

U.S. Department of the Interior

Bureau of Land Management

Environmental Assessment
DOI-BLM-NM-040-2015-01-EA
April, 2015

April 2015 Competitive Oil and Gas Lease Sale

*Cimarron, Coal, Beaver, Le Flore, Woods, Ellis, Roger Mills, Beckham, Payne,
Nowata, Grady, and Woodward Counties, Oklahoma and
Grayson County, Texas*

U.S. Department of the Interior

Bureau of Land Management

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

Project: April 2015 Competitive Oil and Gas Lease Sale
EA Log Number: DOI-BLM-NM-040-2015-01-EA
Location: Cimarron, Coal, Beaver, Le Flore, Woods, Ellis, Roger Mills, Beckham, Payne, Nowata, Grady, and Woodward Counties, Oklahoma and Grayson County, 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 twenty (20) parcels nominated for the April 2015 Competitive Oil and Gas Lease Sale. Four (4) of the 20 parcels are located on surface estate administered by Oklahoma State University (OSU), one (1) of the 20 parcels is located on surface estate administered by the Army Corp of Engineers (USACE), one (1) of the 20 parcels is located on surface estate administered by the US Fish and Wildlife Service (FWS), and fourteen (14) of the 20 parcels are 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.

The BLM issues and administers oil and gas leases managed by other surface management agencies (SMAs) only after the agency authorizes leasing for specific lands. Once a Federal lease is issued on other SMAs, the BLM has the full responsibility and authority to approve and regulate all surface disturbing and downhole 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 also has the authority and responsibility to provide final approval of all APDs including those for operations on Federal leases on other SMA lands. Each APD includes a SUPO and a drilling plan.

The parcels and applicable stipulations were posted online for a two-week public scoping period beginning on September 2, 2014. No comments were received. In addition, this EA will be made available for public review and comment for 30 days beginning on October 31, 2014.

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. These RMPs are currently being revised by what has been named the Oklahoma, Kansas, and Texas RMP Revision and Environmental Impact Statement (EIS). The scoping period for the revision occurred from November 2013 through January 2014. The final Scoping Summary Report was published on June 5, 2014. The revision will contemplate, among other things, mineral development in the planning area, and disclose impacts associated with potential energy development scenarios that are within the scope of the planning document. While the planning effort is underway, the 1994 Oklahoma RMP and the 1996 Texas RMP, as amended, are still the applicable land use plans, and decisions made under those plans are properly applied to the parcels nominated in this lease sale.

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 four Oklahoma parcels under consideration

fall 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 four parcels not described in the RMP will be deferred until it is analyzed in the 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, optional 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. The Texas parcel under consideration falls within this planning area and the applicable stipulations identified in the RMP would be attached to the parcel. If the Texas parcel was leased, leasing the parcel 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.” OSU, USACE, and FWS 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 Oklahoma and Texas RMPs (1994 and 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 in the Proposed Action, along with the appropriate stipulations from the RMP and OSU, USACE, and FWS, 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 September 2, 2014.

An internal review of the Proposed Action, along with the appropriate stipulations from the RMP, OSU, USACE, and FWS, was conducted by an interdisciplinary team of OFO resource specialists on August 11, 2014, 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 and Scenic Rivers
- Wilderness and Wilderness Study Areas

- Wild Horse and Burros
- Public Health and Safety
- Rights-of-way

- 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 twenty (20) parcels would not be offered for lease during the April 2015 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 fifteen (15) of twenty (20) nominated lease parcels and a portion of two (2) lease parcels including:

- Fourteen (14) entire parcels totaling 986.08 acres and a portion of (1) parcel totaling 92.61 acres administered by the BLM Oklahoma Field Office (OFO) and on private surface (split-estate) in Cimarron, Coal, Beaver, Le Flore, Woods, Ellis, Roger Mills, and Grady Counties, OK
- Two (2) entire parcels totaling 800.00 acres and a portion of one (1) parcel totaling 720 acres administered by Oklahoma State University (OSU) in Payne County, OK
- One (1) parcel totaling 610.00 acres administered by the United States Army Corp of Engineers (USACE) in Woodward County, OK
- One (1) parcel totaling 73.200 acres administered by the United States Fish and Wildlife Service (FWS) in Grayson County, TX

totaling 3,281.89 acres offered for sale in the April 2015 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
<u>NM-201504-001</u> T.0060N, R.0070E, IM PM, OK Sec. 025 E2SW Cimarron County, OK	<u>Lease with the following Stipulations:</u> WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	80.000
<u>NM-201504-002</u> T.0060N, R.0070E, IM PM, OK Sec. 025 SESE Cimarron County, OK	<u>Lease with the following Stipulations:</u> WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	40.000
<u>NM-201504-003</u> T.0010N, R.0100E, IM PM, OK Sec. 035 LOTS 23, 24, 39, 40 Coal County, OK	<u>Lease with the following Stipulations:</u> ORA-2:Wetland/Riparian Protection NM-8: Coal Protection WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	92.61
<u>NM-201504-004</u> T.0010S, R.0220E, IM PM, OK Sec. 004 LOTS 1, 2 Sec. 0 Beaver County, OK	<u>Lease with the following Stipulations:</u> ORA-3: Season of Use Stipulation Lesser Prairie Chicken and All Hunting Seasons NM-10: Drainage WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	15.96
<u>NM-201504-005</u> T.0050N, R.0250E, IM PM, OK Sec. 001 SWSW Sec. 002 S2SESE Sec. 011 NENE Sec. 012 W2NE, E2NW Sec. 012 N2NWNW Le Flore County, OK	<u>Lease with the following Stipulations:</u> ORA-LN-3: Floodplain Management Notice ORA-1: Floodplain Protection ORA-2:Wetland/Riparian Protection NM-8: Coal Protection WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	280.00
<u>NM-201504-006</u> T.0260, R.0150W, IM PM, OK Sec. 019 SESW, NWSE Woods County, OK	<u>Lease with the following Stipulations:</u> WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	80.000

Parcel	Comments	Acres
<u>NM-201504-007</u> T.0260N, R.0160W, IM PM, OK Sec. 024 NENE Woods County, OK	<u>Lease with the following Stipulations:</u> WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	40.000
<u>NM-201504-008</u> T.0180N, R.0210W, IM PM, OK Sec. 029 LOTS 2 Sec. 032 LOTS 1 Ellis County, OK	<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 WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	23.900
<u>NM-201504-009</u> T.0160N, R.0230W, IM PM, OK Sec. 022 LOTS 5 Sec. 022 A&R to LOT 5 Roger Mills County, OK	<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 WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	31.220
<u>NM-201504-012</u> T.0190N, R.0010E, IM PM, OK Sec. 035 NE Payne County, OK	<u>Other Surface Management Agency (SMA):</u> Oklahoma State University <u>Lease with the following Stipulations:</u> OSU #1: Lake Carl Blackwell (NSO) OSU #2: Plan of Operation for Lake Carl Blackwell ORA-2:Wetland/Riparian Protection ORA-3: Season of Use Stipulation Greater Prairie Chicken WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	160.000
<u>NM-201504-013</u> T.0050N, R.0080E, IM PM, OK Sec. 001 SW Cimarron County, OK	<u>Lease with the following Stipulations:</u> WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	160.000
<u>NM-201504-015</u> T.0190N, R.0010W, IM PM, OK Sec. 003 S2 Sec. 010 N2 Payne County, OK	<u>Other Surface Management Agency (SMA):</u> Oklahoma State University <u>Lease with the following Stipulations:</u> OSU #1: Lake Carl Blackwell (NSO) OSU #2: Plan of Operations for Lake Carl Blackwell ORA-2:Wetland/Riparian Protection ORA-3: Season of Use Stipulation Greater Prairie Chicken WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation	640.000

