmland; YD: Prime farmland if drained

3.3 Water Resources

3.3.1 Surface water

Oklahoma and Texas both have abundant surface water resources include rivers, streams, and man-made and natural reservoirs. Oklahoma has two major river basins: the Red River and Arkansas River basins. Texas has 23 surface water basins, including 15 major river basins and eight coastal basins, each with varying hydrological regimes and abilities to provide water supplies.

Precipitation is the source of virtually all surface water in Oklahoma. The entire state is drained by the Arkansas and Red Rivers and their tributaries. A large number of reservoirs, lakes, and ponds have been constructed on rivers and streams for flood control and to provide a dependable supply of surface water for municipalities, irrigation, recreation, and generation of electricity. About 80 percent of all water used by municipalities and industries is taken from surface water sources. Each year, approximately 10.5 million acre-feet of water flows into Oklahoma through its two major river basins, while an average of 36 million acre-feet flows out of the state each year.

Texas has approximately 191,000 miles of streams and 196 major reservoirs. Texas' water availability models estimate that available surface water during drought was 13.3 million acre-feet in 2010. Of this amount, only 9.0 million acre-feet can be used as existing supply due to physical and legal constraints. Existing surface water supply is projected to decrease to 8.4 million acre-feet by 2060, primarily from sedimentation of existing reservoirs.

Ellis County, OK

The proposed parcel lies within the Arkansas River Basin. The Arkansas River originates near Leadville, Colorado, flows east to Great Bend, Kansas, then southeast entering Oklahoma in Kay County, and then flows into Arkansas near Fort Smith before eventually entering the Mississippi River in southeastern Arkansas.

The North Canadian (Beaver) River, the Canadian River, and Wolf Creek provide drainage and have shaped the relief in the county. The North Canadian River drains about one-fifth of the county. The Canadian River drains the southern two-fifth of the county. The only large stream in the region is Wolf Creek, which flows northeastward, uniting with the North Fork of Canadian River about 25 miles northeast of Gage. Approximately 11 acres of proposed parcel -035 overlaps the Canadian River and is considered riverbed accretion land.

Proposed parcel -035 is within the Lower Canadian-Deer watershed (USGS 11090201). The nearest impaired waters are greater than 15 miles to the east and northwest.

Jackson County, TX

Proposed lease parcel -037 is within the Lavaca River Basin. The Lavaca Basin covers the smallest area of the major river basins in Texas. From its headwaters in Gozales County, the Lavaca River flows to Lavaca Bay, which, drains to the Gulf of Mexico. Other streams within the basin include the Navidad River, Sandy Creek, and East and West Mustang Creeks. The basin has one major reservoir (Lake Texana) with a conservation storage capacity of 157,900 acre-feet or about 68 acre-feet/square mile. The basin is an important water supply to coastal areas outside the basin that are experiencing population growth and increased demands for water.

The proposed parcel is along the banks of Lake Texana, which is also known as Palmetto Bend Dam and Reservoir, Stage I. It is located seven miles east of Edna, TX on the Navidad River, a major tributary to Lavaca River. The lake and dam are managed by the Lavaca-Navidad River Authority for municipal and industrial water supply and recreational purposes. Congress authorized the Palmetto Bend Reclamation Project in October 1968 as a drainage control feature. Bureau of Reclamation began dam construction in 1976 and completed it in 1979. The reservoir can store 159,845 acre-feet of water and encompass a surface area of about 9.676 at the conservation pool elevation of 44 feet above mean sea level.

Proposed parcel -037 is within the Navidad watershed (USGS 12100102). The nearest impaired water is greater than 9.0 miles to the west.

Sabine County, TX

The proposed lease parcels are within the Sabine River Basin. The basin has the second largest average watershed yield of any major river basin in Texas because of the region's high precipitation and low evaporation rates. The major river in the basin is the Sabine River, which flows from its head-waters in Hunt County and forms much of the border between Texas and Louisiana before draining to the Gulf of Mexico through Sabine Lake. The basin has 2 major reservoirs with a conservation storage capacity of

6,041,300 acre-feet or about 814 acre-feet/square mile. The Sabine River has the second largest average flow volume of any river in Texas. The SRA portion (295.7 acres) of the proposed lease parcels underlay the Toledo Bend Reservoir, which was created by damming the Sabine River.

The Toledo Bend Reservoir is the largest man-made body of water in the south and the fifth largest in surface acres in the U.S., with water normally covering an area of 185,000 acres and have a controlled storage capacity of 4,477,000 acre-feet (1,448,934,927,000 gallons) of water. The Toledo Bend was constructed by the Sabine River Authority of Texas, and the Sabine River Authority, State of Louisiana, primarily for the purposes of water supply, hydroelectric power generation, and recreation. The operation of the reservoir for hydroelectric power generation and water supply provides a dependable yield of 1,868 million gallons per day, which is shared equally by Texas and Louisiana. Most of this water is passed through the turbines for the generation of electrical power and is available for municipal, industrial, and agricultural purposes.

The proposed parcels are within the Toledo Bend Reservoir watershed (USGS 12010004). All of the parcels are overlain by a listed, impaired water (Toledo Bend Reservoir). Toledo Bend is listed as a result of mercury in fish tissue.

3.3.2 Groundwater

Oklahoma

Groundwater can be found throughout most of the state and is considered one of the states' most valuable resources. Groundwater supplied 18 percent of the state's drinking water. About 14.7% of the state's fresh groundwater withdrawals were for public water supply system uses. Reported domestic groundwater withdrawals in 2000 accounted for 3.3 percent of total withdrawals from the state's aquifers. Irrigation accounted for 74.5 percent of groundwater withdrawal and is the largest single use of freshwater in the state in 2000. Industrial, mining, and power generation accounted for 1.6 percent of groundwater withdrawals in 2000 (EPA 2009).

The Oklahoma Water Resources Board (OWRB) lists twenty-one major aquifers in Oklahoma. There are two types: alluvial and terrace aquifers and bedrock aquifers. Alluvial and terrace aquifers consist of sand and gravel along major rivers, including the North Canadian and Cimarron Rivers. Bedrock aquifers, such as the Central Oklahoma, the Rush Springs, Ogallala, and the Ozark Plateau aquifers, cover large areas of the state and consist of hardened materials ranging from sandstone to limestone and gypsum. Large areas of the state generally contain local, low yield aquifers or do not produce groundwater (EPA 2009).

The proposed parcel is within the Canadian River, a terrace and alluvium major aquifer that is capable of yielding at least 150 gallons per minute. Naturally occurring saltwater is found at several localities in the alluvial and terrace aquifers, especially in the western part of the State, and saltwater has intruded from deeper layers into the aquifers along the Cimarron and Salt Fork of the Arkansas River. Nitrate is the most commonly reported contaminant in Oklahoma and is usually associated with land application of chemical fertilizers for crop production and the operation of animal feeding operations which produce

large amounts of animal water. The Canadian River aquifer is considered a highly vulnerable aquifer because it is composed of cavernous limestone or gypsum containing karst features, such as caves, sinkholes, and disappearing streams, which provide direct conduits for precipitation and runoff to transport contaminants to the water table. As well it has shallow water tables and high-yielding water.

Freshwater stored in Oklahoma's aquifers results from downward movement of precipitation and surface waters that enter each aquifer at its recharge area. The system is dynamic; aquifers are recharged continually by percolation down to the water table. The rate of ground-water movement in the state's aquifers is highly variable, probably three to one hundred feet per year in most aquifers, and may reach one hundred to one thousand feet (or more) per year, where the rock is highly porous, cavernous, or fractured (EPA 2009).

Long term groundwater level declines have not been as serious in Oklahoma as in surrounding states. Severe drought conditions in recent years are affecting the state's aquifers' ability to recover from earlier and continuing declines. When there is an increase in rainfall water levels in most alluvial aquifers can recover more quickly from declines, than bedrock aquifers. The greatest protection against overuse of groundwater has come from the permit system operated by Oklahoma Water Resources Board to limit withdrawals (EPA 2009).

Texas

Groundwater deposits underlie about 76 percent of Texas and are considered to be one of the state's most valuable resources. Sixty percent of the freshwater used in Texas is supplied from 23 major aquifers. Groundwater supplies are produced from numerous saturated geologic formations comprised of various mineralogic types such as sand and gravel alluviums and cavernous limestones and dolomites.

The source of all groundwater in Sabine and Jackson Counties is precipitation. Most of the recharge occurs as rainfall on the outcrops of the water-bearing formations, although lesser amounts of recharge probably result from seepage from streams that cross the outcrop areas. The water that enters the formations moves generally down the dip of the water-bearing beds into the artesian sections of the aquifers. Several factors affect recharge including: the intensity and amount of rainfall, the slope of the land surface, the type of soil, the permeability of the aquifer, the rate of evapotranspiration, and the quantity of water in the aquifer.

Proposed parcel -037 is in the central part of the Gulf Coast Major Aquifer. The aquifer parallels the Gulf of Mexico coastline from the Louisiana border to the border of Mexico and covers 54 counties. The maximum total sand thickness of the aquifer ranges from 700 feet in the south to 1,300 feet in the north. Freshwater saturated thickness averages about 1,000 feet. Water quality varies with depth and locality; it is generally good in the central and northeastern parts of the aquifer, including the proposed parcels, where the water contains less than 500 milligrams per liter of total dissolved solids, but declines to the south, where it typically contains 1,000 to more than 10,000 milligrams per liter of total dissolved solids and where the Gulf Coast Aquifer productivity decreases. High levels of radionuclides, thought mainly to be naturally occurring are found in some wells in the outcrop and in South Texas. The aquifer is used for municipal, industrial, and irrigation purposes. In Harris, Galveston, Fort bend, Jasper, and

Wharton Counties, water level declines of as much as 350 feet have led to land subsidence (TWDB 2011). No minor aquifers underlie the parcel.

Proposed parcel-039 is in the Carrizo Major Aquifer. The Carrizo aquifer is primarily composed of sand locally interbedded with gravel silt, clay and lignite and can produce 500 to 3,000 gallons per minute. The aquifer extends across much of eastern Texas and crosses 66 counties. The aquifer contains water under artesian pressure. Under artesian conditions, the water is confined under hydrostatic pressure in the sands between relatively impermeable beds, and where the elevation of the land surface at a well is considerably below the general level of the area of outcrop. Pumpage for irrigation accounts for just over half the water pumped, and pumping for municipal supply accounts for another 40 percent. The groundwater, although hard, is generally fresh in the outcrop, whereas softer groundwater with higher total dissolved solids occurs in the subsurface. High iron and manganese content is characteristic of much of the aquifer, and localized saline contamination has affected portions of the aquifer (TWDB 2011).

Proposed parcel -038 and -040 do not lie above any major aquifers; however, the Yegua-Jackson minor aquifer underlies both proposed parcels. The Sparta minor aquifer also underlies proposed parcel -040. These aquifers contain water under water-table conditions in their outcrop areas, and the water becomes artesian as the formations pass beneath less permeable rocks in the subsurface. Under water-table conditions are when the water is confined and does not rise in wells above the top of the aquifer. Groundwater for domestic purposes and livestock is available from shallow wells over most of the each aquifer's extent. Locally, water for municipal, industrial, and irrigation purposes is also available. The Yegua-Jackson aquifer yields range from a few gpm to over 300 gpm and the Sparta aquifer yields 100 to 500 gpm and locally iron concentrations may exceed the state's secondary drinking water standard (TWDB 2011).

DRASTIC Index

The EPA developed DRASTIC to be a standardized system for evaluating groundwater vulnerability to pollution. The primary purpose of DRASTIC is to provide assistance in resource allocation and prioritization of many types of groundwater-related activities and to provide a practical educational tool. DRASTIC was not designed to deal with pollutants introduced in the shallow or deep subsurface by methods such as leaking underground storage tanks, animal waste lagoons, or injections wells. All pollution is introduced at the ground surface.

DRASTIC considers seven hydrogeologic factors including: depth to water, net recharge, aquifer media, soil media, topography, impact of the vadose zone media, and hydraulic conductivity of the aquifer. In DRASTIC methodology, each of these factors has a "range" and associated "rating." Factor "ratings," multiplied by their assigned "weights," are then added together to yield a DRASTIC index, a numerical indicator of an aquifer's relative susceptibility to impacts from surface activities in a given location. The smallest possible DRASTIC index rating is 23, and the largest is 226. The higher the DRASTIC index, the greater the vulnerability of the aquifer to contamination. A site with low DRASTIC index is not free from

groundwater contamination, but is less susceptible to contamination compared with the sites with high DRASTIC indices.

Table 7. DRASTIC ratings for aquifers potentially affected by leasing the proposed parcels (Osborn and Hardy 1999 [Oklahoma] and TCEQ/TSSWCB 2005 [Texas])

Aquifer	Parcel	Acres	DRASTIC Index	Vulnerability Rank
Canadian (major)	-036	27.660	148	Very High
Gulf Coast (major)	-037		95	Medium
Carrizo-Willcox (major)	-039	159.000	117	Medium
Yegua-Jackson (minor)	-038, -040	172.000	Not Available	Not Available
Sparta (minor)	-040	50.000	98	Medium

3.4 Floodplains, Wetlands, Riparian Areas

3.4.1 Floodplains

For administrative purposes, the 100-year floodplain serves as the basis for floodplain management for Federal actions. These are in general relatively narrow areas along natural drainage ways that carry large quantities of runoff following periods of high precipitation.

All of the proposed lease parcels are within a mapped floodplain due to their proximity to rivers and established reservoirs.

3.4.2 Wetlands, Riparian Areas

Wetland habitats provide important wintering and migration habitat for several species of Migratory Birds. Wetlands also provide a link between land and water and are some of the most productive ecosystems in the world. Executive Order (EO) 11990 on the Protection of Wetlands provides opportunity for early review of Federal agency plans regarding new construction in wetland areas. Under EO 11990, each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for conduction federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating and licensing activities.

NM-201404-035 is located in the South Canadian River bottom.

NM-201404-037 Jackson County, Texas – PFO1A, Palustrine, Forested (Broad-Leaved Deciduous), Temporary Flooded; PUBH, Palustrine, Unconsolidated Bottom, Permanently Flooded; PEM1A, Palustrine, Emergent (Persistent), Temporary Flooded; PEM1C, Palustrine, Emergent (Persistent), Seasonally Flooded; L1UBHh, Lacustrine (Limnetic), Unconsolidated Bottom, Permanently Flooded, Diked/Impounded; L2AB4Hh, Lacustrine (Littoral), Aquatic Bed (Floating Vascular), Permanently Flooded, Diked/Impounded, PEM1Fh, Palustrine, Emergent (Persistent), Semipermanently Flooded, Diked/Impounded; PEM1Ah, Palustrine, Emergent (Persistent), Temporary Flooded, Diked Impounded.

NM-201404-038, -039, -040 Sabine County, Texas – PFO6Fh, Palustrine, Forested (Deciduous), Semipermanently Flooded, Diked/Impounded; L2AB3Hh, Lacustrine (Littoral), Aquatic Bed (Rooted Vascular), Permanently Flooded, Diked/Impounded; PSS1Fh, Palustrine, Scrub-Shrub (Broad-Leaved Deciduous), Semipermanently Flooded, Diked/Impounded; L1OWHh, Lacustrine (Limnetic), Open Water, Permanently Flooded, Diked/Impounded.

3.5 Farmlands, Prime or Unique

The Farmland Protection Policy Act (FPPA), Public Law 97-98, as amended, directs Federal agencies to identify and take into account the adverse effects of Federal programs on the preservation of farmland. The FPPA is intended to minimize the extent Federal programs have on the conversion of farmland to nonagricultural uses. Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, oilseed crops, and is also available for these uses. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality and/or high yields of a specific crop.

The NRCS Web Soil Survey and Soils Data system identified 15 different soil types within the fourteen proposed lease parcels. Table 8 shows a summary of the prime or unique farmlands making up the proposed lease parcels. See Table 6 for individual soil classes classified as “Not prime farmland,” “All areas prime farmland,” or “Prime farmland if drained” along with the associated parcels and acreages.

Table 8. Prime or Unique Farmlands making up the proposed lease parcels.

Parcels	Number of Soil Types	Prime or Unique	Total Acres	Percent
All	Water	Not Prime Farmland	1,234.0	
-035, -037	10	Not Prime Farmland	923.1	
-037	5	All Areas Prime farmland	285.3	
-037	1	Prime farmland if Drained	13.5	

3.6 Heritage Resources

3.6.1 Cultural Resources

To comply with the National Historic Preservation Act a finding of “no historic properties affected” was determined for the lease sale. Additionally, no other significant cultural resources (such as local or state listed properties, or national or state historic trails or battlefields) will be affected by the lease sales.

To support this recommendation a cultural resource background review (Class I level) was done to determine if important resources were in or near the lease sale parcel locations. If such were present, a consideration to withdraw a parcel from sale would be made. No important resources were identified.

The Texas and Oklahoma state historic preservation offices have informed the BLM that oil and gas lease sales are not considered to be “undertakings” as defined in the regulations (36 CFR 800) implementing section 106 of the National Historic Preservation Act because they are administrative actions that do not entail earth disturbing actions. Thorough section 106 compliance is normally done when a lease holder files an Application for Permit to Drill.

3.6.2 Paleontology

When a lease a lease holder submits an Application for Permit to Drill an assessment of potential effects to paleontology resources will be made; it is only at that time that detailed engineering and well locations will be identified such that a finer assessment of potential affects can be made.

3.6.3 Native American Religious Concerns

Consultations with affected tribes will be done when a lease holder submits an Application for Permit to Drill. At that time, detailed engineering and well locations will be identified such that a finer assessment of potential affects can be made.

3.7 Invasive, Non-native Species

Noxious weeds can have a disastrous impact on biodiversity and natural ecosystems. Noxious weeds affect native plant species by out-competing native vegetation for light, water and soil nutrients. Noxious weeds cause \$2 to \$3 million in estimated losses to producers annually. These losses are attributed to: (1) decreased quality of agricultural products due to high levels of competition from noxious weeds; (2) decreased quantity of agricultural products due to noxious weed infestations; and (3) costs to control and/or prevent the spread of noxious weeds.

Oklahoma

The State of Oklahoma has listed three noxious weeds and has them as a public nuisance in all counties across the state and mandates that they be treated, controlled, and eradicated. The Early Detection & Distribution Mapping System (2013) at the University of Georgia has identified 19 species in Ellis County as being exotic to the US and listed as a problem somewhere in the US. The three state listed species are not identified by EDDMS as occurring in the county. None of the nationally listed invasive species are known to occur in Oklahoma.

The three plants are: musk thistle (*Carduus nutans*), Scotch thistle (*Onopordum acanthium*), and Canada thistle (*Cirsium arvense*).

- Musk thistle can be found on all types of land except deserts, dense forests, high mountains, coastal areas, and newly cultivated fields. It is most often described as occurring on disturbed sites and waste areas, and along roads.
- Scotch thistle prefers habitats with dry summers, growing best in sandy, sandy clay and calcareous soils which are rich in ammonium salts. It grows in newly disturbed places, such as wildfire burn scars, avalanche areas, flood zones, as well as dry pastures and disturbed fields. It prefers disturbed sites with fertile soils, agricultural areas range/grasslands, riparian zones, scrub/shrublands valleys and plains along with water courses.
- Canada thistle is most common in open, mesophytic areas and grows in a wide variety of soils, including sand dunes, but is most abundant in clayey soils. Disturbance is necessary for initial establishment, but once established it can rapidly spread by both rhizomes and seeds.

Suitable habitat, in the form of disturbed sites, roadsides, fields, and agricultural areas, occurs within all of the proposed lease parcels. There is potential that all three plants may be present on the proposed parcels, although the extent is unknown.

Texas

The State of Texas listed 27 plant species as having a serious potential to cause economic or ecological harm to the state (4 TAC §19.300, as amended). The EDDMS has identified 39 species in Jackson County and 32 species in Sabine County as being exotic to the US and listed as a problem somewhere in the US. Seven of the 39 species in Jackson County and six of the 32 species in Sabine County were also listed by the State of Texas (Table 9). Two species (hydrilla and giant salvinia) are also identified on the Federal Noxious Weeds list. Sixteen additional species on the Federal Noxious Weeds list have distributions in Texas; however, EDDMS does not identify them as occurring in Jackson or Sabine County.

Table 9. Invasive and Non-native Species documented in Sabine and Live Oak Counties.

County	Species	Habitat	Potential Habitat
Sabine	Giant reed <i>Arundo donax</i>	Grows in various ecosystems, habitat types, and cover types; areas following disturbances where vegetation is killed and/or removed and/or soil is disturbed; more common in riparian, floodplain, and wetland habitats	No: All parcels covered by water too deep to grow giant reed
Jackson	Balloonvine <i>Cardiospermum halicacabum</i>	Prefers moist thickets, waste places, and riverbanks; commonly found at low elevations in disturbed sites	Yes: Portions of the parcel are adjacent to Lake Texan and along the outflows of the Navidad River
Jackson	Common water hyacinth <i>Eichhornia crassipes</i>	Floating plant commonly encountered as dense mats in freshwater habitats; intolerant of freezing conditions	Yes: Portions of the parcel are covered by water
Jackson Sabine	Hydrilla <i>Hydrilla verticillata</i>	Grows in only a few inches to >20 feet deep freshwater (springs, lakes, marshes, ditches, rivers, tidal zones); somewhat winter-hardy, optimum water temperature is 68-81°F; can grow in any nutrient conditions with or without full sun and even in 7% salinity of seawater	Yes: found in Lake Texana and nearby lakes of Toledo Bend Reservoir

County	Species	Habitat	Potential Habitat
Sabine	Japanese climbing fern <i>Lygodium japonicum</i>	Can grow in sun or shade, damp, disturbed or undisturbed areas; usually moist, swampy habitat; disturbed areas are preferred; needs other vegetation around it to spread	No: all parcels in water— no nearby vegetation for species to spread
Jackson	Chinaberry <i>Melia azedarach</i>	Often on sites altered by human activity such as fence rows, abandoned agricultural fields, pastures, highways, logging sites, and riparian areas that are heavily grazed; frequently associated with disturbance, especially soil disturbance; occurs on sites impacted by hurricanes and flooding	Yes: disturbed sites along roadsides; area frequently impacted by flooding
Sabine	Kudzu <i>Pueraria Montana</i> var. <i>lobata</i>	Spreads rapidly in open, disturbed areas (abandoned fields, roadsides, forest edges), in densely vegetated areas spread slowly; areas with mild winters (40-60°F), summer temperatures >80°F and annual precipitation >40"; deep, well-drained, loamy soils	No: all parcels are within water
Jackson Sabine	Giant salvinia <i>Salvinia molesta</i>	Slightly acidic, high nutrient, warm, slow-moving freshwater (streams, lakes, ponds, ditches, rice fields); resistant to periods of low temperature, dewatering, and elevated pH levels; low tolerance to salinity	Yes: documented in Lake Texana and Toledo Bend Reservoir
Jackson Sabine	Chinese tallowtree <i>Triadica sebifera</i>	Invades several plant communities including Gulf coastal prairies and many types of forests in the southeastern U.S.; common on disturbed sites such as spoilbanks, roadsides, agricultural lands, urban areas, and storm-damaged forests.	Yes: -037—disturbed sites along roadsides in parcel, although habitat likely marginal No: -038, -039, -040—not aquatic species

3.8 Vegetation

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. A Roman numeral hierarchical scheme has been adopted for different levels of ecological regions. Level I is the coarsest level, dividing North American into 15 ecological regions. Level II divided the continent into 52 regions. At level III, the continental U.S. contains 104 regions whereas the conterminous U.S. has 48. Level IV ecoregions are further subdivisions of level III ecoregions. In each state, there are 12 level III ecoregions. Oklahoma has 46 level IV ecoregions and Texas has 56 level IV ecoregions with most continuing into ecologically similar parts of adjacent states.

In both states, ecological diversity is strongly related to varied climates, terrain, geology, soil, and land uses. In Oklahoma, forests cover most of the Ozark Plateau and the Ouachita Mountains; they become progressively more stunted and open westward. Southern pine forests, typical of Gulf Coastal Plains, occur in the southeast. Tall grass prairie, mixed grass prairie, and short grass prairie are native to central and western Oklahoma. Mesquite and other xeric plants characterize the dry southwest. Much of Oklahoma's natural vegetation has been lost to overgrazing, burning, logging, erosion, and cultivation. Today, the state is a mosaic of grazing land, cropland, woodland, forest, and abandoned farmland. Wheat and alfalfa are the main crops. Grain sorghum is well adapted to sandy soils. Soybeans are becoming increasingly common on eastern plains and on moister parts of the prairie. Cotton is now concentrated on irrigated farmland in the southwest. Corn, once a major Oklahoma crops, has declined in importance due to soil depletion and periodic droughts.

In Texas, forests cover East Texas changing to desert communities in West Texas. Grassy plains cover North Texas and gradually turn into coastal and inland wetlands and semi-arid brush lands of South Texas. Plants species change accordingly in all parts of Texas.

Table 10. Ecoregions of the proposed lease parcels.

Parcels	Acres	Level III Ecoregion (EPA region)	Level IV Ecoregion (EPA region)	Description of Level IV Ecoregion
-035	27.660	Central Great Plains (27)	Rolling Red Hills (27q)	Upland natural vegetation is mostly mixed grass prairie. In addition, shinnery grows on sand flats and hills in the west, and short grass prairie is found on high elevation, sandy sites in the northwest. Eastern redcedar is becoming increasingly widespread on uplands. Ravines are wooded. During the 1930s, drought and poor soil conservation practices contributed to widespread farm abandonment. Subsequently, many areas have been planted with introduced forage grasses and converted into managed grasslands. The ecoregion is mostly used as rangeland, but croplands occur on suitable, nearly level sites.
-037	281.67	Western Gulf Coastal Plain (34)	Northern Humid Gulf Coastal Prairies (34a)	Historically, the ecoregion was mostly tallgrass grasslands with a few clusters of oaks, known as oak mottes or maritime woodlands. Little bluestem (<i>Schizachyrium scoparium</i>), yellow Indiangrass (<i>Sorghastrum nutans</i>), brownseed paspalum (<i>Paspalum plicatum</i>), gulfy muhly (<i>Muhlenbergia capillaris</i>), and switchgrass (<i>Panicum virgatum</i>) were the dominant grassland species in a mixture with hundreds of other herbaceous species across the prairies. This ecoregion has a long history of alteration from several hundred years of Amerindian occupancy and use of fire, to the grazing of large herds of feral cattle and horses from the Spanish by the early 1800s, to domesticated livestock grazing, agriculture and urban alteration in more recent times. Today most areas have been converted to cropland, rangeland, pasture, or urban and industrial land uses. Crops include rice, soybeans, grain sorghum, cotton, corn and hay.
-037	1856.33	Western Gulf Coastal Plain (34)	Floodplain and Low Terraces (34c)	It covers large river floodplains with sloughs, natural levees, and associated alluvial low terraces, consisting of bottomland forests of pecan (<i>Carya illinoensis</i>), water oak (<i>Quercus nigra</i>), southern live oak (<i>Q. virginiana</i>), and elm (<i>Ulmus spp.</i>), with some baldcypress (<i>Taxodium distichum</i>) on larger streams. On some of the terraces, black hickory (<i>C. texana</i>), post oak (<i>Q. stellata</i>) and winged elm (<i>U. alata</i>) are found. Ecoregion alternations include converting the land to croplands for corn, cotton, grain sorghum, hay, and pecan orchards and altering water flows through damming and diking streams and rivers.
-038, -039, -040	295.7	South Central Plains (35)	Southern Tertiary Uplands (35e)	Vegetation is a diversity of natural communities including upland longleaf pine woodlands, longleaf pine savannas, hardwood slope forests, bogs with pitcher plants and orchids, and sandstone glades with pines and drought tolerant oaks. Currently, large tracts of land have been set aside for public land and are mostly true to the ecoregion description. Outside of the public land areas, vegetation has been altered by decades of timber harvests and commercial pine plantation activities. Other areas have been turned to pasture land for livestock production or converted to agricultural fields from crop production.

Four ecoregions make up the proposed lease parcel areas (Table 10). Vegetation in the upland portion of proposed parcel -035 (approximately 4.82 acres) is as described in the Rolling Red Hills ecoregion; however, the riverbed portion of the parcel (approximately 11.18 acres) where no vegetation grows. Sparse riparian vegetation can be found along the banks of the river in the transition zone between the riverbed and uplands and accounts for approximately 11.76 acres.

Approximately 935.0 acres of proposed parcel -037 is within Lake Texana and covered by water where no vegetation is present. The remaining acreage is typical of the historical floodplain and low terrace ecoregion.

Although proposed parcels -038, -039, and -040 are in the described ecoregion, the actual parcels themselves are covered by water and do not have any vegetation growing on them.

3.9 Wildlife

3.9.1 Threatened and Endangered Species

The purpose of the Endangered Species Act (ESA) is to ensure that federal agencies and departments use their authorities to protect and conserve endangered and threatened species. Section 7 of ESA requires that federal agencies prevent or modify any projects authorized, funded, or carried out by the agencies that are "likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of critical habitat of such species." A biological evaluation was prepared by an Oklahoma Field Office biologist to document the potential for and effects on federally protected species. Five federally protected species (3 endangered, 1 threatened, 1 proposed threatened) were identified as occurring in or having the potential to occur in Ellis County, Oklahoma (Table 11), while 2 species (2 endangered) were identified in Jackson County, and three species (1 endangered, 2 candidate) were identified in Sabine County (Table 12).

Table 11. Federally Protected Threatened and Endangered Species for Oklahoma Lease Parcels.

Scientific Name	Federal Status	County	Habitat/Distribution
Piping plover <i>Charadrius melodus</i>	Threatened	Ellis	<i>Habitat:</i> Mudflats, sandy beaches and shallow wetlands with sparse vegetation. They may be found along the margins of lakes and large rivers where there is exposed (bare) sand or mud. <i>Distribution:</i> Two nesting records for in the OK panhandle. Normally a spring (April - early May) and fall (last week of July – late September) migrant throughout the state occurring across the main body of the state with recent records from Woodward, Alfalfa, Oklahoma, Cleveland, Tulsa and Washington Counties.

Scientific Name	Federal Status	County	Habitat/Distribution
Whooping Crane <i>Grus Americana</i>	Endangered	Ellis	<p><i>Habitat:</i> Typically found in shallow wetlands, marshes, the margins of ponds and lakes, sandbars and shorelines of shallow rivers, wet prairies, and crop fields near wetlands while passing through OK each spring and fall during migration.</p> <p><i>Distribution:</i> Pass through the western half of OK – most sightings occur west of I-35 and east of Guymon in the panhandle. The migratory population consists of approximately 270 birds nesting in northern Canada and winter along the Gulf Coast of Texas.</p> <p>Critical Habitat: Salt Plains National Wildlife Refuge, for use during the fall and spring migrations.</p>
Interior Least Tern <i>Sterna antillarum</i>	Endangered	Ellis	<p><i>Habitat:</i> Terns live along large rivers and may sometimes be found hunting fish in shallow wetlands and the margins of ponds and lakes. Least Terns require bare sand and gravel for nesting and typically nest in small colonies consisting of two to 20 pairs along large rivers on sand bars and scoured bends. Colonies also occur on salt flats such as the large one at Salt Plains National Wildlife Refuge.</p> <p><i>Distribution:</i> The Least Tern is a rare species and is found in Oklahoma during the late spring and summer breeding season (mid-May through late August). In Oklahoma, Least Terns may be found on portions of the Arkansas, Cimarron, Canadian and Red rivers.</p>
Lesser prairie-chicken (<i>Tympanuchus pallidicinctus</i>)	Proposed Threatened	Ellis	<p><i>Habitat:</i> The preferred habitat of the LEPC is native short- and mixed-grass prairies having a shrub component dominated by sand sagebrush or shinnery oak. Small shrubs are important for summer shade, winter protection, and as supplemental foods. Trees and other tall woody vegetation are typically absent from these grassland ecosystems, except along water courses. Landscapes supporting less than 63 percent native rangeland appear incapable of supporting self-sustaining LEPC populations.</p> <p><i>Distribution:</i> The ODWC is aware of 96 known historic and currently occupied leks in Oklahoma. During the mid-1990's all of these leks were active. Recent survey efforts are lacking for most of these known lek locations and the exact number of currently active or occupied leks in Oklahoma is unknown.</p>

Scientific Name	Federal Status	County	Habitat/Distribution
Arkansas River shiner (<i>Notropis girardi</i>)	Endangered	Ellis	<p><i>Habitat:</i> The Arkansas River Shiner inhabits the shallow braided channels of wide sandy prairie rivers in the Arkansas River system. Schools of shiners often gather on the lee side of sandbars and ridges of sand in the river channel. They spawn after heavy summer rains and their eggs drift with the water current and develop as they are carried downstream.</p> <p><i>Distribution:</i> Rhode Island, Massachusetts, South Dakota, Nebraska, Kansas, Arkansas, Texas and Oklahoma. At the time of listing in 1989, there were only two known populations. Latimer County, Oklahoma and on Block Island, Rhode Island.</p>

Table 12. Federally Protected Threatened and Endangered Species for Texas Lease Parcels

Scientific Name	Federal Status	County	Habitat/Distribution
Louisiana pine snake (<i>Pituophis ruthveni</i>)	C	Sabine	<p><i>Habitat:</i> Occur in longleaf pine-oak sandhills interspersed with moist bottomlands; sometimes in adjacent blackjack oak woodlands and in sandy areas of short-leaf pine/post oak forest; prefers openly wooded areas over dense forest; frequently found in fields, farmland, and tracts of second-growth timber.</p> <p><i>Distribution:</i> Historically in portions of west-central Louisiana and extreme east-central Texas. This area roughly coincides with a disjunct portion of the longleaf pine ecosystem situated west of the Mississippi River. Currently extant in a small portion of the historical range.</p>
Red-cockaded woodpecker (<i>Picoides borealis</i>)	E	Sabine	<p><i>Habitat:</i> Open pine forests with large, widely-spaced older trees provide essential habitat for the red-cockaded woodpecker.</p> <p><i>Distribution:</i> The red-cockaded woodpecker can be found in the Pineywoods of east Texas.</p>
Whooping Crane (<i>Grus Americana</i>)	E	Jackson	<p><i>Habitat:</i> Typically found in shallow wetlands, marshes, the margins of ponds and lakes, sandbars and shorelines of shallow rivers, wet prairies, and crop fields near wetlands; salt marshes of Aransas National Wildlife Refuge (NWR); coastal prairies with swales and ponds.</p> <p><i>Distribution:</i> Breed in Canada during the summer months; migrate to Texas' coastal plains near Rockport in and around Aransas NWR November – March</p>

Scientific Name	Federal Status	County	Habitat/Distribution
West Indian Manatee (<i>Trichechus manatus</i>)	E	Jackson	<p><i>Habitat:</i> Manatees are herbivores that feed opportunistically on a wide variety of marine, estuarine, and freshwater plants, including submerged, floating, and emergent vegetation. Manatees also require sources freshwater, obtained from both natural and anthropogenic sources.</p> <p><i>Distribution:</i> Range is generally restricted to the southeastern United States; individuals occasionally range as far north as Massachusetts and as far west as Texas.</p>
Texas golden Gladecress (<i>Leavenworthia texana</i>)	C	Sabine	<p><i>Habitat:</i> Herbaceous communities in vernal wet glades with shallow, calcareous soils on Weches Formation ironstone outcrops.</p> <p><i>Distribution:</i> Endemic to San Augustine and Sabine Counties in eastern Texas, on a particular geologic formation (the Weches Formation).</p>

3.9.2 Special Status Species

Wildlife species may be classified as threatened or endangered at either the state or the federal level. Federally, a species is listed as threatened or endangered under ESA and protection of the species is overseen by the US Fish and Wildlife Service. At a state level, Oklahoma has an endangered species statute that gives the state the authority to list a wildlife species as threatened or endangered within the state although it might not be classified as threatened or endangered federally through ESA. The Oklahoma Department of Wildlife Conservation (ODWC) is responsible for overseeing protection of the species. No State listed species or their critical habitat is present in the proposed lease sale parcels.

Texas legislature authorized the Texas parks and Wildlife Department (TPWD) to establish a list of endangered plants and animals in the state (31 T.A.C §65.171 -65.176). Endangered species, under the Texas legislation, means “species which the Executive Director of TPWD has named as being ‘threatened with statewide extinction (animals)’ [or] ‘in danger of extinction throughout all of a significant portion of its range’ (plants).” Threatened species, under Texas legislation, means “species which the TPWD Commission has determined are likely to become endangered in the future.” TPWD regulations prohibit the taking, possession, transportation, or sale of any of the animal species designated by state law as endangered or threatened without the issuance of a permit. In addition, some species listed as threatened or endangered under state law are also listed under federal regulations. These animals are provided additional protection by the USFWS and ESA.

Sixteen species were identified as occurring or having the potential to occur in Jackson County, TX and 24 species were identified in Sabine County (Table 13).

Table 13. State listed species for Texas Lease Parcels.

Scientific Name	State Status	County	Habitat/Distribution
American Peregrine Falcon (<i>Falco peregrinus anatum</i>)	T	Jackson, Sabine	<p><i>Habitat:</i> They can be found nesting at elevations up to about 12,000 feet, as well as along rivers and coastlines or in cities, where the local Rock Pigeon populations offer a reliable food supply. In migration and winter you can find Peregrine Falcons in nearly any open habitat, but with a greater likelihood along barrier islands, mudflats, coastlines, lake edges, and mountain chains.</p> <p><i>Distribution:</i> The American Peregrine is a resident of the Trans-Pecos region, including the Chisos, Davis, and Guadalupe mountain ranges.</p>
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	T	Jackson	<p><i>Habitat:</i> Bald Eagles typically nest in forested areas adjacent to large bodies of water, staying away from heavily developed areas when possible. Bald Eagles are tolerant of human activity when feeding, and may congregate around fish processing plants, dumps, and below dams where fish concentrate. For perching, Bald Eagles prefer tall, mature coniferous or deciduous trees that afford a wide view of the surroundings. In winter, Bald Eagles can also be seen in dry, open uplands if there is access to open water for fishing.</p> <p><i>Distribution:</i> Bald Eagles are present year-round throughout Texas as spring and fall migrants, breeders, or winter residents. The Bald Eagle population in Texas is divided into two populations; breeding birds and nonbreeding or wintering birds. Breeding populations occur primarily in the eastern half of the state and along coastal counties from Rockport to Houston. Nonbreeding or wintering populations are located primarily in the Panhandle, Central, and East Texas, and in other areas of suitable habitat throughout the state</p>
Interior Least Tern (<i>Sterna antillarum athalassos</i>)	E	Jackson	<p><i>Habitat:</i> Terns live along large rivers and may sometimes be found hunting fish in shallow wetlands and the margins of ponds and lakes. Least Terns require bare sand and gravel for nesting and typically nest in small colonies consisting of two to 20 pairs along large rivers on sand bars and scoured bends.</p> <p><i>Distribution:</i> In Texas, Interior Least Terns are found at three reservoirs along the Rio Grande River, on the Canadian River in the northern Panhandle, on the Prairie Dog Town Fork of the Red River in the eastern Panhandle, and along the Red River (Texas/Oklahoma boundary) into Arkansas.</p>

Scientific Name	State Status	County	Habitat/Distribution
Peregrine Falcon (<i>Falco peregrinus</i>)	T	Jackson, Sabine	<i>Habitat:</i> Occupies wide range of habitats. <i>Distribution:</i> Both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; also known to be a resident breeder in west Texas.
Whooping Crane (<i>Grus americana</i>)	E	Jackson	<i>Habitat:</i> Typically found in shallow wetlands, marshes, the margins of ponds and lakes, sandbars and shorelines of shallow rivers, wet prairies, and crop fields near wetlands; salt marshes of Aransas National Wildlife Refuge (NWR); coastal prairies with swales and ponds. <i>Distribution:</i> Breed in Canada during the summer months; migrate to Texas' coastal plains near Rockport in and around Aransas NWR November – March.
Reddish Egret (<i>Egretta rufescens</i>)	T	Jackson	<i>Habitat:</i> Brackish marshes and shallow salt ponds and tidal flats. <i>Distribution:</i> Resident of Texas Gulf Coast
Sooty Tern (<i>Sterna fuscata</i>)	T	Jackson	<i>Habitat:</i> Foraging habitat is the open ocean where terns can easily catch small fish close to the surface or fish leaping into the air to escape large predatory species. <i>Distribution:</i> The Texas Breeding Bird Atlas project recorded 24 confirmed breeding sites for Sooty Terns from 1987-1992, with most preferring to nest in small colonies above flood tides in flat, sparsely vegetated and fairly open areas. Once nesting as far north as Galveston Island, the species is now restricted to the central and lower coasts where they are considered rare and local.
White-faced Ibis (<i>Plegadis chihi</i>)	T	Jackson,	<i>Habitat:</i> Prefers freshwater marshes, sloughs, and irrigated rice fields. <i>Distribution:</i> The White-faced Ibis is an uncommon to common resident along the Texas coast; and, is a rare and localized breeder inland as far north as the Panhandle.
White-tailed Hawk (<i>Buteo albicaudatus</i>)	T	Jackson	<i>Habitat:</i> Open country, primarily savanna, prairie, and arid habitats of mesquite, cacti, and bushes, very rarely in open forest. <i>Distribution:</i> White-tailed Hawks are resident in their range and breed in Texas from late January to July or even late August, based on egg collection dates of February 1 to August 4.

Scientific Name	State Status	County	Habitat/Distribution
Wood Stork (<i>Mycteria Americana</i>)	T	Jackson, Sabine	<i>Habitat:</i> Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water. <i>Distribution:</i> Breeds in Mexico and then moves into the Gulf States in search of mud flats and other wetlands, and forested areas. No breeding record in Texas since 1960.
Bachman's Sparrow (<i>Aimophila aestivalis</i>)	T	Sabine	<i>Habitat:</i> The Bachman's Sparrow prefers areas with a high density of herbaceous cover and a low density of mid and overstory. <i>Distribution:</i> In Texas, the Bachman's Sparrow occurs only in the far eastern portion of the state.
Piping Plover (<i>Charadrius melodus</i>)	T	Sabine	<i>Habitat:</i> Beaches, bayside and mud and salt flats. <i>Distribution:</i> Wintering migrant along the Texas Gulf Coast.
Red-cockaded Woodpecker (<i>Picoides borealis</i>)	E	Sabine	<i>Habitat:</i> Open pine forests with large, widely-spaced older trees provide essential habitat for the red-cockaded woodpecker. <i>Distribution:</i> The red-cockaded woodpecker can be found in the Pineywoods of east Texas.
Swallow-tailed Kite (<i>Elanoides forficatus</i>)	T	Sabine	<i>Habitat:</i> Nesting and foraging habitats include various pine forests and savannas, cypress swamps and savannas, cypress-hardwood swamps, hardwood hammocks, mangrove swamps, narrow riparian forests, prairies, and freshwater and brackish marshes. <i>Distribution:</i> Breeding range extends from South Carolina south to Florida, and west to Louisiana and east Texas.
Red Wolf (<i>Canis rufus</i>)	E	Sabine	<i>Habitat:</i> Brushy and forested areas, as well as coastal plains. <i>Distribution:</i> Extirpated
West Indian Manatee (<i>Trichechus manatus</i>)	E	Jackson	<i>Habitat:</i> Gulf and bay system. <i>Distribution:</i> Manatees are extremely rare in Texas although near the turn of the century they apparently were not uncommon in the Laguna Madre. Texas records also include specimens from Cow Bayou, near Sabine Lake, Copano Bay, the Bolivar Peninsula, and the mouth of the Rio Grande.