Parcel	Comments	Acres
<p><u>NM-201504-016</u></p> <p>T.0190N, R.0010E, IM PM, OK Sec. 013 E2, S2NW Sec. 024 E2</p> <p>Payne County, OK</p>	<p><u>Other Surface Management Agency (SMA):</u> Oklahoma State University</p> <p><u>Lease with the following Stipulations:</u> OSU #1: Lake Carl Blackwell (NSO) OSU #2: Plan of Operations for Lake Carl Blackwell ORA-2:Wetland/Riparian Protection ORA-3: Season of Use Stipulation Greater Prairie Chicken WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	720.000
<p><u>NM-201504-017</u></p> <p>T.0060N, R.0050W, IM PM, OK Sec. 011 S2N2SWNW, S2NWSEW, SWSEW Sec. 011 W2NESW, E2NWSW, NWSWSEW</p> <p>Grady County, OK</p>	<p><u>Lease with the following Stipulations:</u> WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	75.000
<p><u>NM-201504-018</u></p> <p>T.0240N, R.0220W, IM PM, OK Sec. 029 E2SWNW Sec. 029 NE, E2NW, S2 Sec. 030 SENESE, E2SESE</p> <p>Woodward County, OK</p>	<p><u>Other Surface Management Agency (SMA):</u> Army Corp of Engineers, Fort Supply Lake</p> <p><u>Lease with the following Stipulations:</u> COE-SS 1-A: Army Corp Stipulations WO-ESA-7: Endangered Species Act Consultation WO-NHPA: National Historic Preservation Act Consultation</p>	610.000
<p><u>NM-201504-019</u></p> <p>T.0150N, R.0250W, IM PM, OK Sec. 023 SWNW, NWSW, S2SW</p> <p>Roger Mills County, OK</p>	<p><u>Lease with the following Stipulations:</u> ORA-2: Wetland/Riparian Protection ORA-3: Season of Use Stipulation Lesser Prairie Chicken WO-ESA-7: Threatened & Endangered Consultation WO-NHPA: Tribal and Cultural Resources Consultation</p>	160.000
<p><u>NM-201504-020</u></p> <p>TX 181 TRACTS MKT-1 thru MKT-16; LESS and EXCEPT EXISTING; OG LEASE TXNM 21105</p> <p>Grayson County, TX</p>	<p><u>Other Surface Management Agency (SMA):</u> United States Fish and Wildlife Service, Hagerman National Wildlife Refuge</p> <p><u>Lease with the following Stipulations:</u> NSO: No Surface Occupancy per USFWS-NWR NM-10: Drainage WO-ESA-7: Endangered Species Act Consultation WO-NHPA: National Historic Preservation Act Consultation</p>	73.200

Proposed parcels -005, -008, and -009 occur within floodplains and would have lease stipulation LN-3 for Floodplain Protection and ORA-1 Floodplain Protection attached. 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 parcels -003, -005, -008, -009, -012, -015, -016 and -019 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 parcels -004, -008, -009, -012, -015, -016, and -019 is within Lesser/Greater 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 -004 and -020 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.

Proposed parcel -003 and -005 would have NM-8: Coal Protection attached. NM-8 informs the lessee that they must coordinate development with the Federal coal lease. This stipulation is used to protect the value of the Federal coal resource.

OSU stipulations are attached to parcels -012, -015, and -016. USACE stipulations are attached to parcel -018. FWS stipulations (NSO) are attached to parcel -020. See Appendix 1 for a complete description of each stipulation.

Two lease notices, WO-ESA-7 and WO-NHPH, would also be attached to all sixteen parcels. 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 twenty (20) parcels but it was eliminated from further analysis because all or portions of four (4) parcels (Table 2) were not described in the 1994 Oklahoma RMP or analyzed in the FEIS and is thus not in conformance with the RMP. The parcels will be deferred until an RMP Amendment or RMP Revision is completed. A portion of one (1) additional parcel was eliminated from further analysis because of existing agreements already in place for the entire section.

Table 2. Proposed Action—Parcels Deferred

Parcel	Comments	Acres
<u>NM-201504-003</u> T.0010N, R.0100E, IM PM, OK Sec. 026 LOTS 3, 4, 12-15 Coal County, OK	Compensatory Royalty Agreement already in effect, that was made for the entire section.	80.87
<u>NM-201504-010</u> T.0080N, R.0240W, IM PM, OK Sec. 027 E2, NW Beckham County, OK	Not analyzed in the Oklahoma RMP	480.00
<u>NM-201504-0011</u> T.0190N, R.0010E, IM PM, OK Sec. 015 NWNW Payne County, OK	Not analyzed in the Oklahoma RMP	40.000
<u>NM-201504-014</u> T.0260N, R.0170E, IM PM, OK Sec. 007 SESW Sec. 018 NENW Nowata County, OK	Not analyzed in the Oklahoma RMP	80.000
<u>NM-201504-016</u> T.019N, R.0010W, IM PM, OK Sec. 025 N2N2NE Payne County, OK	Not analyzed in the Oklahoma RMP	40.000

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.

Cimarron County, Oklahoma (Parcels -001, -002, and -013)

The proposed lease parcels are in the northeast corner of Cimarron County ranging in elevation from 3,700 to 3,800 feet above sea level. Cimarron County is at the western end of the Oklahoma Panhandle. It is bounded on the south by Texas, on the west by New Mexico, on the north by Colorado, and on the east by Texas County, Oklahoma. The county has an area of 1,832 square miles (1,172,480 square miles).

Cimarron County is entirely within the Great Plains province. It is in the High Plains section of the province, except for Black Mesa, which is in the Raton section. The surface of the county is a plain that slopes gently toward the east. The plain is broken by two valleys, one in the northern part of the county and the other in the southern part. The elevation on Black Mesa is 4,973 feet dropping to an elevation of 3,700 feet in the southeastern corner of the county.

Coal County, Oklahoma (Parcel -003)

Coal County is in the southeastern part of Oklahoma, bordered by Hughes County on the north, Pittsburg County on the northeast, Atoka County on the southeast, Johnston County on the southwest, and Pontotoc County on the northwest. The county covers an area of 516.68 square miles (330,675 acres) of which 3 square miles (1,920 acres) is water. Historically, Coal County is one of the poorest counties in Oklahoma.

The extreme southwestern corner of the county is sloping to steep limestone escarpments that extend northward. The area is dissected by drainage ways and is sloping to steep. In the valleys between the hills and ridges, topography is mostly nearly level. Small acreages of very gently sloping to sloping, old alluvial terrace remnants in the form of mantles are present on ridge crests in the extreme northeastern corner of the county.

Beaver County, Oklahoma (Parcel -004)

The proposed lease parcel is in the extreme southern part of Beaver County, right on the county line at an elevation of 2,900 feet above sea level. Beaver County is in the eastern part of the Oklahoma Panhandle. The county is bounded on the north by Kansas and on the south by Texas. Adjacent counties in Oklahoma are Texas County on the west and Harper and Ellis Counties on the east. The county has an area of 1,817 square miles (1,162,829 acres).

Topography ranges from the nearly level flood plains along the Beaver and Cimarron Rivers to the broad, level high plains in the northwestern and southwestern parts of the county. Elevation ranges from about

2,000 feet along the Cimarron River near the northeast edge of the county to over 2,900 feet near the Texas State line in the southwestern part of the county.

Le Flore County, Oklahoma (Parcel -005)

The proposed parcel is located in the center of the county and found between 525 and 625 feet elevation. Le Flore County is in the southeastern part of Oklahoma. The county is bordered by Sequoyah County on the north; by Haskell, Latimer, and Pushmataha Counties on the west; and by McCurtain County on the south. The east side of the county is contiguous with the Arkansas State line. The county covers an area of about 1,582 square miles (1,012,480 acres).

Le Flore County is mainly in the Arkansas Valley and the Ouchita Mountains physiographic sections. Topography differences range from the nearly level floodplains of the Arkansas, Poteau, and Kiamichi Rivers and major creeks to the steep mountainous areas in the southern part of the county. Many low ridges are adjacent to the rolling savannah areas in the northern part of the county. The lowest point in the county is on the Arkansas River and is about 420 feet above sea level. Elevation of the valley areas ranges from 465 feet in the north end of the county to 920 feet in the south end of the county. The ridges and mountains range in elevation from 700 feet to nearly 2,400 feet.

Woods County, Oklahoma (Parcel -006 and -007)

The proposed parcels are slightly west of the center of Woods County. They are found at 1,530 and 1,550 feet above sea level respectively. Woods County is in the northwestern part of Oklahoma. The county is bounded to the north by Kansas; by Alfalfa County, Oklahoma to the east; by Major and Woodward Counties to the south; and by Harper County on the west.

Woods County can be divided into four basic topographic areas. The northeast and east-central parts of the county are characterized by broad, nearly level to gently sloping alluvial terraces. The western part of the county is characterized by gently rolling to steep hills and canyons. The central part of the county, which runs generally in a line from north to south, is characterized by steep escarpments and areas of badlands. This area is a gradational zone from the rolling uplands in the west to the broad flat terraces in the east. The fourth area runs parallel to the Cimarron River at the southern edge of the county. The area is characterized by gently sloping to steep sand dunes and very gently sloping alluvial terraces. The highest point in the county is in the far northwest part and is about 2,200 feet in elevation. The lowest point in the county is along the Cimarron River in the southeast corner and is at about 1,250 feet in elevation.

Ellis County, Oklahoma (Parcel -008)

The proposed lease parcel is along the southern boundary of Ellis County in the eastern half of the county at an elevation of about 1,890 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.

The topography of Ellis County is mostly rolling, but throughout the county are small areas that are gently sloping and small areas that are rough and broken. The general slope is from the northwest to the southeast. The highest elevation, about 2,500 feet, is along the western edge of the county, near U.S. Highway 60. The lowest, about 1,900 feet, is in the southeastern part of the county along the Canadian River.