Scientific Name	State Status	County	Habitat/Distribution
Rafinesque's Big-Eared Bat (<i>Corynorhinus rafinesquii</i>)	T	Sabine	<i>Habitat:</i> Occurs in forested regions largely devoid of natural caves. Its natural roosting places are in hollow trees, crevices behind bark, and under dry leaves. It has been observed most frequently in buildings, both occupied and abandoned. Texas specimens have been captured in barns and abandoned wells. <i>Distribution:</i> A bat of the southeastern United States, Rafinesque's big-eared bat reaches the westernmost portion of its range in the pine forests of East Texas.
Louisiana Pigtoe (<i>Pleurobema riddellii</i>)	T	Sabine	<i>Habitat:</i> Streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments. <i>Distribution:</i> Sabine, Neches, and Trinity (historic) River basins.
Southern Hickorynut (<i>Obovaria jacksoniana</i>)	T	Sabine	<i>Habitat:</i> Medium sized gravel substrates with low to moderate current <i>Distribution:</i> Neches, Sabine, and Cypress river basins.
Texas Heelsplitter (<i>Potamilus amphichaenus</i>)	T	Sabine	<i>Habitat:</i> Quiet waters in mud or sand and also in reservoirs. <i>Distribution:</i> Sabine, Neches, and Trinity River basins.
Sandbank Pocketbook (<i>Lampsilis satura</i>)	T	Sabine	<i>Habitat:</i> Small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms. <i>Distribution:</i> East Texas, Sulfur south through San Jacinto River basins; Neches River.
Texas Pigtoe (<i>Fusconaia askew</i>)	T	Sabine	<i>Habitat:</i> Rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures. <i>Distribution:</i> East Texas River basins, Sabine through Trinity Rivers as well as San Jacinto River.
Alligator Snapping Turtle (<i>Macrochelys temminckii</i>)	T	Sabine	<i>Habitat:</i> Perennial water bodies, deep water of rivers, canals, lakes, and oxbows, bayous, swamps, ponds, brackish coastal waters. <i>Distribution:</i> Extensive
Northern Scarlet Snake (<i>Cemophora coccinea copei</i>)	T	Sabine	<i>Habitat:</i> Mixed hardwood scrub on sandy soils. Semi-fossorial, active April-September <i>Distribution:</i> East Texas

Scientific Name	State Status	County	Habitat/Distribution
Timber/Cranebrake Rattlesnake (<i>Crotalus horridus</i>)	T	Sabine, Jackson	<i>Habitat:</i> Swamps, floodplains, upland pine and deciduous forests, riparian zones, abandoned farmland, limestone bluffs, sandy soil or black clay. <i>Distribution:</i> Extensive
Louisiana pine snake <i>Pituophis ruthveni</i>	C	Sabine	<i>Habitat:</i> Occur in longleaf pine-oak sandhills interspersed with moist bottomlands; sometimes in adjacent blackjack oak woodlands and in sandy areas of short-leaf pine/post oak forest; prefers openly wooded areas over dense forest; frequently found in fields, farmland, and tracts of second-growth timber. <i>Distribution:</i> Historically in portions of west-central Louisiana and extreme east-central Texas. This area roughly coincides with a disjunct portion of the longleaf pine ecosystem situated west of the Mississippi River. Currently extant in a small portion of the historical range.
Red-cockaded woodpecker (<i>Picoides borealis</i>)	E	Sabine	<i>Habitat:</i> Open pine forests with large, widely-spaced older trees provide essential habitat for the red-cockaded woodpecker. <i>Distribution:</i> The red-cockaded woodpecker can be found in the Pineywoods of east Texas.
Texas Horned Lizard (<i>Phrynosoma cornutum</i>)	T	Jackson	<i>Habitat:</i> Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scubby trees. <i>Distribution:</i> Texas horned lizards range from the south-central United States to northern Mexico, throughout much of Texas, Oklahoma, Kansas and New Mexico.
Texas Scarlet Snake (<i>Cemophora coccinea lineri</i>)	T	Jackson	<i>Habitat:</i> Mixed hardwood scrub on sandy soils. Semi-fossorial, active April-September. <i>Distribution:</i> East Texas
Texas Tortoise (<i>Gopherus berlandieri</i>)	T	Jackson	<i>Habitat:</i> Open brush with a grass understory is preferred. <i>Distribution:</i> South and West Texas
Texas golden Gladecress (<i>Leavenworthia texana</i>)	C	Sabine	<i>Habitat:</i> Herbaceous communities in vernal wet glades with shallow, calcareous soils on Weches Formation ironstone outcrops. <i>Distribution:</i> Endemic to San Augustine and Sabine Counties in eastern Texas, on a particular geologic formation (the Weches Formation).

Scientific Name	State Status	County	Habitat/Distribution
Black Bear (<i>Ursus americanus</i>)	T	Sabine	<i>Habitat:</i> Bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear. <i>Distribution:</i> Transient
Louisiana Black Bear (<i>Ursus americanus luteolus</i>)	T	Sabine	<i>Habitat:</i> Bottomland hardwoods and large tracts of inaccessible forested areas. <i>Distribution:</i> Transient
Blue Sucker (<i>Cycleptus elongates</i>)	T	Sabine	<i>Habitat:</i> Channels and flowing pools with a moderate current. <i>Distribution:</i> Large portions of major rivers in Texas
Creek Chubsucker (<i>Erimyzon oblongus</i>)	T	Sabine	<i>Habitat:</i> Prefers headwaters, small rivers and creeks. <i>Distribution:</i> Various tributaries of the Red, Sabine, Neches, Trinity and San Jacinto Rivers.
Paddlefish (<i>Polyodon spathula</i>)	T	Sabine	<i>Habitat:</i> Prefers large, free flowing rivers <i>Distribution:</i> Red, Sabine, Neches, Trinity and San Jacinto Rivers.
Smalltooth Sawfish (<i>Pristis pectinata</i>)	E	Jackson	<i>Habitat:</i> Different life history stages have different patterns of habitat use, from close to shore in muddy and sandy bottoms to mangrove, reef, seagrass and coral. <i>Distribution:</i> Extensive

3.9.3 Migratory Birds

Executive Order (EO) 13186, 66 Fed. Reg. 3853, (January 17, 2001) identifies the responsibility of federal agencies to protect migratory birds and their habitats, and directs executive departments and agencies to undertake actions that will further implement the Migratory Bird Treaty Act (MBTA). Under the MBTA, incidental, unintentional, and accidental take, killing, or possession of a migratory bird or its parts, nests, eggs or products, manufactured or not, without a permit is unlawful. EO 13186 includes a directive for federal agencies to develop a memorandum of understanding (MOU) with the USFWS to promote the conservation of migratory bird populations, including their habitats, when their actions have, or are likely to have, a measurable negative effect on migratory bird populations.

For the purpose of this biological evaluation, the term “migratory birds” applies generally to native bird species protected by MBTA. This includes native passerines (flycatchers and songbirds) as well as birds of prey, migratory waterbirds (waterfowl, wading birds, and shorebirds), and other species such as doves, hummingbirds, swifts, and woodpeckers. The term “migratory” is a misnomer and should be interpreted broadly to include native species that remain in the same area throughout the year as well as species that exhibit patterns of latitudinal or elevational migration to avoid winter conditions of cold

or a shortage of food. For most migrant and native resident species, nesting habitat is of special importance because it is critical for supporting reproduction in terms of both nesting sites and food. Also, because birds are generally territorial during the nesting season, their ability to access and utilize sufficient food is limited by the quality of the territory occupied. During non-breeding seasons, birds are generally non-territorial and able to feed across a larger area and wider range of habitats.

Among the wide variety of species protected by the MBTA, special concern is usually given to the following groups:

- Species that migrate across long distances, particularly Neotropical migrant passerines that winter in tropical or Southern Hemisphere temperate zones.
- Birds of prey, which require large areas of suitable habitat for finding sufficient prey.
- Species that have narrow habitat tolerances and hence are vulnerable to extirpation from an area as a result of a relatively minor habitat loss.
- Species that nest colonially and hence are vulnerable to extirpation from an area and hence are vulnerable to extirpation from an area as a result of minor habitat loss.

Because of the many species that fall within one or more of these groups, BLM focuses on species identified by the USFWS as Birds of Conservation Concern (BCC). Table 13 lists the BCC in or near the proposed parcels.

NM-201404-035 Ellis County, Oklahoma – Twenty-seven Birds of Conservation Concern are listed for the Central Mixed-Grass Prairie (Bird Conservation Region 19) BCC 2008 list, in Ellis County where this lease parcel is located. The North American Breeding Bird Survey Results and Analysis 1966-2010, breeding bird surveys conducted near the site (Grimes Route) found eight species from the BCR 19 list that are known to nest in or near the proposed project area, the little blue heron, Mississippi kite, Swainson's hawk, red-headed woodpecker, scissor-tld. flycatcher, Bell's vireo, loggerhead shrike and the Cassin's sparrow.

NM-201404-037 Jackson County, Texas – Forty-four Birds of Conservation Concern are listed for the Gulf Coastal Plain (Bird Conservation Region 37), where this project occurs. Breeding bird surveys conducted near the site found eight species from that list, least bittern, white-tailed hawk, gull-billed tern, loggerhead shrike, seaside sparrow, painted bunting, and dickcissel.

NM-201404-038, -039, -040 Sabine County, Texas – Nineteen Birds of Conservation Concern are listed for the oaks & prairies (Bird Conservation Region 21), where this project occurs. The Weatherford Breeding Bird Survey conducted near the site found six species from that list, the little blue heron, red-headed woodpecker, scissor-tailed flycatcher, loggerhead shrike, Bell's vireo, and orchard oriole.

3.9.4 Wildlife

Counties in Oklahoma where the proposed lease tracts occur contain diverse wildlife populations as well as habitats. Ellis County is located in the Southwestern Tablelands Ecoregion which consists of shinnery

oak scrub. Kay County is located in the Central Great Plains Ecoregion which consists of mixed grass prairie. Regional information on wildlife and their habitats in Texas is contained on pages 1-13 of the OKRMP 1994, as amended.

Counties in Texas where the proposed lease tracts occur contain diverse wildlife populations as well as habitats. Generally speaking the eastern one-third of Texas receives ample rainfall and supports much of the oak, pine and hickory forests. The bulk of the central portion of Texas is within the cross timbers area where the transition begins from eastern deciduous forests to the more arid portions of western Texas. The faunal diversity follows this same transition from cypress swamps and alligators in the southeast tip of the state to piñon-juniper and mule deer in the furthest western portion of the Texas panhandle. Regional information on wildlife and their habitats in Texas is contained on pages 1-13 of the TXRMP 1996, as amended.

3.10 Wastes – Hazardous or Solid

The Resource Conservation and Recovery Act (RCRA) of 1976 established a comprehensive program for managing hazardous wastes from the time they are produced until their disposal. The EPA regulations define solid wastes as any “discarded materials” subject to a number of exclusions. On January 6, 1988, EPA determined that oil and gas exploration, development and production wastes would not be regulated as hazardous wastes under RCRA. The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980, deals with the release (spillage, leaking, dumping, accumulation, etc.), or threat of a release of hazardous substances into the environment. Despite many oil and gas constituent wastes being exempt from hazardous waste regulations, certain RCRA exempt contaminants could be subject to regulations as hazardous substances under CERCLA.

No hazardous or solid waste materials are currently known to be present on any of the proposed lease parcels. However, hazardous and/or solid wastes may be used during the development phase. See Appendix 3—Phases of Oil and Gas Development for a description of anticipated wastes.

3.11 Mineral Resources

Oklahoma

Oklahoma’s mineral resources include: nonfuel minerals such as limestone, gypsum, salt, clays, iodine, and sand and gravel; coal; and petroleum. In recent years, the mineral industry has been the State’s greatest source of revenue. Although Oklahoma’s petroleum production accounts for about 95 percent of Oklahoma’s annual mineral output, nonfuel minerals and coal represent a significant part of the current economy and an important source of future wealth. Leading commodities produced include crushed stone, Portland cement, construction sand and gravel, industrial sand and gravel, iodine, and Grade A helium (USGS 2011). Other commodities now produced in Oklahoma, or for which there are current mining permits, include clays and shale, salt, lime, granite, rhyolite, dolomite, sandstone, volcanic ash, coal, and Tripoli. Deposits and resource that are not mined now, or with no current mining permits, include asphalt, lead, zinc, copper, iron, manganese, titanium, and uranium.

The Federal mineral estate (oil and gas) in Oklahoma totals 1,998,932 acres, with 330,800 (20%) acres currently leased. Most of the state is in a high oil and gas occurrence and development potential category (BLM 1993). Within the Ellis County proposed lease parcel (-035), oil and natural gas production is high. In 2011, 4,448,698 barrels (bbl) of oil were produced in the county and 42,554,867 thousand cubic feet (MCF) of natural gas was produced. Other commodities in the county include salt, volcanic ash, and bentonite.

Producing formations in the area have been from the Ordovician-age Simpson; Silurian-Devonian-age Hunton; Mississippian-age Chester, Meramec, and St. Louis; Pennsylvanian-age Cherokee, Cleveland, Cottage Grove, Bartlesville, Atoka, Morrow, Springer, Desmoinesian, Douglas-Tonkawa, Oswego, Skinner, Red Fork, and Marmaton formations. The maximum anticipated true vertical drilling depth is about 17,800 feet. Proposed parcel (-035) is potentially being drained by a well on an adjacent lease.

Texas

Texas has produced more oil and natural gas than any other state and to date remains the largest daily producer. Oil and natural gas are found in most parts of the state. No state or any other region worldwide has been as heavily explored or drilled for oil and natural gas as Texas. As of October 30, 2013, the Railroad Commission of Texas (RRC) lists 412,660 wells (active and inactive well but not including plugged and abandoned) statewide (RRC 2013). In Texas, an average of 409,298,430 barrels (BBL) of crude oil and 7,608,711,578 thousand cubic feet (MCF) were produced from 2007-2012 (RRC 2013a). Oil and natural gas production in Texas can be divided into seven major producing basins. The Permian Basin dominates oil production in the state, and the Gulf Coast Basin dominates natural gas production. Major oil fields in Texas include Wasson, Yates, and Spraberry in West Texas, as well as the largest Texas oil field, East Texas field in the East Texas Basin. Major natural gas fields in Texas include Newark East field in the Fort Worth basin; Carthage field in East Texas; Panhandle, West, field in the Anadarko Basin; and Giddings field in the Gulf Coast basin (Kim and Ruppel 2005).

The producing formations in Jackson County are primarily from the Tertiary-age Catahoula, Frio, Marginulina, Yegua, and Wilcox formations, where the maximum anticipated vertical drilling depth is about 21,000 feet.

The main oil and gas field in Sabine County is the Jurassic-age Haynesville Shale in the Carthage (Haynesville Shale) field. The Haynesville Shale is a hydrocarbon producing geological formation that may be capable of delivering large amounts of gas. It is located in East Texas and Western Louisiana. The core counties are Panola, Harrison and Shelby, while six additional counties including Sabine county are non-core counties. The productive interval of the shale is greater than 10,000 feet below the land surface. It was not until 2008 that operators realized the Haynesville formation might be as commercially attractive as the other shale gas plays.

Other producing formations in Sabine County include Jurassic-age Cotton Valley, the Cretaceous-age Saratoga, Annon, and Austin Chalk, and the Tertiary-age Sparta. The maximum anticipated true vertical drilling depth is about 15,880 feet.

3.12 Visual Resources

BLM Manual H-8410-1 lays out the visual resource inventory process for determining visual values. The inventory consists of scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. The purpose of the analysis is to determine the area's Visual Resource Management Class (VRM), which defines the degree of acceptable visual change within a characteristic landscape on BLM lands. Because the proposed parcels are on private surface a VRM class has not been established for the areas.

The existing landscape throughout all of the proposed parcel counties include oil and gas development visual impacts from facilities, lease roads, pipelines, utility lines, and above ground components such as tanks, pumpjacks, wellheads, fences, and signs. Visual impacts from agricultural/farming and timber production activities include croplands, pastures, timber plots, clear cuts, outbuildings (i.e. barns, storage sheds, and chicken coops), irrigation pipes/ditches/pivots, and improved and unimproved roads to access outbuildings, crops, pastures, plots, etc. Oil/gas development, agriculture/farming, and timber production facilities are readily visible from residences, highways, and country roads in all of the counties, including each proposed parcel.

Proposed Oklahoma parcel -035 is immediately adjacent to the Canadian River. The parcel is more than 35.0 miles to the nearest interstate (I-40), about 5.0 miles from State Route (SR) 33 and about 2.0 miles from US Highway 283.

All of the Texas proposed parcels are in or near developed recreation areas where water resources and bank vegetation is an important value that has not been drastically altered from the natural state. Proposed parcel -037 is along Lake Texana and proposed parcels -038, -039, and -040 are in Toledo Bend Reservoir. In the recreation areas, boat launches, buildings, camping spots, trails, and roads are common in addition to the increase in visitors as opposed to the proposed parcels not near a recreation area. Outside the recreation areas, the landscape described in the previous paragraph applies.

US Highway 59 and SR 172 pass through proposed parcel -037, while SR 111 is about 5.5 miles to the west of the parcel. Interstate 10 is more than 50.0 miles north of proposed parcel -037. SR 87 is more than 4.0 miles west of proposed parcel -038, -039, and -040, while Interstate 49, in Louisiana, is the nearest interstate at about 50.0 miles to the east.

3.13 Recreation

Ellis County, Oklahoma

Proposed parcel -035 is located on BLM managed surface. Recreation is a legal land use although there is no legal access to the land. Access to the land is dependent on access through adjacent landowners' property, which can range from simply opening a gate and passing through, to requiring permission and a key from the landowner. Recreation can include hiking, biking, off-highway vehicle driving, bird watching, equestrian riding, and hunting.

Jackson County, Texas

The proposed lease parcel is within and adjacent to Lake Texana. The lake covers 10,000 acres and has 125 miles of shoreline. Recreation includes camping, picnicking, hiking, water sports, bird watching, hunting, and fishing. Fish in the Lake include catfish, bass, and crappie. A wide variety of native plant species thrive in the lake, including water hyacinth, coontail, spikerush, cattail, pondweed, bull's tongue, pickerel weed, and duckweed. Hunting in the area is limited to waterfowl, except for a youth hunt in which deer can also be hunted.

Sabine County, Texas

The proposed lease parcels are within or adjacent to the Toledo Bend Reservoir. The reservoir, with its 1,200 miles of shoreline, offers an almost unlimited opportunity for recreational development and is a major element in serving the growing demand for water oriented outdoor recreation. Both public and private facilities are available for swimming, boating, picnicking, fishing, camping, hunting, fishing, and sightseeing. The Toledo Bend Reservoir has an excellent year-round fishery for the largemouth bass, while good year-round crappie and catfish are present. Striped bass, white bass, stripers, bluegill, and sunfish are also plentiful in the reservoir.

The Sabine National Forest adjoins proposed lease parcel -039. The Sabine National Forest offers visitors numerous recreation activities including: bicycling, camping, hiking, equestrian riding, OHV riding, wildlife watching, picnicking, water activities, hunting, and fishing. The Forest offers a number of recreational sites for fishing, camping, and launching boats into Toledo Bend Reservoir. Additionally, there are large tracts of land available for "exploration" and primitive camping and hunting.

Hunting and trapping in Sabine County is common. Typical hunted species include white-tailed deer, feral hog, waterfowl, dove, other migratory game birds, squirrel, turkey, quail, doves, rabbits, hares, coyotes, bobcats, fox, skunk, raccoons, opossums, badgers, and frogs.

3.14 Socioeconomics and Environmental Justice

3.14.1 Socioeconomics

Oklahoma

Oklahoma's population of nearly 3.8 million is mostly urban, with almost 70 percent of the State's population residing in cities or towns. While over 90 percent of the State's land is in farms and ranches, the large size of typical Oklahoma farms and modern farming methods have resulted in relatively few people residing in rural areas.

Oklahoma's economy is based upon a combination of agriculture production, manufacturing, service industries and mineral extraction. Manufacturing contributes \$18.6 billion to Oklahoma's economy and has been the fastest growing industry in the state. The oil and gas industry is a major contributor to the Oklahoma economy bringing in \$15.9 billion through the extraction of more than 13 million barrels of oil and over 54 trillion cubic feet of natural gas (BEA 2012).

Oklahoma employed about 1,824,000 people in 2012, with 1,730,700 employed of which 1,600,500 were non-farm employees. The largest employer for the State is consistently the government, both state and local. Oklahoma's labor force participation rates have remained relatively constant. The unemployment rate in 2012 hovered around 5.2 percent (BLS 2013).

In 2011, Oklahoma's top commodities had a value of \$5,591 million with cattle and calves contributing to almost half of the value, followed by hogs and pigs, poultry and eggs, winter wheat, hay, corn, soybeans, cotton, peanuts, canola, pecans, grain sorghum, rye, watermelon, sunflowers, and oats, all of which had a production value of over \$1 million.

Ellis County, OK

Ellis County's economy primarily relies on agriculture and oil and gas development. In 2007, there were a total 766 farms in the county covering 718,058 acres (91.1%). Approximately 102,382 acres of cropland were harvested in 2007, while 173,736 (22.0%) acres are identified as cropland. A total of 62,396 cow/calf are in the county and 51,777 were actually sold. Wheat accounted for 43,483 acres of cropland that were planted and nearly 905,725 bushels were sold. Approximately 1,158 acres of cropland was planted for sorghum and 527,754 bushels were sold. Hay accounted for 27,302 acres planted and 66,247 dry tons were sold.