Roger Mills County, Oklahoma (Parcel -009)

The proposed parcel is in the extreme northern portion of Roger Mills County abutting the county line in the Canadian River, at about 2,000 feet above sea level. Roger Mills County is a western border county, lying about midway between the northern and southern State lines. The Canadian River forms the northern boundary of the county, separating it from Ellis County. Dewey and Custer Counties adjoin it on the east, Beckham County on the south and on the west by Texas. The county is about 36 miles long from east to west, and averages about 32 miles wide from the north to south. It has an area of 1,135 square miles (726,400 acres).

Roger Mills County lies within the Great Plains and its topographic features are the result of erosion and grading. Its general slope is toward the east. It includes areas of smooth upland remnants of a former high plain which covered the entire region, and two areas of lowland, the products of erosion, lying along the two main streams.

Payne County, Oklahoma (Parcels -012, -015, and -016)

The proposed parcels are in the western part of Payne County ranging in elevation from about 950 feet to 1,100 feet above sea level. Payne County is in north-central Oklahoma and has an area of about 700 square miles (448,000 acres). The county is bordered on the north by Noble and Pawnee Counties; on the east by Creek County, on the west by Logan County, and on the south by Logan and Lincoln Counties. Payne County is rolling with small, nearly level upland plains. The average elevation is just less than 1,000 feet.

Grady County, Oklahoma (Parcel -017)

The proposed parcel is along the eastern border of Grady County at about 1,200 feet elevation. Grady County is in the south central part of Oklahoma. It is bordered by the South Canadian River and Canadian County to the north; McClain and Garvin Counties to the east; Stephens County to the south; and Comanche and Caddo Counties to the west. The county has an area of about 1,092 square miles (698,880 acres).

The county is characterized by rolling plains, cut in places by deeply eroded valleys. Rolling plains developed by erosion of shales and silt-stones characterize the eastern part of the county. The western part is cut by deep drainage channels eroded in sandy shales and sandstones. Local relief in most places does not exceed 200 feet and generally is much less.

Woodward County, Oklahoma (Parcel -018)

The proposed parcel mostly overlies Fort Supply Lake in the northwestern part of Woodward County. The parcel is at about 2,025 feet elevation. Woodward County is in northwestern Oklahoma. It is bordered by Harper and Ellis Counties on the west, Dewey County on the south, Woods County on the north, and Major County on the east. It has an area of about 1,232 square miles (788,480 acres).

Physiographically, the county consists of two plains that are separated by a distinct escarpment, which extends southeastward across the county. The larger plain occupies three-fourths of the county, including the southwestern part, and has a rolling dunelike relief. It slopes gradually to the North Canadian River, which crosses the county from northwest to southeast. The smaller plain is in the northeastern part of the county. It slopes northeastward toward the Cimarron River. Elevations range from 2,460 feet above sea level in the southwestern corner of the county to 1,450 feet in the northeastern corner.

Grayson County, Texas (Parcel -020)

The proposed parcel is between 625 and 640 feet above sea level in Grayson County, Texas. Grayson County is in the extreme north-central part of Texas. It is one of the border counties of Texas, Red River forming its northern boundary. It is bounded on the west by Cooke County, on the south by Denton and Collins counties, and on the east by Fannin County. The county covers 984 square miles (629,760 acres). Water makes up 28,160 acres of water, most of which is in Lake Texoma.

The elevation ranges from 881 feet above sea level, the elevation of a bench mark about four miles south of Pottsboro, to less than 530 feet along the Red River at the eastern edge of the county. The average elevation of the county is about 750 feet.

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 2014). 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 Oklahoma's State Implementation Plan, and each 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.

Oklahoma Parcels

Proposed parcel -003 is less than 50 miles to the nearest "non-attainment" area (Dallas-Ft. Worth, TX for ozone), while -01, -02, and -013 are less than 85 miles from the nearest "non-attainment" area (Lamar, CO for PM₁₀). The remaining 13 parcels in Oklahoma are greater than 100 miles from the nearest "non-attainment" area. Parcel -05 is approximately 45 miles to the nearest Class I Airshed (Caney Creek Wilderness, AR), while proposed parcels -09, -017, and -019 are between 60 and 90 miles to the nearest Class I Airshed (Wichita Mountains, OK). All other Oklahoma parcels are greater than 100 miles to the nearest Class I Airshed. See Appendix 4.

Texas Parcel

Proposed parcel -020 is approximately 20 miles north of the Dallas-Ft. Worth, TX "non-attainment" area. The area is in non-attainment as a result of increased levels of ozone (O₃). The nearest Class I airshed (Wichita Mountains, OK) is over 100 miles north. See Appendix 4.

Dallas-Ft. Worth "Non-Attainment" Area

The project area is located within the Dallas-Ft. Worth (DFW) non-attainment area (Figure 1). The DFW non-attainment area includes 10 counties (Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise Counties) being designated non-attainment and classified as moderate under the 2008 eight-hour ozone NAAQS. The attainment deadline for the DFW moderate non-attainment area is December 31, 2018.

The Texas Commission on Environmental Quality (TCEQ) maintains an emission inventory of current information for sources of NO_x and VOC—those that most contribute to ozone levels. The total inventory of NO_x and VOC emissions for an area is derived from estimates developed for five general categories of emissions sources: point, area, non-road mobile, on-road mobile, and biogenic. Unlike other non-attainment areas in Texas, where industrial point sources account for a greater proportion of the total NO_x emissions in the area, point sources account for only about one-tenth of the total NO_x emissions in the DFW area. The majority of NO_x emissions in the DFW area come from on-road mobile sources (cars and trucks) and non-road mobile sources (i.e. construction equipment, aircraft, and locomotives). TCEQ has implemented several ozone emission reduction strategies to meet the 2018

attainment date set by EPA and seem to be working. Despite a continuous increase in the population of the DFW area, the area is exhibiting decreasing trends for ozone and its precursors, NO_x and VOC. The eight-hour ozone design value in 2010 is 18% lower than the eight-hour ozone design value in 1991. The number of eight-hour ozone exceedance days over the past 20 years has also decreased significantly from 26 days in 1991 to 8 days in 2010. Over the same time period the number of ozone monitors in the DFW area more than doubled (TCEQ 2011).

Modeling and data analyses have consistently shown that NO_x reductions are far more effective at reducing ozone in DFW than VOC reductions. In 2008, biogenic emissions are 66% of the total VOCs in the DFW area. Oil and gas VOC emissions for the same area are 14% of the total VOCs. Thus, even if VOC emissions from oil and gas activities were controlled, there would be enough biogenic VOCs to carry ozone reactions forward.

Emissions of ozone and fine particle smog forming compounds from all Barnett Shale activities were approximately 191 tons per day (tpd) on an annual average basis in 2009. During the summer, VOC emissions increased raising the NO_x and VOC total to 307 tpd, greater than the combined emissions from the major airports and on-road motor vehicles in the DFW area. Emissions in 2009 for air toxic compounds were approximately 6 tpd on an annual average, with peak summer emissions of 17 tpd (Armendariz 2009).

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 for several pollutants. The 2013 design concentrations of criteria pollutants are listed in Table 3.

Table 3. 2013 Design Concentrations of Criteria Pollutants (EPA 2014)

Pollutant	Design Value (County)*	Averaging period	NAAQS
O ₃	0.076 ppm (Eastern OK)	8-hour	0.075 ppm ¹
	0.076 ppm (Central OK)		
	0.073 ppm (Western OK)		
	0.083 ppm (Denton, TX)		
PM _{2.5}	10.5 µg/m ³ (Eastern OK)	Annual	12.0 µg/m ^{3,2}
	9.7 µg/m ³ (Central OK)		
	No Data (Western OK)		
	10.8 µg/m ³ (Dallas, TX)		
PM _{2.5}	22 µg/m ³ (Eastern OK)	24-hour	35 µg/m ^{3,3}
	20 µg/m ³ (Central OK)		
	No Data (Western OK)		
	21 µg/m ³ (Dallas, TX)		

Pollutant	Design Value (County)*	Averaging period	NAAQS
PM ₁₀	2.0 exceedances/ year (Eastern OK)	24-hour	150 µg/m ^{3,5}
	0.0 exceedances/ year (Central OK)		
	No Data (Western OK)		
	0.0 exceedances/ year (Denton, TX)		
Pb	0.02 µg/m ³ (Eastern OK)	Rolling 3-month average	0.15 µg/m ³
	No Data (Central OK)		
	No Data (Western OK)		
	0.02 µg/m ³ (Denton, TX)		
NO ₂	8 ppb (Eastern OK)	Annual	53 ppb
	9 ppb (Central OK)		
	No Data (Western OK)		
	54 ppb (Dallas, TX)		
NO ₂	No Data (Eastern OK)	1-hour	100 ppb ³
	54 ppb (Central OK)		
	No Data (Western OK)		
	54 ppb (Dallas, TX)		
SO ₂	4 ppb (Eastern OK)	Annual	30 ppb ⁶
	0 ppb (Central OK)		
	No Data (Western OK)		
	No Data ppb (Dallas, TX)		
SO ₂	62 ppb (Eastern OK)	1-hour	75 ppb ⁶
	5 ppb (Central OK)		
	No Data (Western OK)		
	7 ppb (Dallas, TX)		
CO	1.0 ppm (Eastern OK)	8-hour	9 ppm ⁴
	0.8 ppm (Central OK)		
	No Data (Western OK)		
	1.5 ppb (Dallas, TX)		
CO	1.6 ppm (Eastern OK)	1-hour	35 ppm ⁴
	1.0 ppm (Central OK)		
	No Data (Western OK)		
	2.0 ppm (Dallas, TX)		

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 2013 (Table 4). The air quality index near the Texas parcel annually reaches “unhealthy for sensitive groups” on a number of days each year, while Oklahoma air quality 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 5). 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. 2013 AQI Data (2014a).

	Eastern OK	Central OK	Western OK	Denton, TX
% Days classified as “Good”	69.5%	69.4%	77.3%	70.1%
% Days classified as “Unhealthy for Sensitive Groups”	0.5%	8.2%	0.0%	5.6%
Median AQI	43	44	40	42
Maximum AQI	108	122	97	137

Table 5. Number of Days classified as “unhealthy for sensitive groups” or worse (EPA 2014a). Unhealthy for sensitive groups/unhealthy/very unhealthy

County	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Eastern OK	0/0	0/0	6/0	3/0	0/0	1/0	0/0	9/2	5/0	2/0
Central OK	6/0	11/0	30/1	6/0	4/0	5/0	3/0	25/0	21/0	3/0
Western OK	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Denton, TX	19/3	35/3	26/6	9/3	10/0	14/0	8/0	27/2	14/0	21/0

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).

Table 6. Summary of climate components that could affect air quality in the region.

	Average Annual Temp. (°F)	Average Daytime High in July (°F)	Average Daytime Low in January (°F)	Total Annual Precipitation (Inches)	Total Annual Snowfall (Inches)	Mean Annual Wind Speed (mph)	Prevailing Wind Direction
Cimarron	55.7	92.6	19.2	18.6	31.1	11.9	Southwest
Coal	61.5	93.4	27.5	41.54	4.9	6.3	Southeast
Beaver	56.2	95.0	17.3	21.27	6.3	11.0	South
Le Flore	61.0	93.2	27.2	46.55	6.3	4.8	Northeast
Woods	59.6	96.8	23.0	27.86	11.9	10.7	South/ Southwest
Ellis	56.6	92.3	20.2	25.44	8.2	9.8	South/ Southwest
Roger Mills	58.0	94.7	20.6	27.17	8.7	13	
Payne	59.2	93.0	23.0	36.79	9.2	7.2	South/ Southeast
Grady	61.6	95.5	25.8	35.28	3.7	8.5	South/ Southeast
Woodward	59.5	95.2	21.9	25.83	17.9	10.8	South
Grayson	63.1	93.0	33.0	43.62	1.0	15.95	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. One of sixty-five soil types were identified as occurring in at least one of the 17 proposed parcels. Water was identified in six of the proposed parcels.

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. Seven index values were identified from the proposed parcels ranging from 0 to 220 tons per year, with 38, 48, 56 and 86 tons per year being the most common (Appendix 5).

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. Ten values ranging from 0.02 to 0.49 were identified for the proposed lease parcels (Appendix 5) indicating moderate to high susceptibility to soil loss by sheet and rill erosion.

3.2.1 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 65 different soil types within the 17 proposed lease parcels. Table 7 shows a summary of the prime or unique farmlands making up the proposed lease parcels. See Appendix 5 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 7. Prime or Unique Farmlands making up the proposed lease parcels.

Parcels	Number of Soil Types	Prime or Unique	Total Acres	Percent
-003, -009, -015, -016, -018, -020	Water	Not Prime Farmland	438.5	13.4
-001, -002, -003, -005, -006, -007 -008, -009, -012, -013, -015, -016, -018, -019, -020	36	Not Prime Farmland	1,764.8	53.9
-003, -004, -005, -007, -008, -012, -015, -016, -018, -019, -020	28	All Areas Prime Farmland	1,070.2	32.7

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.

Table 8. Proximity of Surface Waters to the Proposed Parcels.

Parcel	Distance to Nearest Named Drainage	Distance to Nearest Mapped Drainage	Distance to Nearest Mapped Waterbody	Water Plan Basin*
-001	0.3 miles NW to Cimarron River	~2,300 feet cross through the parcel; Ephemeral.	~0.5 miles W, unnamed appears to be a livestock water, Ephemeral. No large ⁺ waterbodies in Watershed.	Cimarron Headwaters
-002	0.9 miles NW to Cimarron River	~1,400 feet cross through the parcel; Ephemeral	~0.2 miles S, unnamed appears to be a livestock water, Ephemeral. No large waterbodies in Watershed.	Cimarron Headwaters
-003	0.9 miles E to Muddy Boggy Creek tributary to the Red River (>50.0 miles S)	~120 feet cross through the extreme NE corner of parcel; Seasonal	6 unnamed ponds are within the parcel. 2 are previous ponds from coal mining activities (Perennial), 4 are manmade and natural livestock waters (Ephemeral) ~2.25 miles NW to Canney-Coon Creek Reservoir	Muddy Boggy River -- 2
-004	0.3 miles W to South Fork of Clear Creek Tributary to the Beaver River (>20.0 miles N)	Named drainage is closest to the parcel.	~1.0 mile N, unnamed appears to be a natural pond, Ephemeral. No large waterbodies in Watershed.	Upper North Canadian River--2

Parcel	Distance to Nearest Named Drainage	Distance to Nearest Mapped Drainage	Distance to Nearest Mapped Waterbody	Water Plan Basin*
-005	~2,000 feet of Coal Creek pass through the parcel. Coal Creek is a tributary of Poteau River (~4.0 miles NW and S)	~4,600 feet cross through the parcel; Intermittent	6 unnamed manmade and natural livestock ponds are within the parcel. Appear to be Seasonal. ~4.5 miles to Wister Lake.	Poteau River -- 2
-006	~0.25 miles SW to Eagle Chief Creek tributary to the Cimarron River (~10.0 miles S)	~1,650 feet cross through the parcel; Ephemeral	~0.25 miles W, unnamed, dike tributary pond, Seasonal possibly Ephemeral. No large waterbodies in Watershed.	Middle Cimarron River
-007	~0.45 miles S to Eagle Chief Creek tributary to the Cimarron River (~10.0 miles S)	~1,575 feet cross through the parcel; Ephemeral	Diked tributary pond lies in the NE corner of the parcel, Seasonal possibly Ephemeral. No large waterbodies in Watershed.	Middle Cimarron River
-008	Parcel within banks of Canadian River	Numerous tributaries to the Canadian River; Ephemeral	~0.75 miles N, unnamed, appear to be natural pools from tributary streams flowing into Canadian River No large waterbodies within 5 miles.	Upper Canadian River
-009	Parcel within banks of Canadian River	Numerous tributaries to the Canadian River; Ephemeral	~2.5 miles N, unnamed, appears to be natural pond, Seasonal possibly Ephemeral No large waterbodies within 5 miles.	Upper Canadian River
-012	~1.5 miles NW to Harrington Creek tributary to Cimarron River (~8.00 miles S)	~2,000 feet cross through the parcel; Ephemeral possibly Seasonal	At least 1 natural possibly manmade pond within parcel, Seasonal or Ephemeral. ~1.4 miles NW to Stillwater Creek Site 46 Reservoir and ~2.75 miles NW to Lake Carl Blackwell	Arkansas River – Cimarron River to Keystone Lake
-013	~6.5 miles NW to Cimarron River	~2,800 feet cross through the parcel; Ephemeral	~0.2 miles S, unnamed appears to be a livestock water, Ephemeral. No large waterbodies in Watershed.	Cimarron Headwaters
-015	~5,600 feet of Stillwater Creek crosses through center of parcel. Tributary to Cimarron River (~8.25 miles S)	Numerous tributaries to Stillwater Creek; Seasonal and Ephemeral	At least 4 natural and manmade ponds within parcel, Seasonal and Ephemeral. Portion of parcel within Lake Carl Blackwell.	Arkansas River – Cimarron River to Keystone Lake
-016	~0.4 miles N to Stillwater Creek a tributary to Cimarron River (~9.0 miles S)	Numerous tributaries to Stillwater Creek; Seasonal and Ephemeral	At least 6 natural and manmade ponds within parcel, Seasonal and Ephemeral. Portion of parcel within Lake Carl Blackwell.	Arkansas River – Cimarron River to Keystone Lake
-017	~1.1 miles E to Laflin Creek a tributary to the Washita River (~6.0 miles S)	~400 feet cross through extreme NW corner of parcel; Ephemeral	One livestock water within the parcel, Seasonal possibly Ephemeral No large waterbodies within 5 miles.	Middle Washita--1
-018	Wolf Creek passes through parcel; Tributary to the Beaver River (~6.0 miles N)	Numerous tributaries to Wolf Creek/Fort Supply Lake	Parcel within Fort Supply Lake	Upper North Canadian River--3

Parcel	Distance to Nearest Named Drainage	Distance to Nearest Mapped Drainage	Distance to Nearest Mapped Waterbody	Water Plan Basin*
-019	~1,750 feet of Washita River passes through SW corner	Numerous tributaries to Washita River	~0.25 miles W, unnamed, appear to be natural pools from tributary streams flowing into Washita River. ~0.4 miles N to Spring Creek Lake	Washita Headwaters
-020	~400 feet of Deaver Creek and Martin Branch cross through the parcel. Tributary to Big Mineral Creek which parallels parcel 200 feet to the N	Numerous tributaries to Big Mineral Creek	Parcel within Lake Texoma.	Region C

*For Oklahoma parcels reference Oklahoma Water Resources Board—Oklahoma Comprehensive Water Plan 2012 Update (OWRB 2011). For Texas parcels reference Texas Water Development Board – 2012 State Water Plan (TWDB 2012)

+ Large waterbodies for purposes of this analysis are waterbodies that have been named.