Texas

Texas added 4,293,741 residents in the last decade (2000-2010), a 20.6 percent increase to a new population total of 25,145,561 people. Texas nationally ranked number 1 for the highest numeric increase in population and number 2 as the most populous state, behind California. Texas' rapid growth over the past decade was almost entirely concentrated in its major urban areas. The Dallas-Ft. Worth and Houston metro areas together accounted for almost half of the population of Texas and over half of the state's growth.

The economy of Texas is one of the largest and most rapidly growing economies in the United States. As of 2013 is home to six of the top 50 companies on the Fortune 500 list. Texas is the largest exporter of goods and grosses more than \$100 billion a year in trade with other nations. The top eleven industries contributing to Texas' economy include: manufacturing; mining and logging; construction; service-providing industries; professional and business services; education and health services; financial activities; trade, transportation and utilities; information, leisure and hospitality; other services; and government.

Texas saw an increase in employment in 2012, gaining 260,800 seasonally adjusted nonfarm jobs, representing an annual growth of 2.5 percent. Over the same period, U.S. nonfarm employment only rose 1.4 percent. All Texas industries except the information industry saw job increases. The state's trade, transportation, and utilities industries ranked first in job creation, adding 56,000 jobs for an annual employment growth rate of 2.6 percent in 2012. The leisure and hospitality services ranked second in job creation, adding 47,500 jobs for a 4.5 percent rate increase. Construction was the state's fastest growing industry segment, with a 6.6 percent growth rate and 36,800 added jobs. The Texas

unemployment rate remained below the national unemployment rate in 2012 and even decreased in 2012 (EDT 2013).

Jackson County, TX

The economy is based on agriculture, livestock production, oil and gas development, and tourism. In the early 1990s rice culture was the number-one agricultural activity with nearly 30,000 acres under production. Other leading crops include corn, grain sorghums, and beef cattle. Cotton is still produced but not at peak quantities. Potatoes, sweet potatoes, and watermelons are the chief vegetables; other important products include peaches and pecans. Nearly 90 percent of the county is used for farming and ranching. Oil and gas development is the leading nonagricultural industry. Other important businesses include concrete production, heavy construction, metal fabrication and tooling, and sheet-metal manufacturing.

In 2012, Jackson County had a labor force of 7,289 people of which 6,909 were employed. The unemployment rate was 5.2 percent, not seasonally adjusted, down 1.2 percent from the 2011 annual 6.4 percent unemployment rate (LMCI 2013).

Sabine County, TX

The economy is based on tourism, livestock and broiler chicken production, and the lumber industry. In 2012, Sabine County had a labor force of 3,271 people of which 2,770 were employed. The unemployment rate was 15.3 percent, not seasonally adjusted, up 0.1 percent from the 2011 annual 15.2 percent unemployment rate (LMCI 2013).

3.14.2 Environmental Justice

Executive Order 12989, issued on 11 February 1994, addresses concerns over disproportionate environmental and human health impacts on minority and low-income populations. The impetus behind environmental justice is to ensure that all communities, including minority, low-income or federally recognized tribes, live in a safe and healthful environment. Table 14 describes the demographics of each proposed parcel county.

Table 14. Demographics of proposed lease parcel counties.

	Population	Identified as Hispanic or Latino Origin	Not Identified as White or of Hispanic or Latino Origin	Median Household Income	Living Below the Poverty Level
Oklahoma	3,814,820	9.3%	24.5%	\$44,287	16.3%
Ellis	4,104	7.3%	4.4%	\$45,017	15.3%
Texas	26,059,203	38.1%	19.0%	\$50,920	17.0%
Jackson	14,255	30.1%	9.9%	\$50,010	12.5%
Sabine	10,433	3.3%	9.8%	\$33,109	21.8%

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Assumptions for Analysis

The act of leasing parcels would, by itself, have no impact on any resources in the OFO. All impacts would be linked to as yet undetermined future levels of lease development. The effects of oil and gas leasing in Texas are analyzed in the Oklahoma RMP (1994), as amended, and Texas RMP (1996), as amended (Chapter 4). That analysis, which assumes that the impacts from an average well, pipeline and access road would total 5.65 acres of surface disturbance in Oklahoma and Texas is incorporated by reference into this document.

Proposed lease parcels -038, -039, and -040 are all within bodies of water and have lease stipulation ORA-4: No Surface Occupancy attached to each. Proposed lease parcel -037 has LNRA-GS (Palmetto Bend) stipulation attached, which states that no surface occupancy is permitted below 47.5 feet mean surface elevation (top of conservation pool). As a result of these stipulations, accessing the minerals in these leases would occur through directional drilling where surface disturbance would occur outside the boundaries of the lease parcel. Exploration/development of the lease would produce no effect on any resources, except for minerals, within the boundaries of the lease parcel as a result of the no surface occupancy stipulation. However, when the minerals are accessed from a surface location outside the lease parcel, effects to the resources at the access site are likely. The effects described in section 4.3 apply to all proposed lease parcels, assuming that the three parcels are accessed through directional drilling with surface disturbance outside the proposed lease parcel boundaries.

If lease parcels were developed, short-term impacts would be stabilized or mitigated within five years and long-term impacts are those that would substantially remain for more than five years. Potential impacts and mitigation measures are described below.

Cumulative impacts include the combined effect of past projects, specific planned projects and other reasonably foreseeable future actions such as other infield wells being located within these leases. Potential cumulative effects may occur should an oil and gas field be discovered if these parcels are drilled and other infield wells are drilled within these leases or if these leases become part of a new unit. All actions, not just oil and gas development may occur in the area, including foreseeable non-federal actions.

4.2 Effects from the No Action Alternative

Under the No Action Alternative, the proposed parcels would be deferred and not offered for sale. Analysis of the No Action alternative is presented in the following sections. There would be no subsequent impacts from oil and/or gas construction, drilling, and production activities. The No Action Alternative would result in the continuation of the current land and resource uses in the proposed lease areas.

4.2.1 Mineral Resources

There would be no new impacts from oil and gas production on the proposed parcel land. Oil and gas development of federal, state, private, and Indian minerals would continue on the land surrounding the proposed parcels. No additional natural gas or crude oil from the proposed parcels would enter the public markets and no royalties would accrue to the federal or state treasuries. An assumption is that the No Action Alternative (no lease option) would not affect current domestic production of oil and gas. However, this may result in reduced Federal and State royalty income, and the potential for Federal land to be drained by wells on adjacent private or state land. Oil and gas consumption is driven by a variety of complex interacting factors including energy costs, energy efficiency, availability of other energy sources, economics, demography, and weather or climate. If the BLM were to forego leasing and potential development of the proposed parcels, the assumption is that the public's demand for the resource would not be expected to change. Instead, the mineral resource foregone would be replaced in the short- and long-term by other sources that may include a combination of imports, using alternative energy sources (e.g. wind, solar), and other domestic production. This offset in supply would result in a no net gain for oil and gas domestic production.

4.2.2 Environmental Justice

By not leasing the proposed parcels under the No Action Alternative, there may be negative effects on the overall employment opportunities related to the oil and gas and service support industry, as well as a loss of the economic benefits to state and county governments related to royalty payments and severance taxes. However, there would be no increase in activity and noise associated with these proposed leases unless the land is used for other purposes.

4.2.3 All Other Resources

No other resources would be affected under the No Action Alternative, as there would be no surface disturbance that could detrimentally affect these resources. The No Action Alternative would result in the continuation of the current land and resource uses on the parcels. However, the selection of the no action alternative would not preclude these parcels from being nominated and considered in a future lease sale, which would result in impacts as described under the action alternatives.

4.3 Effects from the Proposed Action

4.3.1 Air Resources

4.3.1.1 Air Quality

While the act of leasing Federal minerals would produce no impacts to air quality, subsequent exploration/development of the proposed lease could increase air borne soil particles blown from new well pads or roads, exhaust emissions from drilling equipment, compressor engines, vehicles, dehydration and separation facilities coupled with volatile organic compounds during drilling or production activities.

In order to reasonably quantify emissions associated with well exploration and production activities, certain types of information are needed. Such information includes a combination of activity data such as the types of equipment needed if a well were to be completed successfully (e.g. compressor, separator, dehydrator), the technologies which may be employed by a given company for drilling any new wells, area of disturbance for each type of activity (e.g. roads, pads, electrical lines compressor station), number of days to complete each kind of construction, number of days for each phase of the drilling process, type(s), size, number of heavy equipment used for each type of construction (backhoe, dozer, etc.), number of wells of all types (shallow, deep, exploratory, etc.), compression per well (sales, field booster), or average horsepower for each type of compressor. The degree of impact will also vary according to the characteristics of the geological formations from which production occurs. Currently, it is not feasible to directly quantify emissions. What can be said is that emissions associated with oil and gas exploration and production would incrementally contribute to increases in air quality emissions into the atmosphere.

During drilling and completion, the following source of emissions are anticipated during any oil and gas exploration or development: combustion engines (i.e. fossil fuel fired internal combustion engines used to supply electrical or hydraulic power for hydraulic fracturing to drive the pumps and rigs used drill the well, drill out the hydraulic stage plugs and run the production tubing in the well; generators to power drill rigs, pumps, and other equipment; compressors used to increase the pressure of the oil or gas for transport and use; tailpipe emissions from vehicles transporting equipment to the site), venting (i.e. fuel storage tanks vents and pressure control equipment), mobile emissions (i.e. vehicle bringing equipment, personnel, or supplies to the location) and fugitive sources (i.e. pneumatic valves, tank leaks, dust). A number of pollutants associated with combustion of fossil fuels are anticipated to be released during drilling including: CO, NO_x, SO₂, Pb, PM, CO₂, CH₄, and N₂O. Venting may release VOC/HAP, H₂S, and CH₄. Mobile source emissions are likely to include fugitive particulate matter from dust or inordinate idling. The actual emissions of each pollutant will be entirely dependent on the factors described in the previous paragraph.

During the completion phase, the most significant emissions of criteria pollutants emitted by oil and gas operations in general are VOCs, particulate matter and NO₂. VOCs and NO_x contribute to the formation of ozone, which is a pollutant of concern in Oklahoma and Texas. Data provided to EPA's Natural Gas STAR Program show that some of the largest air emissions in the natural gas industry occur as natural gas wells that have been fractured are being prepared for production. During well completion, "flowback", fracturing fluids, water, and reservoir gas come to the surface at high velocity and volume. This mixture includes a high volume of VOCs and methane, along with air toxics such as benzene, ethylbenzene, and n-hexane. The typical flowback process lasts from three to 10 days. Pollution also is emitted from other processes and equipment in during production and transportation of the oil and gas from the well to a processing facility.

Proposed parcel -035 is a significant distance from ozone nonattainment areas; however, parcels -037 thru -040 are all within 50 miles of a "non-attainment" area. The additional NO_x and VOCs emitted from any new oil and gas development, by means of just drilling or drilling *and* hydraulic fracturing the well,

on these leases are anticipated to be too small to have a significant effect on the overall ozone levels of the area.

Although the hydraulic fracturing of wells within a lease parcel is hard to predict, it is anticipated that with more wells being drilled, there will be an increase in the amount of wells being hydraulically fractured and completed. There is a higher probability of dust particulates in the atmosphere from the increase in vehicular traffic due to the increase in the number of wells hydraulically fractured.

Mitigation

The BLM encourages industry to incorporate and implement best management practices (BMPs), which are designed to reduce impacts to air quality by reducing emissions, surface disturbances, and dust from field production and operations. Typical measures include: adherence to BLM's Notice to Lessees' (NTL) 4(a) concerning the venting and flaring of gas on Federal leases for natural gas emissions that cannot be economically recovered, flared hydrocarbon gases at high temperatures in order to reduce emissions of incomplete combustion; water dirt roads during periods of high use in order to reduce fugitive dust emissions; collocate wells and production facilities to reduce new surface disturbance; implementation of directional drilling and horizontal completion technologies whereby one well provides access to petroleum resources that would normally require the drilling of several vertical wellbores; require that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored; and perform interim reclamation to reclaim areas of the pad not required for production facilities and to reduce the amount of dust from the pads. In addition, the BLM encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce natural gas emissions.

In October 2012, EPA promulgated air quality regulations for completion of hydraulically fractured gas wells. These rules require air pollution mitigation measures that reduce the emissions of volatile organic compounds during gas well completions. Mitigation includes a process known as "Green Completion" in which natural gas brought up during flowback must be recaptured and reroute into the gathering line.

4.3.1.2 Climate

The assessment of GHG emissions, their relationship to global climatic patterns, and the resulting impacts is an ongoing scientific process. It is currently not feasible to know with certainty the net impacts from the proposed action on climate—that is, while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. The BLM does not have the ability to associate a BLM action's contribution to climate change with impacts in any particular area. The science to be able to do so is not yet available. The inconsistency in results of scientific models used to predict climate change at the global scale coupled with the lack of scientific models designed to predict climate change on regional or local scales, limits the ability to quantify potential future impacts of decisions made at this level and determining the significance of any discrete amount of GHG emissions is beyond the limits of existing

science. When further information on the impacts to climate change is known, such information would be incorporated into the BLM's planning and NEPA documents as appropriate.

While the act of leasing Federal minerals would have no impact on climate as a result of GHG emissions, subsequent exploration/development of the proposed lease could have effects on global climate through GHG emissions. However, those effects on global climate change cannot be determined. (Refer to cumulative effects section, 4.3.15). It is unknown whether the petroleum resources specific to these leases in the Proposed Action are gas or oil or a combination thereof.

Production statistics developed from EIA (EIA, 2012) are shown in Table 15 for the US, Oklahoma, and Texas, as well as federal mineral estate in each state obtained from BLM's Automated Fluid Minerals Support System (AFMSS).

Table 15. 2010 Oil and Gas Production

Location	Oil (bbl)	% U.S. Total	Gas (MMcf)	% U.S. Total
United States	1,999,731,000	100	26,836,353	100
Oklahoma	67,730,000	3.39	1,827,328	6.81
Texas	427,386,000	21.4	7,593,697	28.3
Federal leases in Oklahoma	187,000	0.01	14,549	0.05
Federal leases in Texas	291,000	0.01	20,831	0.08

In order to estimate the contribution of Federal oil and gas leases to greenhouse gases in Texas it is assumed that the percentage of total U.S. production is comparable to the percentage of total emissions. Therefore, emissions are estimated based on production starting with total emissions for the United States from EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010* (EPA, 2012b), and applying production percentages to estimate emissions for Texas. It is understood that this is a rather simplistic technique and assumes similar emissions in basins that may have very different characteristics and operational procedures, which could be reflected in total emissions. This assumption is adequate for this level of analysis due to the unknown factors associated with eventual exploration and development of the leases. However, the emissions estimates derived in this way, while not precise, will give some insight into the order of magnitude of emissions from federal oil and gas leases administered by the Bureau of Land Management (BLM) and allow for comparison with other sources in a broad sense.

Table 16. 2010 Oil and Gas Field Production Potential Emissions

Location	Oil (Metric tons of CO ₂ ^e)		Gas (Metric tons of CO ₂ ^e)		Total O&G Production (Metric tons CO ₂ e)	%U.S. Total GHG emissions
	CO ₂	CH ₄	CO ₂	CH ₄		
United States	300,000	30,600,000	10,800,000	126,000,000	167,700,000	2.6
Oklahoma	10,170	1,037,340	735,480	8,580,600	10,363,590	0.15

Texas	64,200	6,548,400	3,056,400	35,658,000	45,327,000	0.71
Federal leases in Oklahoma	30	3,060	5,400	63,000	71,490	0.001
Federal leases in Texas	30	3,060	8,640	100,800	112,530	0.002

Table 16 shows the estimated greenhouse gas emissions for oil and gas field production for the U.S., Texas, and Federal leases in Texas. Because oil and gas leaves the custody and jurisdiction of the BLM after the production phase and before processing or refining, only emissions from the production phase are considered here. It should also be remembered that following EPA protocols, these numbers do not include fossil fuel combustion which would include such things as truck traffic, pumping jack engines, compressor engines and drill rig engines. Nor does it include emissions from power plants that generate the electricity used at well sites and facilities. The estimates are only for operations, not for construction and reclamation of the facilities, which may have a higher portion of a project's GHG contribution. Note that units of Metric tons CO₂^e have been used in the table above to avoid very small numbers. CO₂^e is the concentration of CO₂ that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas.

Table 16 also provides an estimate of direct emissions that occur during production of oil and gas. This phase of emissions represents a small fraction of overall emissions of CO₂^e from the life cycle of oil and gas. For example, acquisition (drilling and development) for petroleum is responsible for only 8% of the total CO₂e emissions, whereas transportation of the petroleum to refineries represents about 10% of the emissions, and final consumption as a transportation fuel represents fully 80% of emissions (U.S.DOE, NETL, 2008).

To estimate the potential emissions from the proposed lease sale, an estimate of emission per well is useful (Table 17). To establish the exact number of Federal wells in Oklahoma and Texas is problematic due to the ongoing development of new wells, the abandonment of unproductive wells, land sales and exchanges, and incomplete or inaccurate data bases. Total emissions from Federal leases in Oklahoma in 2010 was estimated at 71,490 metric tons CO₂^e; therefore, the estimate of emission per well is 196.4 metric tons CO₂e annually. Total emissions from Federal leases in Texas in 2010 was estimated at 112,530 metric tons CO₂e; therefore, the estimate of emission per well is 24.93 metric tons CO₂e annually.

Table 17. Potential Greenhouse Gas Emissions Resulting from the Proposed Lease Sale based on the latest available 2010 estimates.

GHG Emission Source	Total Emissions (metric tons)	Percent
U.S. GHG Emissions From All Sources	6,372,900,000	100.00 %
U.S. GHG Emissions From Oil & Gas Field Production	167,700,000	2.6%
Total Oklahoma Emissions From Oil & Gas Field Production		
Total Texas Emissions From Oil & Gas Field Production	45,327,000	0.71%

Total Oklahoma Federal Emissions from Oil & Gas Field Production	71,490	0.001%
Total Texas Federal Emissions from Oil & Gas Field Production (4,513 wells)	112,530	0.002%
Oil & Gas Field Production at Full Development for Oklahoma Parcels (1 well)	196.4	0.0000004%
Oil & Gas Field Production at Full Development For Proposed Action (4 Wells)	99.72	0.0000002%

Environmental impacts of GHG emissions from oil and gas consumption are not effects of the proposed action as defined by the Council on Environmental Quality (CEQ), and thus are not required to be analyzed under NEPA. GHG emissions from consumption of oil and gas are not direct effects under NEPA because they do not occur at the same time and place as the action. They are also not indirect effects because oil and gas leasing and production would not be a proximate cause of GHG emissions resulting from consumption.

Mitigation

The EPA's GHG emissions data describes "Natural Gas Systems" and "Petroleum Systems" as two major categories of US sources of GHG emissions. The inventory identifies the contributions of natural gas and petroleum systems to total CO₂ and CH₄ emissions (natural gas and petroleum systems do not produce noteworthy amounts of any of the other greenhouse gases). Within the larger category of "Natural Gas Systems", the EPA identifies emissions occurring during distinct stages of operation, including field production, processing, transmission and storage, and distribution. "Petroleum Systems" sub-activities include production field operations, crude oil transportation and crude oil refining. Within the two categories, the BLM has authority to regulate only those field production operations that are related to oil and gas measurement, and prevention of water (via leaks, spills and unauthorized flaring and venting).

The EPA data show that improved practices and technology and changing economics have reduced CO₂ emissions from oil and gas exploration and development (Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2010 (EPA 2012)). One of the factors in this improvement is the adoption by industry of the BMPs proposed by the EPA's Natural Gas Energy Star program. The OFO will work with industry to facilitate the use of the relevant BMPs for operations proposed on Federal mineral leases where such mitigation is consistent with agency policy. While EPA data shows that methane emissions increased from oil and gas exploration and development from 1990-2010, reductions in methane emissions from oil and gas exploration and development should occur in future years as a result of EPA's recently finalized oil and gas air emissions regulations.

4.3.2 Soils

While the act of leasing Federal minerals would produce no impacts to soils, subsequent exploration/development of the proposed lease may produce impacts by physically disturbing the

topsoil and exposing the substratum soil on subsequent project areas. Direct impacts resulting from the oil and gas construction of well pads, access roads, and reserve pits include removal of vegetation, exposure of the soil, mixing of horizons, compaction, loss of topsoil productivity and susceptibility to wind and water erosion. Wind erosion would be expected to be a minor contributor to soil erosion with the possible exception of dust from vehicle traffic during all phases of development. Vehicle traffic related wind erosion would be limited to approved travel routes in which the surface has not been paved or dressed in a material to prevent soil movement. The extent of wind erosion related to vehicle traffic will be dependent on a number of factors including: length of well bore; whether hydraulic fracturing is used during completion; whether telemetry is used during production; whether the well is gas, oil, condensate, or a combination thereof. These impacts could result in increased indirect impacts such as runoff, erosion and off-site sedimentation. Activities that could cause these types of indirect impacts include construction and operation on well sites, access roads, gas pipelines and facilities.

Additional soil impacts associated with lease development would occur when heavy precipitation causes water erosion damage. When water saturated segment(s) on the access road become impassable, vehicles may still be driven over the road. Consequently, deep tire ruts would develop. Where impassable segments are created from deep rutting, unauthorized driving may occur outside the designated route of access roads.