Watersheds of the Proposed Parcels

The 17 proposed parcels lie within eleven HUC 8 watersheds (Table 9) as designated by EPA. Each watershed has undergone water quality assessments, which begins with water quality standards that were adopted by the State and approved by EPA under the Clean Water Act. Where possible, state, tribes and other jurisdictions identify pollutants or stressors causing water quality impairment that prevent the waters from meeting the criteria adopted by the states to protect designated uses. Causes of impairment include chemical contaminants (such as PCBs, metals, and oxygen-depleting substances), physical conditions (such as elevated temperature, excessive siltation, or alterations of habitat), and biological contaminants (such as bacteria and noxious aquatic weeds).

Table 9. Watersheds of the proposed lease parcels.

Watershed	Parcel	Acres	Watershed Impairments	Nearest Impaired Water
Upper Cimarron (HUC 8 11040002)	-001, -002, -013	280.000	Enterococcus Bacteria, pH, Sulfates, Turbidity, Dissolved Oxygen, Escherichia Coli (E. Coli)	-001: ~0.25 miles NW to Cimarron River -002: ~0.8 miles NW to Cimarron River -013: ~6.1 miles NW to Cimarron River
Muddy Boggy (HUC 8 11140103)	-003	92.610	Color, Copper, Enterococcus Bacteria , pH, Sulfates, Chloride, Fecal Coliform, Lead, Sedimentation/Siltation, Turbidity, Dissolved Oxygen , TDS	~0.9 miles E to Muddy Boggy Creek
Lower Beaver (HUC 8 11100201)	-004	15.960	Enterococcus Bacteria , Fish bioassessments, Sulfates, Thallium, Chloride, Fecal Coliform, Lead, E. Coli , Sedimentation/Siltation, TDS, <i>Dissolved Oxygen</i>	~7.25 miles E to Duck Pond Creek

Watershed	Parcel	Acres	Watershed Impairments	Nearest Impaired Water
Poteau (HUC 8 11110105)	-005	280.000	Cadmium, Color, Enterococcus Bacteria, pH, Chlorophyll-A, Lead, Turbidity , Phosphorous Total, Copper , Dissolved Oxygen, Silver, Selenium	~3.5 miles N to Poteau River
Lower Cimarron-Eagle Chief (HUC 8 11050001)	-006, -007	120.000	Enterococcus Bacteria , Fish Bioassessments, pH, Sulfates, Thallium, Turbidity, Chloride, Fecal Coliform, Dissolved Oxygen, E. Coli. , Sedimentation/Siltation, TDS	~0.25 miles SW to Eagle Chief Creek
Lower Canadian-Deer (HUC 8 11090201)	-008, -009	55.120	Enterococcus Bacteria (both), Sulfates (both) , Thallium, Chloride (-008) , Fecal Coliform, Dissolved Oxygen, E. Coli (-009) , Sedimentation/Siltation, TDS (-009)	-008: Within Canadian River -009: ~8.6 miles NE to Hackberry Creek
Lower Cimarron (HUC 8 11050003)	-012, -015, -016	1,520.000	Color (Lake Carl Blackwell [LCB]), Enterococcus Bacteria (LCB) , Thallium, Chlorophyll-A (LCB) , Chloride, Fecal Coliform, Lead, Nitrates, Dissolved Oxygen (both) , E. Coli, TDS, Turbidity (both)	-012: ~3.25 miles NE to Stillwater Creek and LCB -015, -016: Parcels within Stillwater Creek and LCB
Middle Washita (HUC 8 11130303)	-017	75.000	Color, Enterococcus Bacteria , Fish Bioassessments, pH, Sulfates, Fecal Coliform, Lead, Thallium , Chlorophyll-A, Turbidity , Chloride, Ammonia Un-ionized, Dissolved Oxygen, E. Coli, TDS	~6.5 miles S to Washita River
Lower Wolf (HUC 8 11100203)	-018	610.000	Enterococcus Bacteria, Thallium, Chlorophyll-A, Turbidity , E. Coli, <i>Color</i>	Parcel within Fort Supply Lake
Washita Headwaters (HUC 8 11130301)	-019	160.000	Enterococcus Bacteria, Fish Bioassessments, Sulfates, Thallium, Turbidity , Fecal Coliform, Lead, E. Coli, Sedimentation/Siltation, TDS	Parcel within Washita River
Lake Texoma (HUC 8 11130210)	-020	73.200	Bacteria	~200 feet NW to Big Mineral Creek

Italicized words: Previously impaired, but currently meeting standards

Bold words: Impairments directly affecting nearest impaired water

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).

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 is a major source of water in Texas, providing about 60 percent of the 16.1 million acre-feet of water used in the state. Groundwater deposits underlie about 76 percent of Texas. Texas has numerous aquifers capable of producing groundwater for households, municipalities, industry, farms, and ranches. The Texas Water Development Board (TWDB) recognizes 9 major aquifers and 21 minor aquifers.

The source of most groundwater in Texas 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.

Between 1994 and 2004, water levels in the state’s aquifers declined in some parts of the state and rose in others. Water levels continued to decline in much of the Ogallala Aquifer in West Texas, with declines greater than 40 percent in parts of the aquifer. However, other parts of the Ogallala Aquifer showed water level rises, presumably due to increased recharge resulting from fallow fields in areas of dry land farming. Water levels have risen more than 40 feet in 10 years in the Houston area because of reduced pumping to prevent land subsidence. Water levels have fallen more than 40 feet, however in the suburbs north of Houston.

Although the vast majority of groundwater used for drinking in Texas meets states and federal requirements for safety, in some parts of the state naturally occurring levels of total dissolved solids, arsenic, and radionuclides, as well as human-cause contamination, prevent the water from meeting those standards.

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. DRASTIC ratings for the proposed parcel aquifers range from very low to very high (Table 10).

Table 10. Aquifers underlying the proposed lease parcels and DRASTIC ratings of each aquifer (Osborn and Hardy 1999 [Oklahoma] and TCEQ/TSSWCB 2005 [Texas]).

Aquifer	Parcel	Acres	Type	Vulnerability (DRASTIC)
Ogallala (major)*	-001, -002, -004, -013	295.960	Bedrock	Low (86)
Canadian River (major)	-008, -009	55.120	Alluvium and Terrace	Very High (148)
North Canadian River (major)	-018	610.000	Alluvium and Terrace	Very High (145)
Washita River (major)	-019	160.000	Alluvium and Terrace	Very High (149)
Trinity (major)	-020	73.200	Bedrock	Moderate (95)
Pennsylvanian (minor)	-003	92.610	Bedrock	Very Low (81)
Kiamichi (minor)	-005	280.000	Bedrock	No rating
El Reno (minor)	-006, -007, -017	195.000	Bedrock	No rating

Aquifer	Parcel	Acres	Type	Vulnerability (DRASTIC)
Woodbine (minor)	-020	73.200	Bedrock	Low (82)
No Aquifer	-012, -015, -016	1,520.000	--	--

*Major aquifers: bedrock aquifers that can yield at least 50 gallons per minute; alluvium and terrace aquifers that can yield at least 150 gpm. Minor aquifers: yield less than 50 gpm

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.

The RMP determined that proposed parcels -005, -008, and -009 occur in floodplains. After further review, proposed parcels -015, -016, -018, -019, and -020 are in mapped floodplains according the Federal Emergency Management Agency (FEMA) flood insurance maps. Proposed parcel -003, -006, -007, -012, and -017 are not in a mapped floodplain according to flood insurance maps. Cimarron and Beaver counties (-001, -002, -004, -013) have not been mapped by FEMA.

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.

The presence or absence of wetlands within the parcels was evaluated using the National Wetland Inventory (NWI). NWI was established by the US Fish and Wildlife Service (FWS) to conduct a nationwide inventory of US wetlands to provide biologists and others with information on the distribution and type of wetlands to aid in conservation efforts. NWI developed a wetland classification system (Cowardin et al. 1979) that is now the official Federal standard for wetland classification. All but three parcels have been identified as having wetland characteristics within the parcel (Table 11).

Table 11. Proposed parcels with wetland characteristics.

Wetland Characteristics	Parcel
Yes – Identified in RMP	-001, -002, -008, -009, -018, -019
Yes – Not Identified in RMP	-003, -005, -006, -013, -015, -016, -020
No	-004, -012, -017

3.5 Heritage Resources

3.5.1 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 (CRR#BLM-NM-040-2015-02). 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.

3.5.2 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.

3.5.3 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.

3.6 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 (2014) at the University of Georgia has identified 52 species in Cimarron County; 7 species in Coal County; 39 species in Beaver County; 62 species in Le Flore County; 89 species

in Woods County; 19 species in Ellis County; 51 species in Roger Mills County; 133 species in Payne County; 90 species in Grady County; and 32 species in Woodward County as being exotic to the US and listed as a problem somewhere in the US. Only five counties have documented occurrences of at least one of the three state listed species (Table 12). Five counties (Cimarron, Coal, Beaver, Ellis, and Woodward) did not have any documented state listed species. None of the nationally listed invasive species are known to occur in Oklahoma.

Table 12. Invasive species listed by the State of Oklahoma.

Species	Description	Documented in County
Musk thistle <i>Carduus nutans</i>	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.	Le Flore, Woods, Payne, Grady
Canada thistle <i>Cirsium arvense</i>	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.	None
Scotch thistle <i>Onopordum acanthium</i>	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.	Roger Mills

Suitable habitat, in the form of disturbed sites, roadsides, fields, and agricultural areas, occurs within all of the proposed lease parcels, despite the species not being previously documented in the county. 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 157 species in Grayson County as being exotic to the US and listed as a problem somewhere in the US. Seven of the 157 species were also listed by the State of Texas (Table 13). One species (hydrilla) is 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 Grayson County.

Table 13. Invasive and Non-native Species documented in Sabine and Live Oak Counties.

Species	Habitat	Potential Habitat
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	Marginal
Balloonvine <i>Cardiospermum halicacabum</i>	Prefers moist thickets, waste places, and riverbanks; commonly found at low elevations in disturbed sites	No
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	No
Eurasian watermilfoil <i>Myriophyllum spicatum</i>	Requires stagnant to slowly moving water and can tolerate brackish conditions. It forms dense mats of leaves restricting light availability, leading to decline in the diversity and abundance of native macrophytes.	No
Kudzu <i>Pueraria Montana var. 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	Yes
Saltcedar <i>Tamarix spp.</i>	Invades stream banks, sandbars, lake margins, wetlands, moist rangelands, and saline environments. It can crowd out native riparian species, diminish early successional habitat, and reduce water tables and interference with hydrologic process.	No
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

3.7 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.

Eleven ecoregions make up the proposed lease parcel areas (Table 14). Of the 11 proposed parcels one parcel (-012) shows characteristics of the native ecoregion. The remaining 16 parcels have all been modified from the native ecoregion in the form of livestock grazing, cultivation, research, and/or recreation. All of the disturbed parcels have non-native species present and in some cases weedy species are more prominent. Approximately 381 acres of proposed parcel -018 is under Fort Supply Lake, while the remaining acreage for the parcel has been converted to a recreation area by the Army Corp of Engineers. No vegetation exists on proposed parcel -020. The parcel was historically a railroad bed in which the US Fish and Wildlife Service converted to a maintained road for access throughout the refuge.

Table 14. Ecoregions of the proposed lease parcels.

Parcels	Level III Ecoregion (EPA region)	Level IV Ecoregion (EPA region)	Description of Level IV Ecoregion
-001, -013	High Plains (25)	Rolling Sand Plains (25b)	Plains, sand hills, depressions, and scattered, mostly stabilized dunes. Small interdune wetlands occur and are important habitat for many wetland species. Sand and silt deposits laid by rivers and reworked by wind naturally support sand sage-brush-bluestem prairie. Today, native range is found in areas too sandy or too steep for farming. Elsewhere, irrigated cropland growing grain sorghum occurs.
-002	High Plains (25)	Moderate Relief Plains (25c)	Irregular, rolling to broken plains. Natural vegetation is short grass prairie. Today less rugged areas have been widely overgrazed.
-003	Arkansas Valley (37)	Lower Canadian Hills (37e)	Native vegetation is a mixture of oak woodland, tall grass prairie, oak-hickory forest, and oak-hickory-pine forest.
-004	Southwestern Tablelands (26)	Canadian/Cimarron High Plains (26a)	Natural vegetation is short grass prairie that is distinct from the mixed grass and tall grass prairies of moister ecoregions to the east; it is adapted to the ecoregion's limited, erratic precipitation and high evaporation rates. Today groundwater-irrigated cropland, mainly growing wheat and grain sorghum, is extensive. Rangeland is found on land that is too sandy or too rugged for farming; it has been widely overgrazed.
-005	Arkansas Valley (37)	Arkansas Valley Plains (37d)	It was once covered by a distinctive mosaic of savanna, woodland, forest and prairie. Prairie was most extensive on fire-prone sites on soils derived from shale. Today, its undulating plains are mostly pastureland or hayland, whereas its scattered hills and ridges remain wooded.

Parcels	Level III Ecoregion (EPA region)	Level IV Ecoregion (EPA region)	Description of Level IV Ecoregion
-006	Central Great Plains (27)	Prairie Tableland (27d)	Natural vegetation is mixed grass prairie; it is distinct from the sand sagebrush-bluestem prairie of other ecoregions. It has a greater natural vegetation density, less rainfall variability, less evaporation, and receives more precipitation than neighboring ecoregions
-007, -008, -009, -018, -019	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 cropland occur on suitable, nearly level sites.
-012	Cross Timbers (29)	Northern Cross Timbers (29a)	Naturally covered by a mosaic of oak savanna, scrubby oak forest, eastern redcedar, and tall grass prairie. Native on porous, coarse-textured soils derived from sandstone are post oak, blackjack oak, and understory grasses. Tall grass prairie naturally occurs on fine-textured soils derived from limestone or shale. Today livestock farming is the main land use; cropland is less extensive than in the Central Great Plains ecoregion and rangeland is less widespread in the High Plains ecoregion.
-015, -016	Central Great Plains (27)	Cross Timbers Transition (27o)	Rough plains that are covered by prairie grasses and eastern redcedar, scattered oaks and elms. Terrain and vegetation are transitional between the less rugged, grass-covered ecoregions to the west and the hilly, oak savanna regions to the east. The abundance of upland trees and the number of tree species have greatly increased due, in part, to fire suppression. Natural riparian forests and wetlands have been degraded or lost due to channelization and land use changes. Today, land use is a mixture of rangeland and cropland.
-017	Cross Timbers (29)	Northwestern Cross Timbers (29h)	Blackjack oak-post oak savanna occurs on sandy soils, tall grass prairie is native on fine-textured soils, and forests dominated by sugar maple grow in the shelter of larger canyons. Eastern redcedar is native fire-protected areas; it is now common due to the combined effects of grazing and fire suppression. Cultivation has largely destroyed the native prairie.
-020	Cross Timbers (29)	Eastern Cross Timbers (29b)	Rolling hills, cuestas, and ridges are naturally covered by oak savanna, scrubby oak forest, eastern redcedar, and tall grass prairie. Post oak and blackjack oak are dominant on sandy soils; finer soils support grasses.

3.8 Wildlife

3.8.1 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. Sixteen federally protected species (8 endangered, 3 threatened, 1 proposed endangered, 2 proposed threatened, 2 candidates) were identified as occurring in or having the potential to occur in Oklahoma parcels, while 2 species (2 endangered) were identified as occurring or having the potential to occur in Texas parcels (Table 15).

Table 15. Federally protected species in or having the potential to occur in the proposed parcels.

Species Name	Federal Status	County	Habitat/Distribution
Piping plover <i>Charadrius melodus</i>	Threatened	Payne, Grady, Woodward, Roger Mills, Woods, Ellis, Cimarron, Coal, Beaver	<i>Habitat:</i> Mudflats, sandy beaches and shallow wetlands with sparse vegetation; 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. Wintering migrant along the Texas Gulf Coast.
Lesser Prairie-Chicken (LPC) <i>Tympanuchus pallidicinctus</i>	Proposed Threatened	Woodward, Roger Mills, Woods, Ellis, Cimarron, Beaver	<i>Habitat:</i> Sand shinnery and sand sagebrush native rangelands of northwest OK <i>Distribution:</i> Found in southeastern CO, southwestern KS, northwestern OK, Eastern NM, and TX Panhandle.