Contamination of soil from drilling, hydraulic fracturing, and production wastes mixed into soil or spilled on the soil surfaces could cause a long-term reduction in site productivity. Contaminants spilled on soil would have the potential to pollute and/or change the soil chemistry. See section 4.3.11 – Wastes, Hazardous or Solid for a more in-depth analysis of spill contamination. These direct impacts can be reduced or avoided through proper design, construction, maintenance and implementation of BMPs.

Mitigation

The operator would stockpile the topsoil from the surface of well pads which would be used for surface reclamation of the well pads. The impact to the soil would be remedied upon reclamation of well pads when the stockpiled soil that was specifically conserved to establish a seed bed is spread over well pads and vegetation re-establishes.

During the life of the development, all disturbed areas not needed for active support of production operations should undergo “interim” reclamation in order to minimize the environmental impacts of development on other resources and uses. Upon abandonment of wells and/or when access roads are no longer in service final reclamation would be implemented. Earthwork for interim and final reclamation must be completed within 6 months of well completion or well plugging (weather permitting).

Road construction requirements and regular maintenance would alleviate potential impacts to access roads from water erosion damage.

Fluid impermeable containment systems (i.e. liners, dikes, berms) would be placed in, under and/or around any tank, pit, drilling cellar, ditches associated with the drilling process, or other equipment that

use or has the potential to leak/spill hazardous and non-hazardous fluids, to completely prevent soil contamination (e.g. liners) at the site or to prevent the spill from going beyond the immediate site (e.g. dikes, berms).

4.3.3 Water Resources

While the act of leasing Federal minerals would produce no impacts to water resources, subsequent exploration/development of the proposed lease may produce impacts. Surface disturbance from the construction of well pads, access roads, pipelines, and utility lines can result in degradation of surface water and groundwater quality from non-point source pollution, increased soil losses, and increased gully erosion.

Quality

Potential impacts that would occur due to construction of well pads, access roads, fracturing ponds, pipelines, and utility lines include increased surface runoff and off-site sedimentation brought about by soil disturbance; increased salt loading and water quality impairment of surface waters; channel morphology changes due to road and pipeline crossings; and possible contamination of surface waters by produced water. The magnitude of these impacts to water resources would depend on the proximity of the disturbance to the drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, duration and time within which construction activity would occur, and the timely implementation and success or failure of mitigation measures.

Direct impacts would likely be greatest shortly after the start of construction activities and would decrease in time due to natural stabilization, and reclamation efforts. Construction activities would occur over a relatively short period; therefore, the majority of the disturbance would be intense but short lived. Direct impacts to surface water quality would be minor, short-term impacts which may occur during storm flow events.

Contamination of groundwater could occur without adequate cementing and casing of the proposed well bore. For fracturing fluid to escape the wellbore and affect the usable quality water or contaminate or cross contaminate aquifers, the fluid would have to breach several layers of steel casing and cement. Failure of the cement or casing surrounding the wellbore is a possible risk to water supplies. If the annulus is improperly sealed, natural gas, fracturing fluids, and formation water containing high concentrations of dissolved solids may be transferred directly along the outside of the wellbore among the target formation, drinking water aquifers, and layers of rock in between. Complying with BLM and state regulations regarding casing and cementing, implementing BMPs, testing casings and cement prior to continuing to drill or introducing additional fluids and continual monitoring during drilling and hydraulic fracturing allow producers and regulators to check the integrity of casing and cement jobs and greatly reduce the chance of aquifer contamination.

Casing specifications are designed and submitted to the BLM. The BLM independently verifies the casing program, and the installation of the casing and cementing operations are witnessed by certified Petroleum Engineering Technicians.

An expressed public concern about subsurface hydraulic fracturing operations in deep shale formations is that the process might create fractures that extend well beyond the target formation to water aquifers, allowing methane, contaminants naturally occurring in formation water, and fracturing fluids to migrate from the target formation into drinking water supplies (Zoback et al 2010). Typically, many thousands of feet of rock separate most major formation in the U.S. from the base of aquifers that contain drinkable water (GWPC 2009). The direct contamination of underground sources of drinking water from fractures created by hydraulic fracturing would require hydrofractures to propagate several thousand feet beyond the upward boundary of the target formations through many layers of rock. It is extremely unlikely that the fractures would ever reach fresh water zones and contaminate freshwater aquifers (Zoback et al 2010, RRC 2013b). During the APD review, the exact difference between the base of treatable water and the top of the target formation for the specific site would be reviewed to determine the potential for direct contamination of underground sources.

Typically flowback is hauled away to be injected into disposal wells. It is estimated that approximately 30 percent of the injected water returns without too much of a quality decrease, whereas the remaining 40 percent is more degraded. Since the flowback would be disposed of at a regulated and permitted facility, it is assumed that they would ensure all water quality regulations and laws are followed and that BMPs are in place to prevent contamination of aquifers, thus having no impact on water quality in the aquifers from flowback.

Petroleum products and other chemicals used during drilling or hydraulic fracturing, accidentally spilled, could result in surface and groundwater contamination. Similarly, possible leaks from reserve and evaporation pits could degrade surface and groundwater quality. Authorization of the proposed projects would require full compliance with BLM directives and stipulations that relate to surface and groundwater protection.

Quantity

Impacts of water use for oil and gas development and production depend on local water availability and competition for water from other users. Overall, impacts range from declining water levels at the regional or local scales and related decreases in base flow to streams (Nicot and Scanlon 2012). Water supplied for hydraulic fracturing could come from surface or groundwater sources. If surface water is used, there would be a temporary decrease in the source's water levels. The time it takes to return to baseline conditions is dependent on the amount of rainfall received and other competing uses of the resource.

Typically when groundwater is used, impacts to the aquifer would be minimal due to the size of the aquifers impacted and recharge potential across the entire aquifer. However, localized aquifer effects are expected. A cone of depression may occur in the immediate vicinity of the existing water well used to supply the fracturing water. With each rain event, the aquifer is expected to recharge to some degree, but it is unknown if or when it would recharge to baseline conditions after pumping ceases. The time it takes depends greatly on rainfall events, drought conditions, and frequency of pumping that has already occurred and will continue to occur into the future.

The amount of water actually used for development is highly dependent on a number of factors including: length of well bore, closed-loop or reserve pit drilling system, type of mud, whether hydraulic fracturing would be used during stimulation, whether recycled water would be used, dust abatement needs, type and extent of construction, to name a few. The impacts of water use on water quality and quantity would be analyzed in more detail during the APD review.

Mitigation

Fluid impermeable containment systems (i.e. liners, dikes, berms) would be placed in, under and/or around any tank, pit, drilling cellar, ditches associated with the drilling process, or other equipment that use or has the potential to leak/spill hazardous and non-hazardous fluids, to prevent chemicals from penetrating the soil and impacting the aquifer or from moving off-site to a surface water source.

Complying with BLM and state regulations regarding casing and cementing, implementing BMPs, testing casings and cement prior to continuing to drill or introducing additional fluids and continual monitoring during drilling and hydraulic fracturing allow producers and regulators to check the integrity of casing and cement jobs and greatly reduce the chance of aquifer contamination.

RRC requires operators to disclose all chemicals used along with the amount of water used to hydraulically fracture wells in Texas.

4.3.4 Floodplains, Wetlands, Riparian Areas

4.3.4.1 Floodplains

While the act of leasing Federal minerals would produce no direct impacts to floodplains, subsequent exploration/development of the proposed lease parcel may produce impacts. Surface disturbance from the development of well pads, access roads, pipelines, and utility lines can result in impairment of the floodplain values from removal of vegetation, removal of wildlife habitat, impairment of water quality, decreased flood water retention and decreased groundwater recharge.

Floodplains occur within all of the proposed parcels. ORA-1 states that, "All or portions of the lands under this lease lie in and or adjacent to a major watercourse and are subject to periodic flooding. Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the BLM." In addition to ORA-1, the BLM identified the need to develop a Floodplain Protection Lease Notice that would also be attached to these parcels. This notice would inform the lessee and operator that surface occupancy of these areas and surface disturbance within up to 200 meters of the outer edge of the floodplain may not be allowed in order to protect the integrity and functionality of the floodplain and associated watercourse (Appendix 1). Furthermore, controlled surface use requiring special mitigation measures may be required and will be developed during the application for permit to drill.

Mitigation

Potential mitigation is deferred to site-specific development at the APD stage.

4.3.4.2 Wetlands, Riparian Areas

While the act of leasing Federal minerals would produce no direct impacts to Wetland/Riparian Areas; Wetland/Riparian Areas could be adversely impacted by mineral development (drilling, hydraulic fracturing, production, etc.) by:

- Changes to water quality or quantity (chemical spills, storm water runoff, etc...) (refer to 4.3.4 Water Resources) ;
- Insufficient stream flow for aquatic biota or to maintain stream habitat;
- The actual water withdrawal infrastructure;

Improperly installed water withdrawal structures can result in the entrainment of aquatic organisms, which can remove any/all life stages of fish and macroinvertebrates from their natural habitats as they are withdrawn with water.

Mitigation

Potential mitigation is deferred to site-specific development at the APD stage.

To avoid adverse impacts to aquatic biota from entrainment, intake pipes can be screened to prevent entry into the pipe. Additionally, the loss of biota that becomes trapped on intake screens, referred to as impingement, can be minimized by properly sizing the intake to reduce the flow velocity through the screens. Transporting water from the water withdrawal location for use off-site can transfer invasive species from one waterbody to another via trucks, hoses, pipelines, and other equipment. Screening of the intakes can minimize this transfer; however additional site-specific mitigation considerations may be necessary.

Additionally, protective stipulation ORA-2 would be attached to the lease of a tract which falls within a wetland/riparian areas. ORA-2 states that, "All or portions of the lands under this lease contain wetland and/or riparian areas. Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the Bureau of Land Management. Impacts or disturbance to wetlands and riparian habitats which occur on this lease must be avoided or mitigated. The mitigation shall be developed during the application for permit to drill."

4.3.5 Farmlands, Prime or Unique

While the act of leasing Federal minerals would produce no impacts to prime or unique farmlands, subsequent exploration/development of the proposed lease would remove the area from production for the life of the well. Direct impacts resulting from the construction of well pads, access roads, and reserve pits can affect the soil properties, increase erosion, and reduce water infiltration potentially affecting the characteristics unique to prime or unique farmlands.

The amount of farmlands lost depends on the amount and type of development proposed during the APD process. Up to 199.4 acres (31%) of six proposed lease parcels could be impacted and/or removed

as prime farmland, while all acreage within five proposed parcels (340.3 acres) and portions of six proposed parcels (104.2 acres) totaling 444.5 acres (69%) would not be affected as they are not prime or unique farmland. It is anticipated that there would be no permanent loss of prime or unique farmland once all reclamation activities are complete. Initial construction and development would result in greater surface disturbance and more area temporarily lost for production. Acres not needed during the production phase would be reclaimed and returned to prime or unique farmlands suitable for production. When the well is no longer productive, the entire site would be reclaimed and returned to prime or unique farmlands.

Mitigation

During the APD process, efforts would be made to relocate the disturbance onto soils identified as “not prime farmland”; however, if relocation is not an option the following mitigation measure would be placed on the project.

When removing soil, the three major mineral soil horizons (A, B, and C) would be removed and stockpiled independent of one another. All separation would occur prior to implementation of any other construction activities. During the interim and final reclamation phases, the three independently stockpiled soil layers would be replaced in the reverse order that they were removed with the C horizon placed first followed by B, then A.

The soil and water resources mitigation measures would also minimize the impacts to prime or unique farmlands.

4.3.6 Heritage Resources

4.3.6.1 Cultural Resources

While the act of leasing Federal minerals would produce no direct impacts to cultural resources, subsequent development of a lease could. To comply with Section 106, a cultural resources survey will need to be conducted for all surface disturbance activities related to development of the lease. Direct and indirect effects cannot be predicted without analysis of site-specific development at the APD stage of development. Potential impacts at that stage could include increased human activity in the area increasing the possibility of removal of, or damage to, heritage artifacts. The increase in human activity in the area increases the possibility of irretrievable loss of information pertaining to the heritage of the project region. Conversely, the benefits to heritage resources derived from the future development are the heritage and historic survey that adds to literature, information, and knowledge of cultural resources.

Many cultural resource issues exist beyond the NHPA, such as state and municipal registers of historic sites, National Heritage Areas, National Trails, or other heritage designations. Leasing the proposed parcels would have no effect on any of these types of cultural resources.

Please refer to the Cultural and Paleontological Resources Summary and BLM Cultural Determination in Appendix 5 for more information.

4.3.6.2 Paleontology

While the act of leasing Federal minerals would produce no direct impacts to paleontological resources, subsequent development of a lease could. Direct and indirect effects cannot be predicted without analysis of site-specific development at the APD stage of development. Potential impacts at that stage could include increased human activity in the area increasing the possibility of removal of, or damage to, paleontology resources. The increase in human activity in the area increases the possibility of irretrievable loss of information pertaining to the paleontology of the project region. Conversely, the benefits to paleontology resources derived from the future development are the paleontology survey that adds to literature, information, and knowledge of cultural resources.

Protection and preservation of significant fossil materials in specific locations would be required for any BLM permitted project.

4.3.6.3 Native American Religious Concerns

The proposed action is not known to physically threaten any TCPs, prevent access to sacred sites, prevent the possession of sacred objects, or interfere or otherwise hinder the performance of traditional ceremonies and rituals pursuant to AIRFA or EO 13007. There are currently no known remains that fall within the purview of NAGPRA or ARPA that are threatened by leasing.

Please refer to the Cultural and Paleontological Resources Summary and BLM Cultural Determination in Appendix 5 for more information.

Mitigation Common to all Heritage Resources

Specific mitigation measures, including but not limited to, site avoidance or excavation and data recovery would be determined when site-specific APDs and cultural surveys are received. As well, a second NHPA section 106 evaluation would be completed. The Oklahoma State Historic Preservation Office confirmed that studies will need to be done at the APD stage.

Standard Conditions of Approval are attached to each APD including:

- In the event that lease development practices are found in the future to have an adverse effect on significant cultural resources, the operator and the BLM, in consultation with the affected tribe(s), and Oklahoma State Historic Preservation Office will take action to mitigate or negate those effects. Measures include, but are not limited to physical barriers to protect resources, relocation of practices responsible for the adverse effects, or other treatments as appropriate.

- If additional ground disturbance is required outside of the currently proposed APE, the Bureau of Land Management archaeologist must be notified prior to any work. If archeological material such as chipped stone tools, pottery, bone, historic ceramics, glass, metal, or building structures are exposed; stop work at that spot immediately and contact the BLM archaeologist at (918) 621-4100.
- If archeological material such as chipped stone tools, pottery, bone, historic ceramics, glass, metal, or building structures are exposed; stop work at that spot immediately and contact the BLM, and the Oklahoma State Historic Preservation Office at (405) 521-6249.

4.3.7 Invasive, Non-native Species

While the act of leasing Federal minerals would not contribute to the spread or control of invasive or non-native species, subsequent exploration/development of the proposed lease may. Any surface disturbance could establish new populations of invasive non-native species, although the probability of this happening cannot be predicted using existing information. Noxious weed seeds can be carried to and from the project areas by construction equipment, the drilling rig and transport vehicles. At the APD stage, BLM requirements for use of weed control strategies would minimize the potential for the spread of these species.

Mitigation

Mitigation is deferred to site-specific development at the APD stage. BMPs require that all Federal actions involving surface disturbance or reclamation take reasonable steps to prevent the introduction or spread of noxious weeds, including requirements to use weed-free hay, mulch and straw.

4.3.8 Vegetation

While the act of leasing Federal minerals would produce no impacts to vegetative resources, subsequent exploration/development of the proposed lease would have impacts to vegetation. The level of impact depends on the vegetation type, the vegetative community composition, soil type, hydrology, and the topography of the parcel. Surface-disturbing activities could affect vegetation by removing, trampling, or killing the vegetation; churning soils; losing substrates for plant growth; impacting biological crusts; disrupting seedbanks; burying individual plants; reducing germination rates; covering plants with fugitive dust; and generating sites for undesirable weedy species. In addition, development could reduce available forage or alter livestock distribution leading to overgrazing or other localized excess grazing impacts to palatable plant species. If these impacts occurred after seed germination but prior to seed establishment, both current and future generations could be affected.

Vegetation would be lost within the construction areas of pads, roads, and rights of ways. Those areas covered in compacted native substrates, such as pads and roads, would have no vegetation for the life of the well. Interim and final reclamation should result in vegetation establishment in three to five growing season (one to two years) with appropriate techniques used and adequate precipitation.

Inadequate precipitation over several growing seasons could result in loss of vegetative cover, leading to weed invasion and deterioration of native vegetation.

Mitigation

Mitigation is primarily deferred to site-specific development at the APD stage. If potential wells are productive disturbed areas not needed for the production facility would be reclaimed. In the case of non-productive wells, all disturbed areas would be reclaimed through reseeding or vegetative cover reestablishment. BMPs identified in BLM guidance documents such as the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development: The Gold Book (USDI, 2007) recommend areas to be restored with native vegetation in regards to both species and structure. This recommendation is contingent upon the wishes of the surface owner.

4.3.9 Wildlife

4.3.9.1 Threatened and Endangered Species

Threatened and Endangered Species may be disturbed during construction, drilling, or hydraulic fracturing operations, as these activities involve many vehicles, mobile and non-mobile heavy equipment, and numerous noise-producing equipment (i.e. generators, compressors). The most significant impacts would be limited to the construction, drilling, and completion/stimulation phases, which can span from several weeks to several months and is entirely dependent on the size and extent of new surface disturbance, length of the well bore, formations encountered during drilling, or whether hydraulic fracturing is used just to name a few. During production, impacts from noise and human disturbance would greatly diminish. In general, most wildlife species would become habituated to the disturbances. For other wildlife species with a low tolerance to activities, the operations on the well pad would continue to displace wildlife from the area due to ongoing disturbances such as vehicle traffic from inspectors and semi-trucks hauling produced fluids, noise from compressors and/or a pump-jack if needed, and equipment maintenance. These impacts would last for the life of the well.

Mitigation

Protective stipulation WO-ESA-7 would be attached to any lease of a tract which falls within an area of potential wildlife habitat. WO-ESA-7 states that, "The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. § 1531 et seq., including completion of any required procedure for conference or consultation."

The ORA-3, Season of Use Stipulation restricts the time that the lessee can be on the lease for a period of more than 60 days. Most season of use restrictions involve wildlife seasonal use requirements or recreational use conflicts with drilling activities.

4.3.9.2 Special Status Species

While the act of leasing Federal minerals would produce no direct impacts to special status species, subsequent development of a lease may produce impacts. Impacts could result from increased habitat fragmentation, noise, or other disturbance during development (Refer to 4.3.10.1).

4.3.9.3 Migratory Birds

While the act of leasing Federal minerals produces no impacts to migratory birds, subsequent exploration/development of the proposed parcel may produce impacts. Surface disturbance from the development of well pads, access roads, pipelines, and utility lines can result in an impact to migratory birds and their habitat.

The Service estimates that many migratory birds are killed annually throughout the United States in oil field production skim pits, reserve pits, and centralized oilfield wastewater disposal facilities. Numerous grasshoppers, moths, June bugs, and the like become trapped on the surface in tanks and on pits, and become bait for many species of migratory birds. Open tanks and pits then become traps to many species of birds protected under the MBTA. Properly covered tanks and pits (and regularly inspected covered tanks and pits) is imperative to continued protection of migratory birds in the well pad area.

Mitigation

Per the MOU between BLM and the Service, entitled “To Promote the Conservation of Migratory Birds,” the following temporal and spatial conservation measures must be implemented as part of the Conditions of Approval with a permit to drill:

1. Avoid any take of migratory birds and/or minimize the loss, destruction, or degradation of migratory bird habitat while completing the proposed project or action.
2. If the proposed project or action includes a reasonable likelihood that take of migratory birds will occur, then complete actions that could take migratory birds outside of their nesting season. This includes clearing or cutting of vegetation, grubbing, etc. The primary nesting season for migratory birds varies greatly between species and geographic location, but generally extends from early April to mid-July. However, the maximum time period for the migratory bird nesting season can extend from early February through late August. Strive to complete all disruptive activities outside the peak of migratory bird nesting season to the greatest extent possible.
3. If no migratory birds are found nesting in proposed project or action areas immediately prior to the time when construction and associated activities are to occur, then the project activity may proceed as planned.

Additionally, WRGCOA #4 (Burying Transmission Lines) and Notice to Lessees (NTL) 96-01-TDO (Modification of Oil and Gas Facilities to Minimize Bird and Bat Mortality) address measures designed to protect migratory birds from accidental deaths associated with power line collisions/electrocutions, open-vent exhaust stacks and open pits and tanks (see attached).

4.3.9.4 Wildlife

While the act of leasing Federal minerals would produce no direct impacts to wildlife, subsequent development of a lease may produce impacts. Impacts could result from increased habitat fragmentation, noise, or other disturbance during development. Although reclamation and restoration efforts for surface disturbance could provide for the integrity of other resources, these efforts may not always provide the same habitat values (e.g. structure, composition, cover, etc.) in the short or in some instance, the long-term in complex vegetative community types (e.g., shrub oak communities). The short-term negative impact to wildlife would occur during the construction and production phase of the operation (drilling, fracturing, production, etc.) due to noise and habitat destruction. In general, most wildlife species would become habituated to the new facilities. For other wildlife species with a low tolerance to activities, the operations on the well pad would continue to displace wildlife from the area due to ongoing disturbances such as vehicle traffic, noise and equipment maintenance. The conditions of approval would alleviate most losses of wildlife species, such as; fencing the reserve pits, netting storage tanks, installation or other modifications of cones on separator stacks, and timing stipulations. The magnitude of above effects would be dependent on the rate and location of the oil and gas development, but populations could likely not recover to pre-disturbance levels until the activity was completed and the vegetative community restored.