Species Name	Federal Status	County	Habitat/Distribution
Whooping Crane <i>Grus Americana</i>	Endangered	Payne, Grady, Woodward, Roger Mills, Woods, Ellis, Coal, Beaver, Grayson	<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</p> <p><i>Distribution:</i> Breed in Canada during the summer months; migrate to Texas' coastal plains November – March. In the western half of OK – most sightings occur west of I-35 and east of Guymon in the panhandle. In TX found near Rockport in and around Aransas NWR. Approximately 270 birds nest 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>
Red Knot <i>Calidris canutus rufa</i>	Proposed Threatened	Payne, Grady, Woodward, Roger Mills, Woods, Ellis, Cimarron, Coal, Beaver	<p><i>Habitat:</i> Breeds in dry tundra areas, outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal inlets, and bays.</p> <p><i>Distribution:</i> Pass through Oklahoma during migration through the contiguous United States mainly March-early June, and July-August.</p>
Interior Least Tern <i>Sterna antillarum</i>	Endangered	Payne, Grady, Woodward, Roger Mills, Woods, Ellis, Cimarron, Coal, Beaver, Grayson	<p><i>Habitat:</i> Live along large rivers and may sometimes be found hunting fish in shallow wetlands and the margins of ponds and lakes. 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> Rare; found in OK during late spring and summer breeding seasons (mid-May - late August). Can be found on portions of the Arkansas, Cimarron, Canadian and Red Rivers. Colonies occur on salt flats such as the Salt Plains National Wildlife Refuge. In Texas, 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>

Species Name	Federal Status	County	Habitat/Distribution
Sprague's Pipit <i>Anthus spragueii</i>	Candidate	Payne, Grady	<p><i>Habitat:</i> Found in low brushy thickets of deciduous trees such as oaks, redbuds and plums. Thickets often found on thin, rocky soils that slow or stunt the growth of trees maintaining the low thickets they prefer.</p> <p><i>Distribution:</i> It breeds in the northern Great Plains and southern Canada and winters in southern states including Oklahoma.</p>
Arkansas Darter <i>Etheostoma cragini</i>	Candidate	Beaver	<p><i>Habitat:</i> Shallow, clear, cool water, sand or silt bottom streams with spring-fed pools and abundant rooted aquatic vegetation. Persist in large, deep pools during low-water periods when streams become intermittent in late summer.</p> <p><i>Distribution:</i> Sites in extreme northwestern AR, southwestern MO, and northeastern OK, within the Neosho River watershed. Also occurs in watersheds and isolated streams in eastern CO, south-central and southwestern KS, and the Cimarron watershed in northwest OK.</p>
Arkansas River Shiner <i>Notropis girardi</i>	Threatened	Payne, Grady, Woodward, Roger Mills, Woods, Ellis, Beaver	<p><i>Habitat:</i> Inhabits the shallow braided channels of wide sandy prairie rivers in the Arkansas River system. Schools gather on the lee side of sandbars and ridges of sand in the river channel. Spawn after heavy summer rains and eggs drift with water current and develop as they are carried downstream.</p> <p><i>Distribution:</i> Nearly all of the remaining populations occur in the Canadian River in OK, western TX and eastern NM. A small population may persist in the Cimarron River in OK. An accidentally introduced, isolated population occurs in the Pecos River in southwest TX.</p> <p><i>Critical Habitat:</i> Approximately 532 linear miles of 2 river reaches, including 300 feet of adjacent riparian areas measured laterally from each bank. Areas eligible for designation as critical habitat include portions of the Canadian River (South Canadian River) in NM, TX, and OK; Beaver/North Canadian River of OK; Cimarron River in KS and OK, and the Arkansas River in KS.</p>

Species Name	Federal Status	County	Habitat/Distribution
American Burying Beetle <i>Nicrophorus americanus</i>	Endangered	Payne, LeFlore, Nowata, Coal	Habitat: Terrestrial, Cropland/hedgerow, Forest-Hardwood, Grassland/herbaceous, Old fields, Shrubland/chaparral. Distribution: Eastern Oklahoma
Ouachita Rock pocketbook <i>Arkansia whellen</i>	Endangered	Le Flore	Habitat: Freshwater mussel, creeks, mediums rivers, riffles Distribution: Arkansas River System
Scaleshell mussel <i>Leptodea leptodon</i>	Endangered	Le Flore	Habitat: Freshwater mussel, riffles with moderate to high gradients in creeks to large river. Distribution: Critically Imperiled in LeFlore, McCurtain and Pushmataha Counties.
Winged Mapleleaf <i>Quadrula fragosa</i>	Endangered	Le Flore	Habitat: Freshwater mussel, big to medium rivers with a high to moderate gradient, riffle. Distribution: Kiamichi River System
Leopard darter <i>Percina pantherina</i>	Threatened	Le Flore	Habitat: Freshwater Distribution: Little River System (Red River drainage) of southeastern Oklahoma
Harperella <i>Ptilimnium nodosum</i>	Endangered	Le Flore	Habitat: Rock/gravelly shoals, or cracks in bedrock outcrops beneath the water surface in clear, swift-flowing streams, edges of intermittent pineland ponds or low, wet savannah meadows on the Coastal Plain and granite outcrop seeps. Distribution: LeFlore and McCurtain Counties, Oklahoma
Indiana bat <i>Myotis sodalis</i>	Endangered	Le Flore	Habitat: Caves, trees Distribution: Adair, Delaware LeFlore, Pushmataha and Sequoyah Counties, Oklahoma
Northern long-eared bat	Proposed Endangered	Le Flore	Habitat: Trees, caves, mines Distribution: Unknown

3.8.2 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. Only one state listed species (Black-sided darter [*Percina maculate*]) was identified as occurring or having the potential to occur in proposed parcel -005 in Le Flore County. No State listed species or their critical habitat is present or has the potential to be present in the remaining 15 Oklahoma 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. Eleven species have been identified as occurring or having the potential to occur in the Texas parcels (Table 16).

Table 16. State Listed species found in or near Texas parcels.

Scientific Name	State Status	County	Habitat/Distribution
American Peregrine Falcon (<i>Falco peregrinus anatum</i>)	T	Grayson	<i>Habitat:</i> Found nesting at elevations up to 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 found in nearly any open habitat, but with a greater likelihood along barrier islands, mudflats, coastlines, lake edges, and mountain chains. <i>Distribution:</i> Resident of the Trans-Pecos region, including the Chisos, Davis, and Guadalupe mountain ranges.
Peregrine Falcon (<i>Falco peregrinus</i>)	T	Grayson	<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.
Interior Least Tern (<i>Sterna antillarum athalassos</i>)	E	Grayson	See Table 15.
Whooping Crane (<i>Grus americana</i>)	E	Grayson	See Table 15
Piping Plover (<i>Charadrius melodus</i>)	T	Grayson	See Table 15

Scientific Name	State Status	County	Habitat/Distribution
Wood Stork (<i>Mycteria Americana</i>)	T	Grayson	<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 records in Texas since 1960.
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	T	Grayson	<i>Habitat:</i> Nest in forested areas adjacent to large bodies of water, staying away from heavily developed areas when possible. Tolerant of human activity when feeding, and may congregate around fish processing plants, dumps, and below dams where fish concentrate. Prefer tall, mature coniferous or deciduous trees that afford a wide view of the surroundings for perching. Can also be seen in dry, open uplands if there is access to open water for fishing in the winter. <i>Distribution:</i> Present year-round throughout TX as spring and fall migrants, breeders, or winter residents. Population in TX 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.
Texas Heelsplitter (<i>Potamilus amphichaenus</i>)	T	Grayson	<i>Habitat:</i> Quiet waters in mud or sand and also in reservoirs. <i>Distribution:</i> Sabine, Neches, and Trinity River basins.
Alligator Snapping Turtle (<i>Macrochelys temminckii</i>)	T	Grayson	<i>Habitat:</i> Perennial water bodies, deep water of rivers, canals, lakes, and oxbows, bayous, swamps, ponds, brackish coastal waters. <i>Distribution:</i> Extensive
Timber/Cranebrake Rattlesnake (<i>Crotalus horridus</i>)	T	Grayson	<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
Texas Horned Lizard (<i>Phrynosoma cornutum</i>)	T	Grayson	<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.

3.8.3 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).

Twenty-seven Birds of Conservation Concern are listed for the Central Mixed-Grass Prairie (Bird Conservation Region 19) *BCC 2008* list, for Ellis, Beaver, Grady, Roger Mills, Woodward, and Woods Counties, Oklahoma and Grayson County, Texas. The lesser prairie-chicken, little blue heron, Mississippi kite, Bald Eagle, Swainson's hawk, black rail, snowy plover, mountain plover, solitary sandpiper, upland sandpiper, long-billed curlew, hudsonian godwit, marbled godwit, buff-breasted sandpiper, short-billed dowitcher, red-headed woodpecker, scissor-tailed flycatcher, loggerhead shrike, Bell's vireo, Sprague's

pipit, Cassin's sparrow, lark bunting, Henslow's sparrow, Harris's sparrow, McCown's longspur, Smith's longspur and the chestnut-collared longspur have been identified as occurring in this BCC region and are of conservation concern.