Mitigation Common to ALL Species

Measures would be taken to prevent, minimize, or mitigate impacts to fish and wildlife animal species from exploration and development activities. Prior to authorization, activities would be evaluated on a case-by-case basis, and the project would be subject to mitigation measures. Mitigation could potentially include rapid re-vegetation, noise restrictions, project relocation, or pre-disturbance wildlife species surveying.

The Wildlife Resource General Conditions of Approval (WRGCOAs) included in the approved APD and use of standard Best Management Practices (BMPs) should provide extra measures of protection to general wildlife populations and habitats in the area. Impacts to the wildlife resource component of the environment can be avoided or minimized by adopting the WRGCOAs and BMPs. WRGCOA #4 (Burying Transmission Lines) and Notice to Lessees (NTL) 96-01-TDO (Modification of Oil and Gas Facilities to Minimize Bird and Bat Mortality) address measures designed to protect migratory birds from accidental deaths associated with power line collisions/electrocutions, open-vent exhaust stacks and open pits and tanks.

4.3.10 Wastes – Hazardous or Solid

While the act of leasing Federal minerals would produce no impacts on the environment from hazardous or solid wastes, subsequent exploration/development of the proposed lease could have result in the introduction of hazardous and non-hazardous substances to the site. Hazardous substances may be produced, used, stored, transported or disposed of as a result of the project. Properly used, stored, and disposed of hazardous and non-hazardous substances greatly decreases the potential for any impact on any environmental resources. One way operators and the BLM ensure hazardous and non-hazardous substances are properly managed in through the preparation of a Spill Prevention, Control, and Countermeasure (SPCC) plan.

In hydraulic fracturing, chemical substances other than water make up a small percentage of the fluid composition; however, the very large volumes used require correspondingly large volumes of a variety of compounds. These substances range from the relatively benign to the highly toxic at certain concentrations. In addition to these added chemicals, naturally occurring toxicants such as heavy metals, volatile organics, and radioactive compounds are mobilized during extraction and return to the surface with the produced water. Of the millions of gallons of water used to hydraulically fracture a well one time, less than 30 percent to more than 70 percent may remain underground (Bamberger and Oswald 2012). Although the risk is low, the potential exists for unplanned releases that could have serious effects on human health and environment. A number of chemical additives are used that could be hazardous, but are safe when properly handled according to requirements and long-standing industry practices. In addition, many of these additives are common chemicals which people regularly encounter in everyday life (GWPC 2009).

Surface spills of drilling mud and additives, hydraulic fracturing fluids and additives, flowback water, and other produced water can happen at a variety of points in the development and production phases. Spills that occur can span a range of different spill sizes and causes of failure at any point in the process. For example, small spills often happen as the result of poor pipe connections or leaks; large spills sometimes occur as the result of a major well blowout, but such blowouts rarely occur. Additionally, spills from some parts of the phases may be the result of human error (i.e. vehicle collisions, improper handling, improper equipment operation or installation, etc.), while others stem from equipment failure (i.e. broken pipes, torn pit liners, leaking tanks, etc.) or acts of nature (Fletcher 2012). The most common cause of spills comes from equipment failure and corrosion (Wenzel 2012).

The cause of the spill, the spill size, the hazard rating of the spilled material, response time to clean up the spill and the effectiveness of the cleanup, all play a critical role in determining the overall impact on the environment. The volume of a spill can significantly vary with spill types. Pipe spills are not expected to release more than 1,000 gallons into the environment; retaining pit spills and truck spills are not expected to release more than 10,000 gallons of fluid; and blowouts are expected to cause the largest spills, with the potential to release tens of thousands of gallons into the environment. Small spills occur with greater frequency than large spills. Secondary containment or recovery for small spills would likely minimize if not eliminate any potential release into the environment. However, for spills on the order of several thousands of gallons of fluid, it is expected that less than half the fluid may be captured by

secondary containment or recovery. The vast majority of operations do not incur reportable spills (5 gallons or more), indicating the fluid management process can be, and usually is managed safely and effectively (Fletcher 2012).

Mitigation

Specific mitigation is deferred to the APD process. The following measures are common to most projects: all trash would be placed in a portable trash cage and hauled to an approved landfill, with no burial or burning of trash permitted; chemical toilets would be provided for human waste; fresh water zones encountered during drilling operations would be isolated by using casing and cementing procedures; a berm or dike would enclose all production facilities if a well is productive; and all waste from all waste streams on site would be removed to an approved disposal site.

4.3.11 Mineral Resources

While the act of leasing Federal minerals would produce no impacts to mineral resources, subsequent exploration/development of the proposed lease could impact the production horizons and reservoir pressures. If production wells are established, the resources allotted to the wells would eventually be depleted. The amount and location of direct and indirect effects cannot be predicted until site-specific development information is available typically during the APD stage.

Other mineral resources could be impacted as a result of exploration/development through the loss of available surface or subsurface area needed to develop or access the other mineral resource overlapping the proposed lease parcel. The extent of the impacts, if any cannot be predicted until site-specific development information is available typically during the APD stage.

Mitigation

Mitigation is deferred to site-specific development at the APD stage. Spacing orders and allowable production orders are designed to conserve the oil and/or gas resource and provide maximum recovery.

NM-10 has been attached to -035, which indicates that the lease is subject to drainage by well(s) adjacent to the lease and that within six months of leasing the operator must submit plans for protecting the lease from drainage.

4.3.12 Visual Resources

While the act of leasing Federal minerals would produce no impacts to visual resources, subsequent exploration/development of the proposed lease could impact visual quality through: increased visibility of constructed features such as roads, well pads, pipelines, tank batteries; road degeneration from heavy trucks and vehicles following rain and snow; dust and exhaust from construction, drilling, and production vehicles and equipment; vegetation removal and construction of steep slopes; unreclaimed sites; and discarded equipment. Well pads, power lines, access roads, and associated production facilities and storage tanks have the greatest potential to alter visual conditions for the life of the well. Vegetation removal would present an obvious contrast in color with the surrounding vegetation and

affect foreground and middleground distance zones for more than a decade. These impacts would be most obvious immediately after construction. Impacts would decrease as the disturbed surface began to blend in color, form, and texture, when interim or final reclamation occurs. Long-term visual impacts could persist as long as the well is producing, which could be a couple of years to more than 50 years. Long-term impacts may include vegetation removal, alteration of the landscape, and installation of equipment and facilities.

Mitigation

Mitigation is deferred to site-specific development at the APD stage.

4.3.13 Recreation

While the act of leasing Federal minerals would produce no impacts to recreation resources, subsequent exploration/development of the proposed lease could impact recreation quality and opportunities through: increased vehicle traffic and human presence, loss of areas to recreate, blocked access, and increased noise and visual disturbance.

Mitigation

Mitigation is deferred to site-specific development at the APD stage.

4.3.14 Socioeconomics and Environmental Justice

No minority or low income populations would be directly affected in the vicinity of the proposed lease parcel. Indirect impacts could include an increase in overall employment opportunities related to the oil and gas and service support industry in the region, as well as the economic benefits to State and County governments related to royalty payments and severance taxes. Other impacts could include a small increase in activity and noise disturbance in areas used for agriculture and recreational activities. However, these impacts would apply to all land users in the area.

Oil and gas development, especially during drilling and hydraulic fracturing, can create short-term increases in traffic volume, dust and noise and negatively impact nearby residents or businesses. These nuisance impacts are usually limited to the construction, drilling, completion and/or hydraulic fracturing phases of the well. These impacts would be significantly reduced during production, when the site would be visited periodically for inspection and/or to haul produced fluids.

Mitigation

Mitigation is deferred to site-specific development at the APD stage.

4.3.15 Cumulative Effects

The NMSO manages approximately 41 million acres of Federal mineral estate. Of the 41 million acres, 35 million acres are available for oil and gas leasing. Approximately 16 percent of the 35 million acres is currently leased (73% of the leases are in production and 63% of the lease acres are in production). The

NMSO received 15 parcel nominations (2778.650 acres) for consideration in the April 2014 Oil & Gas Lease Sale, and is proposing to lease 14 (2773.650 acres) of the 15 parcels. If these 14 parcels were leased, the percentage of Federal minerals leased wouldn't change. Only parcels in OK and TX will be

Table 18. Actual – Acres of Federal Minerals/Acres Available/Acres Leased

State	Federal O&G Mineral Ownership	Acres Available	Acres Leased	Percent Leased
KS	744,000	614,586	125,091	20%
NM	34,774,457	29,751,242	4,839,255	16%
OK	1,998,932	1,668,132	324,072	19%
TX	3,404,298	3,013,207	425,511	14%
Totals/Average	40,921,687	35,058,167	5,713,929	16%

Table 19. Parcels Nominated and Offered in the February 2014 Oil and Gas Lease Sale

Field Office	No. of Nominated Parcels	Acres of Nominated Parcels	No. of Parcels to be Offered	Acres of Parcels to be Offered
Oklahoma	3	1306.42	2	1301.42
Texas	12	1472.23	12	1472.23
Totals	15	2778.65	14	2773.65

Table 20. Foreseeable – Acres of Federal Minerals/Acres Available/Acres Leases

State	Federal O&G Mineral Ownership	Acres Available	Acres Leased	Percent Leased
KS	744,000	614,586	125,211	20%
NM	34,774,457	29,751,242	4,878,141	16%
OK	1,998,932	1,668,132	325,990	19%
TX	3,404,298	3,013,207	461,002	15%
Totals/Average	40,921,687	35,067,167	5,790,344	17%

The cumulative impacts fluctuate with the gradual reclamation of well abandonments and the creation of new additional surface disturbances in the construction of new access roads and well pads. The on-going process of restoration of abandonments and creating new disturbances for drilling new wells gradually accumulates as the minerals are extracted from the land. Preserving as much land as possible and applying appropriate mitigation measures will alleviate the cumulative impacts.

Analysis of cumulative impacts for reasonably foreseeable development of oil and gas wells in Texas was analyzed in the Oklahoma RMP (1994), as amended, and Texas RMP (1996), as amended. Potential development of all available federal minerals in Oklahoma and Texas including those in the proposed lease parcels was included as part of the analysis. Total surface disturbance projected by the plan was based on an estimated 20 Federal wells being drilled annually in Oklahoma and Texas, each, with an

estimated 113 acres of disturbance. Over the last 10 years there have been no changes to the basic assumptions or projections described in the either RMP's, analysis.

More than 100 years of oil and gas development in Oklahoma Texas has resulted in an extensive infrastructure of existing roads and pipelines. The Oklahoma Corporation Commission reports a total of 115,000 oil wells and 65,000 natural gas wells that are drilled and not plugged in Oklahoma. A total of 74,319 thousand barrels of oil was produced in 2011 with an average of 62 rotary rigs in operation per month. They also report a total of 1,827,328 million cubic feet of natural gas was produced in 2011 with an average of 120 rotary rigs in operation per month.

As of October 30, 2013, the Railroad Commission of Texas lists 412,660 current wells statewide including 305,567 active wells and 107,093 inactive wells (RRC 2013). In 2012, there were 167,864 producing oil wells with a total oil production of 592,437,753 (RRC 2013 and 2013a). In 2012, there were 102,633 producing gas wells in Texas with total gas production of 8,024,741,449 mcf (RRC 2013 and 2013a). Impacts from this development would remain on the landscape until final abandonment and reclamation of facilities occurs as wells are plugged when they are no longer economically viable.

4.3.15.1 Effects on Air Quality

The following analysis of cumulative impacts of the proposed action on air quality will be limited to the two counties in which the proposed lease parcels occur.

The primary activities that contribute to levels of air pollutants in the five counties are predominately combustible engines of road and non-road, diesel and gasoline vehicles and equipment. The Air Resources Technical Report includes a description of the varied sources of national and regional emissions that are incorporated here to represent the past, present and reasonably foreseeable impacts to air resources (BLM 2013). It includes a summary of emissions on the national and regional scale by industry source. Sources that are considered to have notable contributions to air quality impacts and GHG emissions include electrical generating units, fossil fuel production (nationally and regionally) and transportation.

The very small increase in emissions that could result from approval of the proposed action or preferred alternative would not result in the area violating the NAAQS for any criteria pollutant. In October 2012, EPA regulations that require control of VOC emissions from oil and gas development became effective. These regulations will reduce VOC emissions from oil and gas exploration and production emissions that contribute to the formation of ozone. Emissions from any lease development are not expected to impact the 8-hour average ozone concentrations, or any other criteria pollutants in the area of the proposed lease.

4.3.15.2 Cumulative Effects on Climate Change

The cumulative impacts of GHG emissions and their relationship to climate change are evaluated at the national and global levels in the Air Resources Technical Report (USDI 2013). The very small increase in GHG emissions that could result from approval of the proposed action would not produce climate change impacts that differ from the No Action Alternative. This is because climate change is a global

process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from the proposed action cannot be translated into effects on climate change globally or in the area of this site-specific action. It is currently not feasible to predict with certainty the net impacts from particular emissions associated with Federal actions; however, EPA's recently finalized oil and gas air quality regulations have a co-benefit of methane reduction that will reduce greenhouse gas emissions from any oil and gas development that would occur on this lease.

5.0 CONSULTATION/COORDINATION

This section includes the resource specialists located within the OFO that specifically participated and provided input in the lease parcel review process and the development of this EA document.

ID Team Member	Title	Organization
Larry Moore	Archaeologist	BLM
Becky Peters	Wildlife Biologist	BLM
Pat Stong	Geologist	BLM
Melinda Fisher	Natural Resource Specialist	BLM
Galen Schwertfeger	Environmental Specialist	BLM
Gary McDonald	Environmental Specialist	BLM
Larry Levesque	Planning and Environmental Coordinator	BLM

On October 31, 2013 a briefing for the BLM NM State Director was held at the Oklahoma Field Office to review Field Office recommendations for nominated parcels.

5.1 Public Involvement

The nominated parcels, along with the appropriate stipulations from the Oklahoma RMP (1994), as amended, and Texas RMP (1996), as amended were posted online for a two week review period beginning October 28, 2013. No comments were received. This EA will be made available for public review and comment for 30 days beginning November 25, 2013. Comments provided prior to the lease sale will be considered and incorporated into the EA as appropriate.

6.0 REFERENCES

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7.0 AUTHORITIES

Code of Federal Regulations (CFR)

40 CFR All Parts and Sections inclusive Protection of Environment, Revised as of January 1, 2001.

43 CFR All Parts and Sections inclusive – Public Lands: Interior. Revised as of October 1, 2000.

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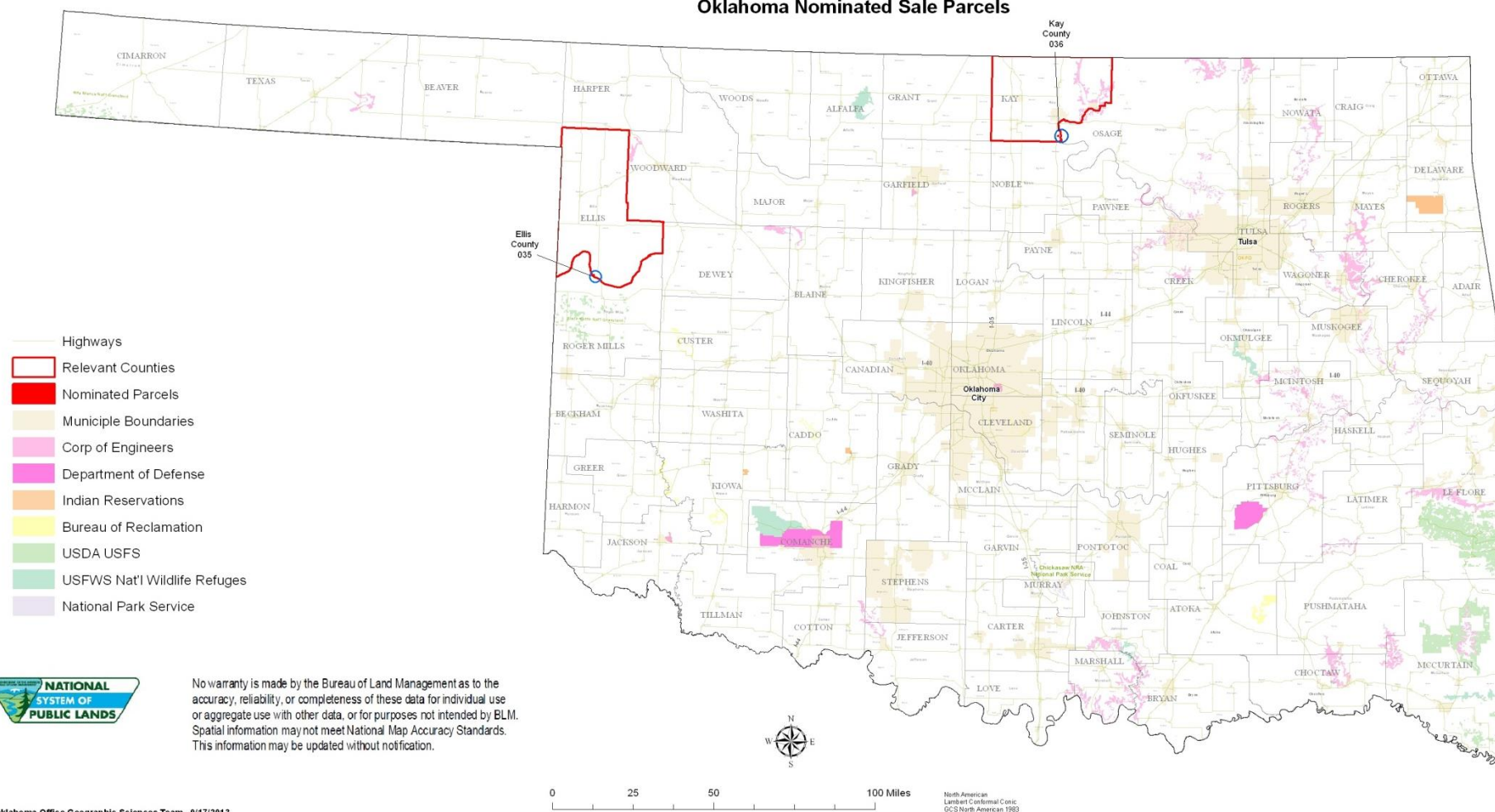
APPENDIX 1. OKLAHOMA FIELD OFFICE LEASE STIPULATION SUMMARY

Stipulation	Description/Purpose
LNRA-GS TX	<p>GENERAL STIPULATIONS FOR PALMETTO BEND RIVER PROJECT: All surface work performed by the lessee on the lands shall be under the general supervision of the Lavaca Navidad River Authority (LNRA) General Manager or his designees, and shall be subject to such conditions and regulations as may be prescribed. Detailed plans and location for all structures, appurtenances thereto, and surface disturbance work on Project Lands shall be submitted to the LNRA for approval in advance of commencement of any surface work. General stipulations include, but are not limited to: No well shall be drilled for oil or gas below the surface elevation of 47.5 feet mean sea level (msl) (top of conservation pool). All storage tanks shall be constructed outside the flood plain above elevation 47.5 feet msl. No “mud pits” shall be constructed on Project Lands; a close mud system is required with containerization of drill cuttings. No drilling will be allowed within any developed recreation area. Berms shall be constructed around storage batteries, tanks, and separators to contain their entire volume should an accidental spill or rupture occur. Drilling a well for oil or gas is prohibited within 5,280 feet of any dam, dike, or other major structure and no well shall be drilled within 1/8 mile (660 feet) of a river, channel, permanent stream, tributary, or marsh site unless otherwise approved by the LNRA General Manager or his designee in consultation with the local managing agency(s).</p>
FS 1 TX	<p>STIPULATION FOR LANDS OF THE NATIONAL FOREST SYSTEM UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE: The permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of the Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of an exploration plan by the Secretary of the Interior, (2) uses of all existing improvements, such as Forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by an exploration plan approved by the Secretary of the Interior.</p>
FS 8 TX CSU-1A	<p>CONTROLLED SURFACE USE - STREAMSIDE MANAGEMENT: Portions of this lease contain streamside management zones (floodplains, wetlands). Site- specific proposals for surface-disturbing activities within these areas will be analyzed and will normally result in establishment of protective requirements or limitations for the affected site. Surface occupancy for oil and gas wells will not be allowed within the streamside management zone.</p>
FS 8 TX CSU-1B	<p>CONTROLLED SURFACE USE – PERENNIAL AND INTERMITTENT STREAM PROTECTION: Portions of this lease contain segments of either perennial or intermittent streams as defined by the Forest Service. Areas within 100’ of perennial streams or 66’ of intermittent streams will be subject to special requirements or limitations of surface use or occupancy. Specific requirements or limitations will be determined as Surface Use Plan of Operations are submitted and will normally result in establishment of protective requirements or limitations for the affected site.</p>

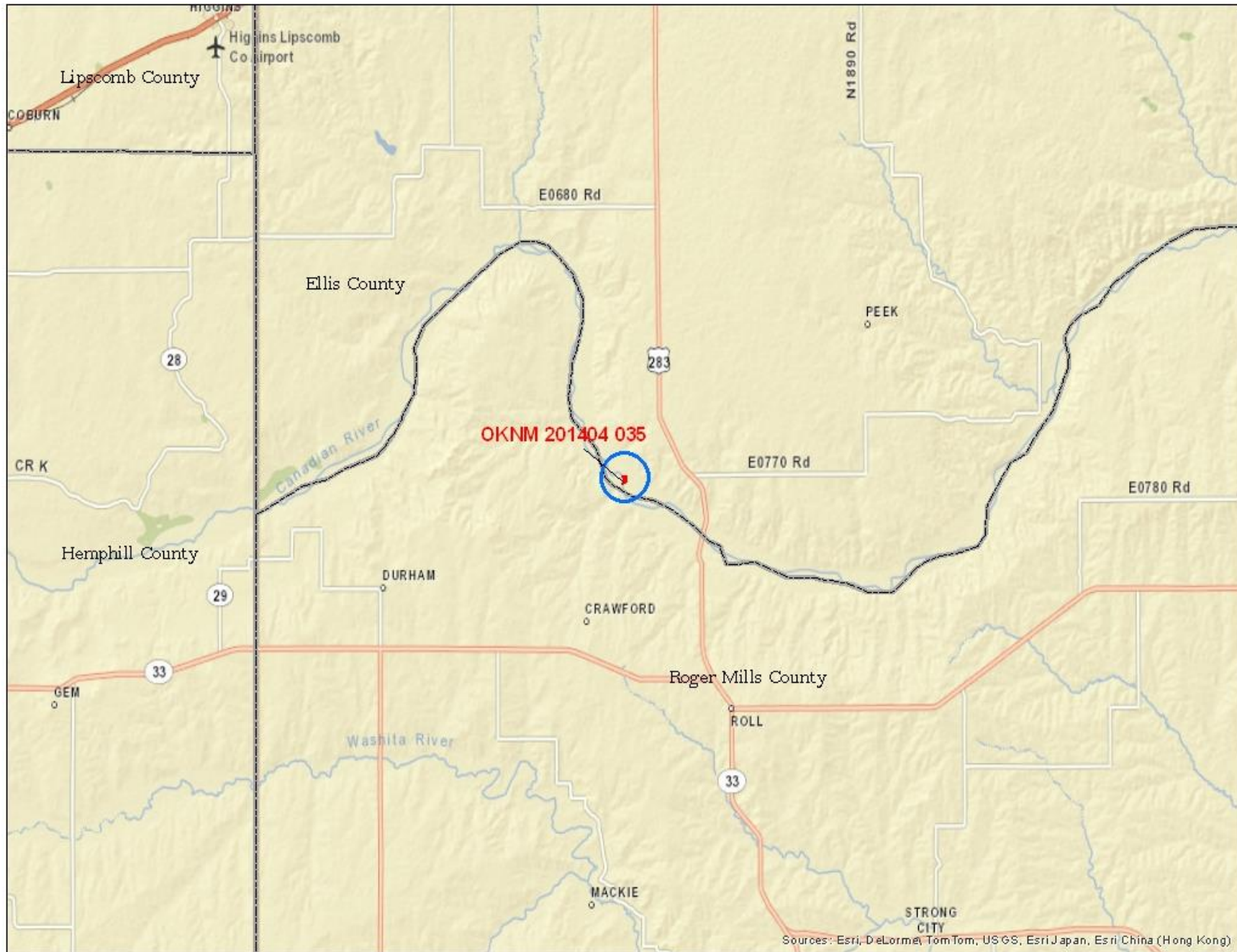
Stipulation	Description/Purpose
FS 8 TX CSU-1E	CONTROLLED SURFACE USE STIPULATION - TOLEDO BEND RESERVOIR LAKESHORE PROTECTION: Proposals for a structure, facility, or motorized uses on Toledo Bend Reservoir lands between the 172' and 175' MSL contours, or on a strip of land extending inland 200 meters from the 175' contour, may be subject to special requirements or limitations, such to be determined on a case-by-case basis.
FS 8 TX CSU-1I-2	CONTROLLED SURFACE USE - RED-COCKADED WOODPECKER: Portions of the land in this lease are, or may be, occupied by clusters of the endangered red-cockaded woodpeckers (RCWs). Exploration and development proposals may be modified and/or limited, in accordance with the Recovery Plan for the Red-cockaded Woodpecker, second revision approved January 27, 2003.
FS 8 TX CSU-1K	CONTROLLED SURFACE USE – FLOOD PREVENTION AND/OR EROSION CONTROL: Extensive areas within this lease are considered critical areas for flood prevention and/or erosion control. Control structures and erosion damage rehabilitation work either exist now or may be added during the period of the lease. Surface occupancy may be restricted including no surface occupancy, or limited in order to assure minimum conflict with erosion control or flood prevention goals. Restrictions or limitations will be identified by a site-specific analysis of a proposal of lease activities.
FS 8 TX LN-4B	LEASE NOTICE – COE/FS JOINT APPROVAL (Sabine River Authority): Other than foot travel, any proposals for surface occupancy involving those lands below the 172' MSL contour, which have been exchanged to the Sabine River Authority (SRA), will require coordination with the United States Corps of Engineers (COE) as the Forest Service is not the responsible surface management agency for the transferred lands. In addition, the Sabine River Authority of Texas will be requested to comment on such proposals. Proposals for surface occupancy involving both FS administered and COE administered lands will require joint approval from both agencies.
FS 8 TX TLS-1B	TIMING LIMITATION STIPULATION – PROBABLE BALD EAGLE NESTING LOCATIONS (October 1 – May 15): Part or this entire lease is within one (1) mile of a bald eagle nesting site. During nesting periods, seismic exploration, new clearing of vegetation, and exploratory drilling or any other site-specific proposals for activities within these areas will be analyzed. Such analysis could result in establishment of protective requirements or limitations for the affected site and activities may be restricted if, in the opinion of the responsible agency biologist, restrictions are necessary to assure nesting success.
ORA-1 OK, TX	FLOODPLAIN PROTECTION: A result of EO 11988 Floodplain Management of May 24, 1977. All or portions of the lands under this lease lie in and or adjacent to a major watercourse and are subject to periodic flooding. Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the Bureau of Land Management.
ORA-2 OK, TX	WETLAND/RIPARIAN: Mandated by EO 11990 Protection of Wetlands of May 24, 1977. All or portions of the lands under this lease contain wetland and/or riparian areas. Surface occupancy of these areas will not be allowed without the specific approval, in writing, of the Bureau of Land Management. Impacts or disturbance to wetlands and riparian habitats which occur on this lease, must be avoided or mitigated. The mitigation shall be developed during the application for permit to drill.
ORA-3 OK, TX	SEASON OF USE: Surface occupancy of this lease will not be allowed from February 15 – May 15 for protection of the lesser/greater prairie-chicken breeding season.

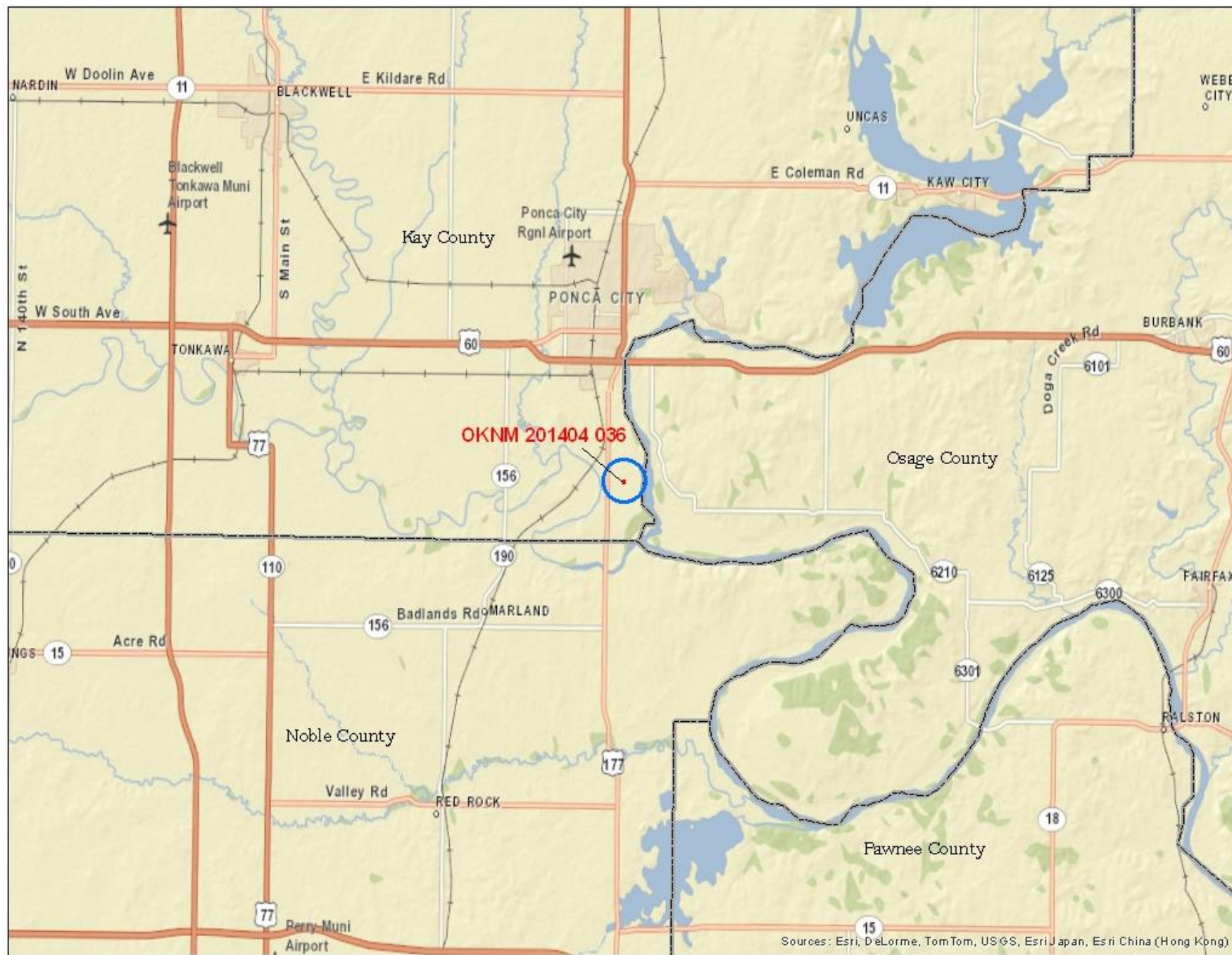
Stipulation	Description/Purpose
ORA-4 TX	NO SURFACE OCCUPANCY: To protect and preserve significant cultural and other resource values of this lease. The tract could be leases for inclusion in a drilling unit and may be drilled directionally from an off-site location where occupancy is allowed.
NM-10 OK, TX	DRAINAGE: All or part of the lands contained in this lease are subject to drainage by wells(s) located adjacent to this lease. The lessee shall be required within 6 months of lease issuance to submit to the authorized officer plans for protecting the lease from drainage. Compensatory royalty will be assessed effective the expiration of this six-month period if no plan is submitted. The plan must include either an Application for Permit to Drill (APD) for a protective well, or an application to communitize the lease so that it is allocated production from a protective well off the lease. Either of these options may include obtaining a variance to State-spacing for the area. In lieu of this plan, the lessee shall be required to demonstrate that a protective well would have little or no chance of encountering oil and gas in quantities sufficient to pay in excess the costs of protecting the lease from drainage or an acceptable justification why a protective well would be uneconomical, the lessee shall be obligated to pay compensatory royalty to the Minerals Management Service at a rate to be determined by the authorized officer.
WO-ESA-7 OK, TX	ENDANGERED SPECIES ACT SECTION 7 CONSULTATION STIPULATION: The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. § 1531 <u>et seq.</u> , including completion of any required procedure for conference or consultation.
WO-NHPA TX, OK	CULTURAL RESOURCES AND TRIBAL CONSULTATION STIPULATION: This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders. The BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations (e.g., State Historic Preservation Officer (SHPO) and tribal consultation) under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated.

**BLM New Mexico Competitive Oil and Gas Lease Sale
April 16, 2014
Oklahoma Nominated Sale Parcels**

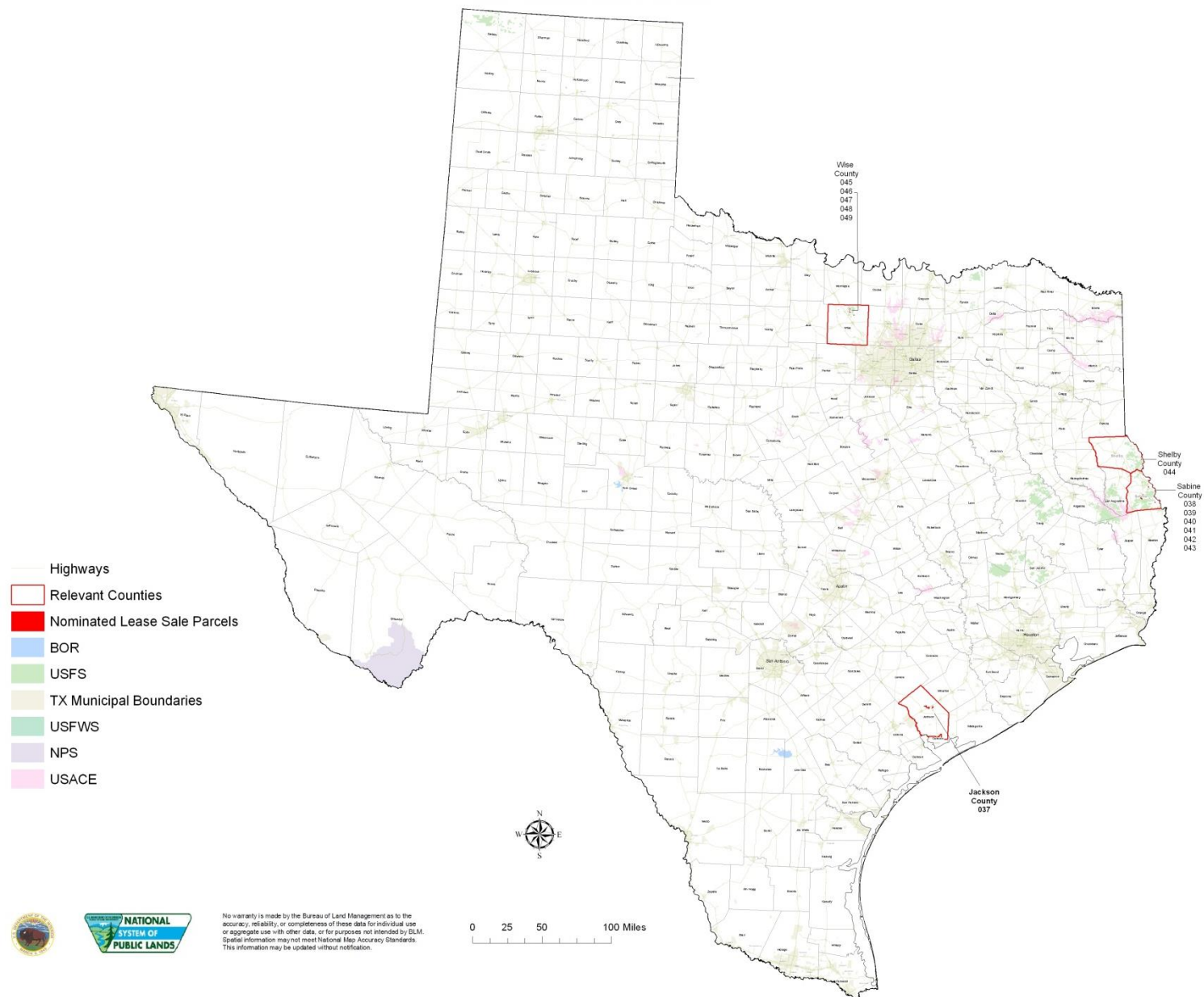


Ellis County nominated parcel.

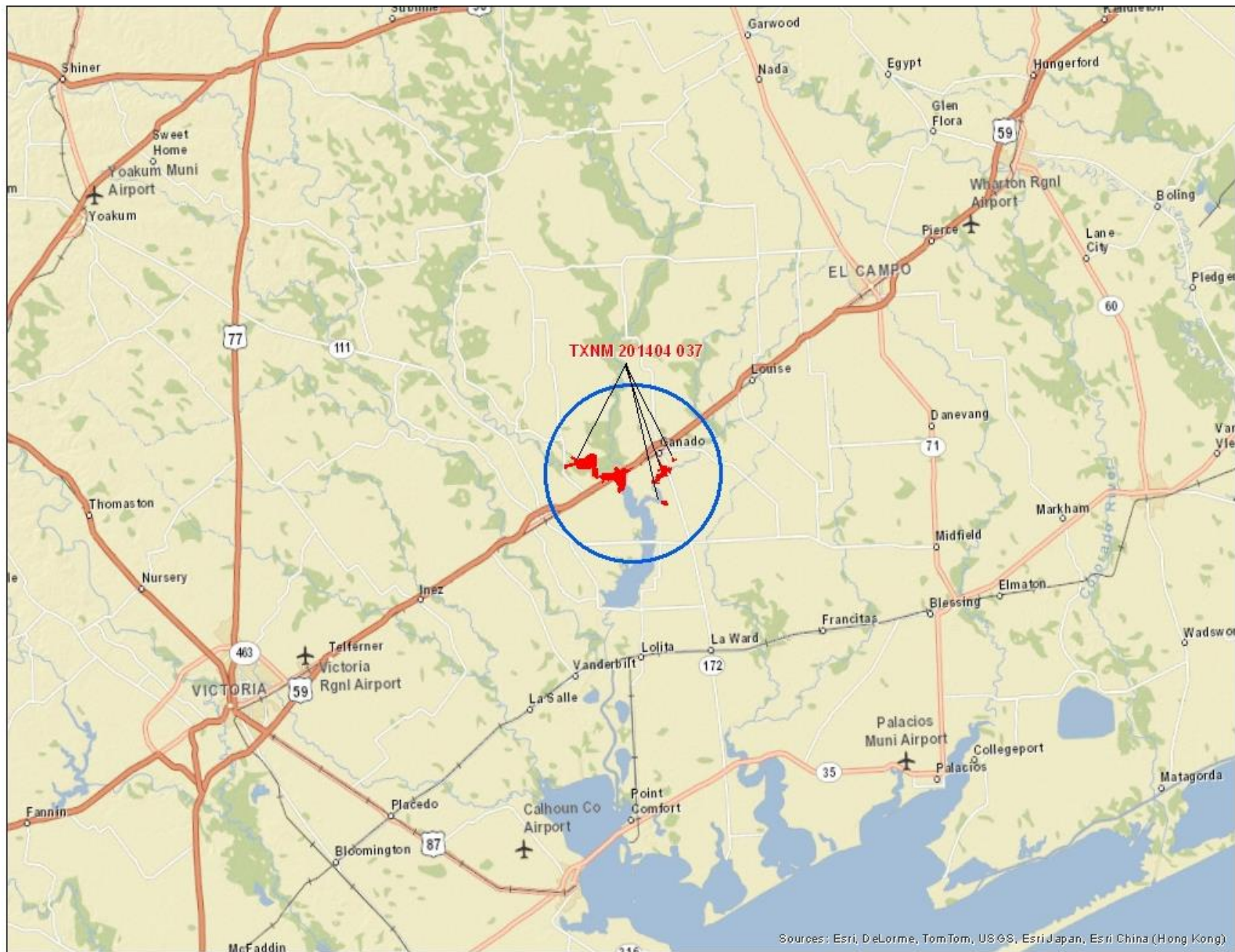




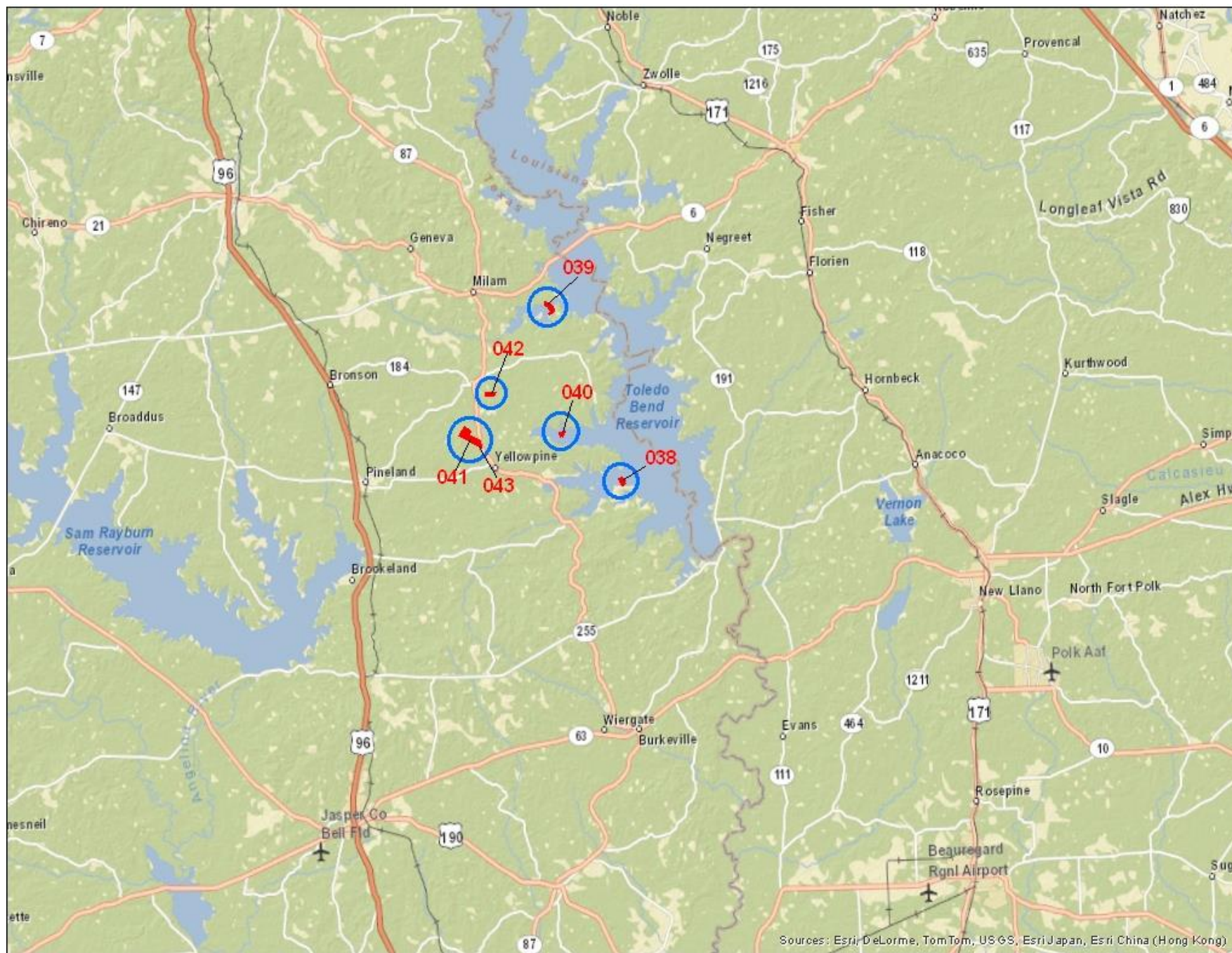
BLM New Mexico Competitive Oil and Gas Lease Sale April 16, 2014 Texas Nominated Parcels

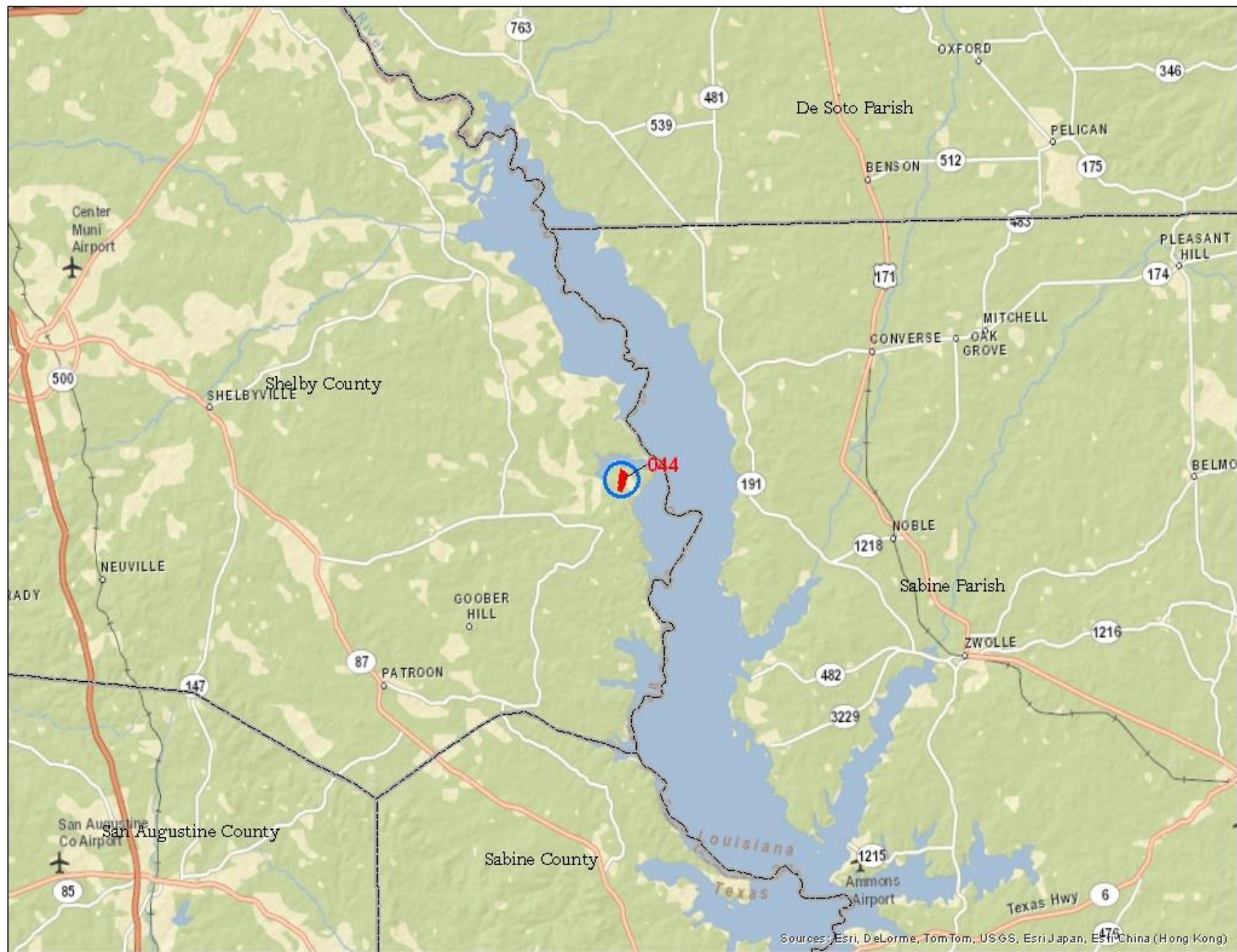


Jackson County nominated parcel.

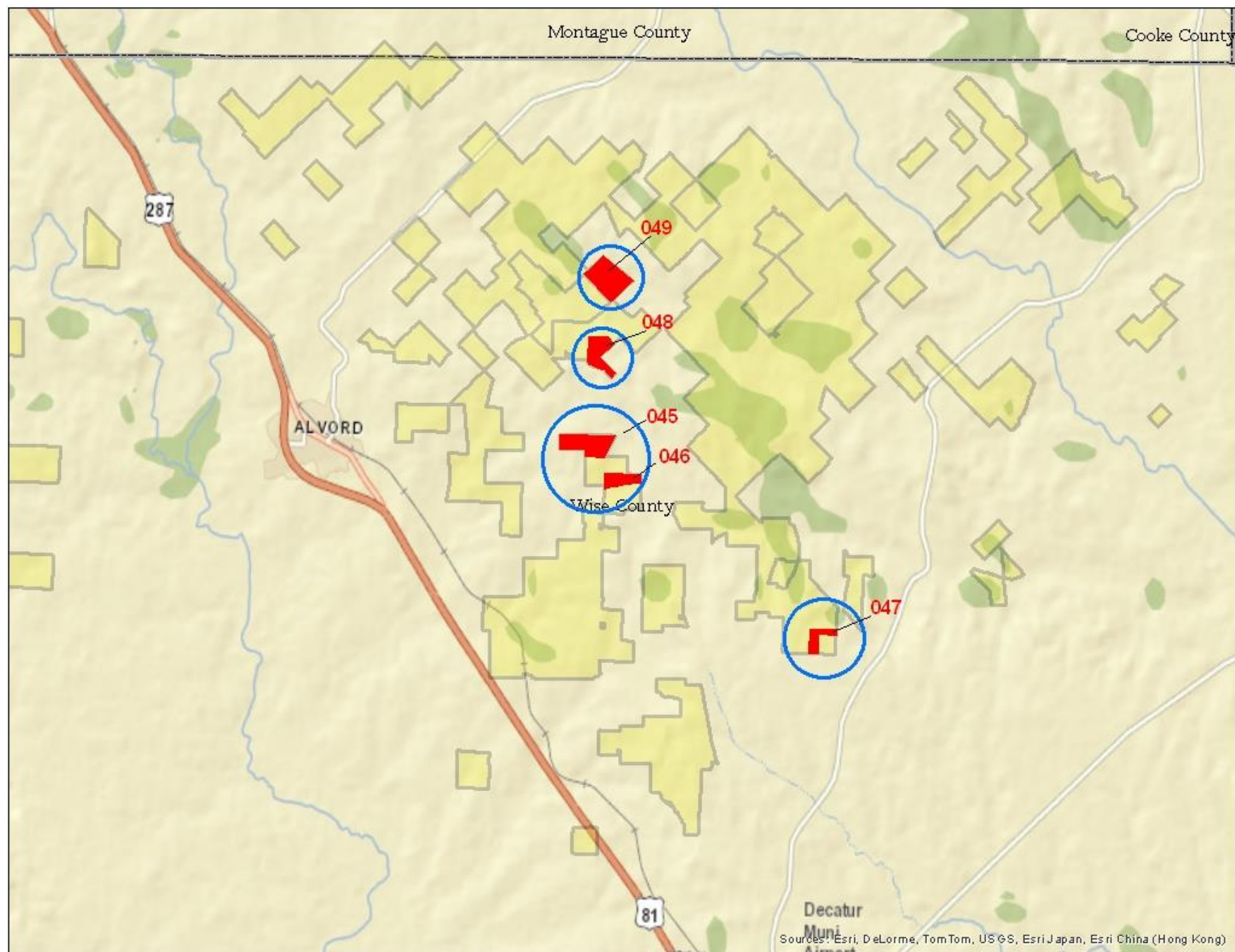


Sabine County nominated parcels.





Wise County nominated parcels.



APPENDIX 3: PHASES OF OIL AND GAS DEVELOPMENT

Construction Activities

Clearing of the proposed well pad and access road would be limited to the smallest area possible to provide safe and efficient work areas for all phases of construction. First all new construction areas need to be cleared of all vegetation. All clearing activities are typically accomplished by cutting, mowing and/or grading vegetation as necessary. Cut vegetation may be mulched and spread on site or hauled to a commercial waste disposal facility.

Next, heavy equipment including but not limited to bulldozers, graders, front-end loaders, and/or track hoes are used to construct at a minimum the pad, but other features, as needed for development, may include, but is not limited to an access road, reserve pit, pipeline, and/or fracturing pond. Cut and fills may be required to level the pad or road surfaces. If a reserve pit is authorized, it would be lined using an impermeable liner or other lining mechanism (i.e. bentonite or clay) to prevent fluids from leeching into the soil. Access roads may have cattle guards, gates, drainage control, or pull-outs installed, among a host of other features that may be necessary based on the site specific situation. Long-term surfaces are typically dressed with a layer of crushed rock or soil cemented. Construction materials come from a variety of sources, but in Oklahoma, Texas, and Kansas, the most common are commercial. Areas not needed for long-term development (i.e. portions of the pipeline or road right-of-way) are reclaimed by recontouring the surface and establishing vegetation.

If a pipeline is needed, the right-of-way would be cleared of all vegetation. The pipeline would be laid out within the cleared section. A backhoe, or similar piece of equipment, would dig a trench at least 36 inches below the surface. After the trench is dug, the pipes would be assembled by welding pieces of pipe together and bending them slightly, if necessary, to fit the contour of the pipeline's path. Once inspected, the pipe can be lowered into the trench and covered with stockpiled subsoil that was originally removed from the hole. Each pipeline undergoes hydrostatic testing prior to natural gas being pumped through the pipeline. This ensures the pipeline is strong enough and absent of any leaks.

Drilling Operations

When the pad is complete, the drilling rig and associated equipment would be moved onsite and erected. A conventional rotary drill rig with capability matched to the depth requirements of the proposed well(s) would be used. The well could be drilled as a vertical or horizontal well to target the desired formation. The depth of the well is entirely dependent on the target formation depth and could be several hundred feet vertical depth to over 20,000 feet vertical depth.

When a conventional reserve pit system is proposed, drilling fluid or mud is circulated through the drill pipe to the bottom of the hole, through the bit, up the bore of the well, and finally to the surface. When mud emerges from the hole, it enters into the reserve pit where it would remain until all fluids are evaporated and the solids can be buried.

A closed-loop system, operates in a similar fashion except that when the mud emerges from the hole, it passes through a series of equipment used to screen and remove drill cuttings (rock chips) and sand-sized solids rather than going into the pit. When the solids have been removed, the mud would be placed into holding tanks, and from the tank, used again.

In either situation the mud is maintained at a specific weight and viscosity to cool the bit, seal off any porous zones (thereby protecting aquifers or preventing damage to producing zone productivity), control subsurface pressure, lubricate the drill string, clean the bottom of the hole, and bring the drill cuttings to the surface. Water-based or oil-based muds can be used and is entirely dependent on the site-specific conditions.

Completion Operations

Once a well has been drilled, completion operations would begin once crews and equipment are available. Well completion involves setting casing to depth and perforating the casing in target zones.

Wells are often treated during completion to improve the recovery of hydrocarbons by increasing the rate and volume of hydrocarbons moving from the natural oil and gas reservoir into the wellbore. These processes are known as well-stimulation treatments, which create new fluid passageways in the producing formation or remove blockages within existing passageways. They include fracturing, acidizing, and other mechanical and chemical treatments often used in combination. The results from different treatments are additive and complement each other.

Hydraulic Fracturing

Hydraulic fracturing (HF) is one technological key to economic recovery of oil and gas that might have been left by conventional oil and gas drilling and pumping technology. It is a formation stimulation practice used to create additional permeability in a producing formation, thus allowing gas to flow more readily toward the wellbore. Hydraulic fracturing can be used to overcome natural barriers, such as naturally low permeability or reduced permeability resulting from near wellbore damage, to the flow of fluids (gas or water) to the wellbore (GWPC 2009). The process is not new and has been a method for additional oil and gas recovery since the early 1900s; however, with the advancement of technology it is more commonly used.

Hydraulic fracturing is a process that uses high pressure pumps to pump fracturing fluid into a formation at a calculated, predetermined rate and pressure to generate fractures or cracks in the target formation. For shale development, fracture fluids are primarily water-based fluids mixed with additives which help the water to carry proppants into the fractures, which may be made up of sand, walnut hulls, or other small particles of materials. The proppant is needed to “prop” open the fractures once the pumping of fluids has stopped. Once the fracture has initiated, additional fluids are pumped into the wellbore to continue the development of the fracture and to carry the proppant deeper into the formation. The additional fluids are needed to maintain the downhole pressure necessary to accommodate the increasing length of opened fracture in the formation.

Hydraulic fracturing of horizontal shale gas wells is performed in stages. Lateral lengths in horizontal wells for development may range from 1,000 feet to more than 5,000 feet. Depending on the lengths of the laterals, treatment of wells may be performed by isolating smaller portions of the lateral. The fracturing of each portion of the lateral wellbore is called a stage. Stages are fractured sequentially beginning with the section at the farthest end of the wellbore, moving uphole as each stage of the treatment is completed until the entire lateral well has been stimulated.

This process increases the flow rate and volume of reservoir fluids that move from the producing formation into the wellbore. The fracturing fluid is typically more than 99 percent water and sand, with small amounts of readily available chemical additives used to control the chemical and mechanical properties of the water and sand mixture (see discussion about Hazardous and Solid Wastes below). Because the fluid is composed mostly of water, large volumes of water are usually needed to perform hydraulic fracturing. However, in some cases, water is recycled or produced water is used.

Before operators or service companies perform a hydraulic fracturing treatment, a series of tests is performed. These tests are designed to ensure that the well, casing, well equipment, and fracturing equipment are in proper working order and will safely withstand the application of the fracture treatment pressures and pump flow rates.

To ensure that hydraulic fracturing is conducted in a safe and environmentally sound manner, the BLM approves and regulates all drilling and completion operations, and related surface disturbance on Federal public lands. Operators must submit Applications for Permit to Drill (APDs) to the agency. Prior to approving an APD, a BLM OFO geologist identifies all potential subsurface formations that would be penetrated by the wellbore. This includes all groundwater aquifers and any zones that would present potential safety or health risks that may need special protection measures during drilling, or that may require specific protective well construction measures.

Once the geologic analysis is completed, the BLM reviews the company's proposed casing and cementing programs to ensure the well construction design is adequate to protect the surface and subsurface environment, including the potential risks identified by the geologist and all known or anticipated zones with potential risks.

During drilling, the BLM is on location during the casing and cementing of the ground water protective surface casing and other critical casing and cementing intervals. Before hydraulic fracturing takes place, all surface casing and some deeper, intermediate zones are required to be cemented from the bottom of the cased hole to the surface. The cemented well is pressure tested to ensure there are no leaks and a cement bond log is run to ensure the cement has bonded to the casing and the formation. If the fracturing of the well is considered to be a "non-routine" fracture for the area, the BLM would always be onsite during those operations as well as when abnormal conditions develop during the drilling or completion of a well.

Production Operations

Production equipment used during the life of the well may include a 3-phase separator-dehydrator; flow-lines; a meter run; tanks for condensate, produced oil, and water; and heater treater. A pump jack may be required if the back pressure of the well is too high. Production facilities are arranged to facilitate safety and maximize reclamation opportunities. All permanent above-ground structures not subject to safety considerations are painted a standard BLM or company color or as landowner specified.

Workovers may be performed multiple times over the life of the well. Because gas production usually declines over the years, operators perform workover operations which involve cleaning, repairing and maintaining the well for the purposes of increasing or restoring production.

Hazardous or Solid Wastes Associated with Oil and Gas Development

Anticipated use or produced hazardous materials during the development may come from drilling materials; cementing and plugging materials; HF materials; production products (natural gas, condensates, produced water); fuels and lubricants; pipeline materials; combustion emissions; and miscellaneous materials. Appendix 3, Table 1 includes some of the common wastes (hazardous and non-hazardous) that are produced during oil and gas development.

Appendix 3, Table 1. Common wastes produced during oil and gas development.

Phase	Waste
Construction	<ul style="list-style-type: none">• Domestic wastes (i.e. food scraps, paper, etc.)• Excess construction materials• Used lubricating oils• Solvents• Woody debris• Paints• Sewage
Drilling	<ul style="list-style-type: none">• Drilling muds, including additives (i.e. chromate and barite) and cuttings• Well drilling, completion, workover, and stimulation fluids (i.e. oil derivatives such as polycyclic aromatic hydrocarbons (PAHs), spilled chemicals, suspended and dissolved solids, phenols, cadmium, chromium, copper, lead, mercury, nickel)• Equipment, power unit and transport maintenance wastes (i.e. batteries; used filters, lubricants, oil, tires, hoses, hydraulic fluids; paints; solvents)• Fuel and chemical storage drums and containers• Cementing wastes• Production testing wastes• Excess construction materials• Scrap metal• Sewage• Rigwash• Excess drilling chemicals• Processed water• Contaminated soil• Domestic wastes
HF	See below

Phase	Waste
Production	<ul style="list-style-type: none"> Power unit and transport maintenance wastes (i.e. batteries; used filters, lubricants, filters, tires, hoses, coolants, antifreeze; paints; solvents, used parts) Discharged produced water Production chemicals Workover wastes (e.g. brines) Tank or pit bottoms Contaminated soil Scrap metal
Abandonment/ Reclamation	<ul style="list-style-type: none"> Construction materials Decommissioned equipment Contaminated soil Insulating materials Sludge

Hydraulic Fracturing

Chemicals serve many functions in hydraulic fracturing, from limiting the growth of bacteria to preventing corrosion of the well casing. Chemicals are needed to insure the hydraulic fracturing job is effective and efficient. The fracturing fluids used for shale stimulations consist primarily of water but also include a variety of additives. The number of chemical additives used in a typical fracture treatment varies depending on the conditions of the specific well being fractured. A typical fracture treatment will use very low concentrations of between 3 and 12 additive chemicals depending on the characteristics of the water and the shale formation being fractured. Each component serves a specific, engineered purpose. The predominant fluids currently being use for fracture treatments in the shale gas plays are water-based fracturing fluids mixed with friction-reducing additives, also known as slickwater (GWPC 2009).

The make-up of fracturing fluid varies from one geologic basin or formation to another. Because the make-up of each fracturing fluid varies to meet the specific needs of each area, there is no one-size-fits-all formula for the volumes for each additive. In classifying fracture fluids and their additives it is important to realize that service companies that provide these additives have developed a number of compounds with similar functional properties to be used for the same purpose in different well environments. The difference between additive formulations may be as small as a change in

Figure 2. Typical Chemical Additives Used In Fracturing Fluids (GWPC 2009)

Compound	Purpose	Common application	
Acids	Helps dissolve minerals and initiate fissure in rock (pre-fracture)	Swimming pool cleaner	
Sodium Chloride	Allows a delayed breakdown of the gel polymer chains	Table salt	
Polyacrylamide	Minimizes the friction between fluid and pipe	Water treatment, soil conditioner	
Ethylene Glycol	Prevents scale deposits in the pipe	Automotive anti-freeze, deicing agent, household cleaners	
Borate Salts	Maintains fluid viscosity as temperature increases	Laundry detergent, hand soap, cosmetics	
Sodium/Potassium Carbonate	Maintains effectiveness of other components, such as crosslinkers	Washing soda, detergent, soap, water softener, glass, ceramics	
Glutaraldehyde	Eliminates bacteria in the water	Disinfectant, sterilization of medical and dental equipment	
Guar Gum	Thickens the water to suspend the sand	Thickener in cosmetics, baked goods, ice cream, toothpaste, sauces	
Citric Acid	Prevents precipitation of metal oxides	Food additive; food and beverages; lemon juice	
Isopropanol	Used to increase the viscosity of the fracture fluid	Glass cleaner, antiperspirant, hair coloring	

concentration of a specific compound (GWPC 2009).

Typically, the fracturing fluids consist of about 99 percent water and sand and about 1 percent chemical additives. The chemical additives are essential to the process of releasing gas trapped in shale rock and other deep underground formation.

NORM

Some soils and geologic formations contain low levels of radioactive material. This naturally occurring radioactive material (NORM) emits low levels of radiation, to which everyone is exposed on a daily basis. When NORM is associated with oil and natural gas production, it begins as small amounts of uranium and thorium within the rock. These elements, along with some of their decay elements, notably radium₂₂₆ and radium₂₂₈, can be brought to the surface in drill cuttings and produced water. Radon₂₂₂, a gaseous decay element of radium, can come to the surface along with the shale gas. When NORM is brought to the surface, it remains in the rock pieces of the drill cuttings, remains in solution with produced water, or, under certain conditions, precipitates out in scales or sludges. The radiation is weak and cannot penetrate dense materials such as the steel used in pipes and tanks.

APPENDIX 4. BIOLOGICAL EVALUATION.

APPENDIX 5. CULTURAL RESOURCES REPORT.