Nineteen Birds of Conservation Concern are listed for the Oaks and Prairies (Bird Conservation Region 21) *BCC 2008* list, for Coal and Payne Counties. The little blue heron, swallow-tailed kite, Bald Eagle, peregrine falcon, black rail, upland sandpiper, long-billed curlew, hudsonian godwit, buff-breasted sandpiper, red-headed woodpecker, scissor-tailed flycatcher, loggerhead shrike, Bell's vireo, Sprague's pipit, Swainson's warbler, Henslow's sparrow, Harris's sparrow, Smith's longspur and the orchard oriole have been identified as occurring in this BCC region and are of conservation concern.

Sixteen Birds of Conservation Concern are listed for the Shortgrass Praire (Bird Conservation Region 18) *BCC 2008* list, for Cimarron County. The little blue heron, Bald Eagle, peregrine falcon, snowy plover, mountain plover, upland sandpiper, long-billed curlew, burrowing owl, Lewis's woodpecker, willow flycatcher, Bell's vireo, Sprague's pipit, lark bunting, McCown's longspur, and the chestnut-collared longspur have been identified as occurring in this BCC region and are of conservation concern.

Twenty-eight Birds of Conservation Concern are listed for the West Gulf Coastal Plain/Ouachitas (Bird Conservation Region 25) *BCC 2008* list, for Le Flore County. The least bittern, little blue heron, swallow-tailed kite, Bald Eagle, American kestrel, yellow rail, solitary sandpiper, hudsonian godwit, buff-breasted sandpiper, Chuck-will's-widow, red-headed woodpecker, loggerhead shrike, brown-headed nuthatch, Bewick's wren, wood thrush, Sprague's pipit, prairie warbler, cerulean warbler, prothonotary warbler, worm-eating warbler, Swainson's warbler, Louisiana waterthrush, Kentucky warbler, Bachman's sparrow, Henslow's sparrow, Smith's longspur, painted bunting, and orchard oriole have been identified as occurring in this BCC region and are of conservation concern.

3.8.4 Wildlife

There is a variety of wildlife that occurs or has the potential to occur in the proposed parcels including: turkey, white-tailed deer, squirrels, chipmunks, rabbits, cottontails, gophers, armadillos, coyotes, skunks, fox, bobcat, opossums, raccoon, free-tailed bats, cave myotis, several species of rats and mice, numerous bird species, and several species of lizards, and venomous and non-venomous snakes.

3.9 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.

3.10 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. Coal is especially prominent under proposed parcels -003 and -005. NM-8 has been added to both to inform the lease of the need to coordinate with any Federal coal leasing and/or mining operations.

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).

Proposed parcels -003 and -004 are being drained

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).

Proposed parcel -020 is being drained.

Table 17. Potential Producing Mineral Formations for the proposed lease parcels.

	Producing Formations	Anticipated Drilling Method	Anticipated True Vertical Drilling Depth (feet)
Cimarron	Pennsylvanian-age Marmaton, Cherokee, Granite Wash, Atoka, and Morrow. Not situated in known or existing plays.	Vertical, but horizontal possible	~4,700 - 4,800
Coal	Pennsylvanian-age Gilcrease, Booch, Spiro, Wapanucka, Hartshorne, Atoka, and Cromwell. Mississippian-Devonian-age Woodford Shale. Ordovician-age Oil Creek and McLish. Situated in the Woodford Shale Play in the Arkoma Basin	Horizontal laterals with a North-South orientation with a length >5,280 feet.	~9,550
Beaver	Pennsylvanian-age Marmaton, Kansas City, Lansing, Chase, Atoka, and Morrow. Mississippian-age Chester and St. Louis. Situated in the Marmaton Lime Play.	Horizontal laterals with a North-South orientation with a length >5,280 feet.	~8,200
Le Flore	Pennsylvanian-age Fanshaw, McAlester, Spiro, Red Oak, Hartshorne, Atoka, and Savanna. Situated in the Arkoma Basin coalbed methane area.	Coalbed methane horizontal laterals drilled with an East-West to Southwest-Northeast orientation with a length >5,280 feet	~2,543
Woods	Pennsylvanian-age Cherokee, Cottage Grove, Redfork, Tonkawa, Oswego, and Kansas City. Mississippian-age Chester and Limes. Devonian-Ordovician-age Hunton and Simpson. Situated in the Mississippian Play area.	Horizontal laterals drilled with a North-South orientation with a length >5,280 feet	~5,900
Ellis	Pennsylvanian-age Cherokee, Cottage Grove, Redfork, Skinner, Bartlesville, Oswego, Tonkawa, Morrow, Cleveland, Marmaton, Big Lime, and Atoka. Situated in the Cleveland-Marmaton Play area.	Horizontal laterals drilled with a North-South orientation with a length >5,280.	~10,320
Roger Mills	-009 = Pennsylvanian-age Douglas, Tonkawa, Prue, Red Fork, Skinner, Oswego, Morrow, and Hoxbar. Mississippian-age Chest. Situated in the Tonkawa-Cleveland-Marmaton Play area. -010= Pennsylvanian-age Marmaton, Douglas, Tonkawa, Cherokee, Red Fork, Skinner, Oswego, Granite Wash, Atoka and Morrow. Situated in the Tankawa, Cleveland, Marmaton, and Granite Wash Plays.	Horizontal laterals drilled with a North-South orientation with a length >5,280.	-009 = ~11,330 -010 = ~13,400
Payne	Pennsylvanian-age Red Fork, Bartlesville, Skinner, Layton. Mississippian-Devonian-age Limes and Misener. Situated in Mississippian Play.	Horizontal lateral with a length >5,280 feet. Possible vertical.	-012 = ~4,000 -015 = ~5,140 -016 = ~5,000

	Producing Formations	Anticipated Drilling Method	Anticipated True Vertical Drilling Depth (feet)
Grady	Pennsylvanian-age Hart and Osborn. Ordovician-age Viola and Bromide. Mississippian-Devonian-age Sycamore, Woodford, Misener, and Hunton. Situated in Woodford play (Anadarko Basin)	Horizontal laterals range from 5,280 to 10, 560 feet	~13,000 feet
Woodward	Pennsylvanian-age Cherokee, Morrow, Oswego. Not situated in any plays.	Horizontal or Vertical. Horizontal laterals approximately 5,280 feet in length	~8,800
Grayson	Creataceous-age Baker, Trinity and Walnut. Pennsylvanian-age Desmoines, Dronick Hills, Cordell, Strawn, Foster, and Handy. Mississippian-Ordovician-age Arbuckle, Viola, Ellenburger, Oil Creek, Mississippi, Arkansas Novaculites, and Viola. Situated at the southern edge of Woodford play.	Horizontal or vertical. Horizontal laterals approximately 5,280 feet in length.	~10,670

3.11 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 parcels -001, -002, -008, -009, and -019 are immediately adjacent to or a within the Cimarron, Washita, or Canadian Rivers. The rivers have not been designated as wild and scenic. Proposed parcels -012, -015, and -016 are adjacent to the Lake Carl Blackwell Recreation Area and OSU Research Areas. Proposed parcels -018 and -020 are in recreation areas managed by the Army Corp of Engineers and US Fish and Wildlife Serve Refuge System, respectively. In these recreational areas water resources and bank vegetation is an important value that has not been drastically altered from the natural state. 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.

Table 18. Distance of proposed parcels to nearest major roadways.

Parcel	Interstate/Distance	U.S. Highway/Distance	State Routes
-001, -002	I-40, I-25/>100 miles	US 56/~8.5 miles	SR 95/~18.5 miles
-003	I-35/~50.0 miles	US 75/<1.0 mile	SR 31/~1.5 miles
-004	I-40/~90 miles	US 83/~5.75 miles	SR 15/~3.5 miles
-005	I-40/~32.0 miles	US 59 crosses through the parcel	SR 128/<1.0 mile
-006, -007	I-40/~85 miles	US 64/~5.0 miles	SR 14/~1.25 miles
-008	I-40/~40.0 miles	US 60/~10.0 miles	SR 34/~9.5 miles
-009	I-40/~32.0 miles	US 283/~5.0 miles	SR 47/~4.0 miles
-012	I-35/~10.0 miles	US 177/~6.0 miles	SR 51/~2.0 miles
-013	I-40, I-25/>100 miles	US 56/~4.0 miles	SR 95/~13.5 miles
-015	I-35/~1.75 miles	US 77/~4.5 miles	East border of parcel formed by SR 86
-016	I-35/~5.0 miles	US 77/~7.5 miles	SR 51 crosses through the parcel
-017	I-44/~11.25 miles	US 62/~5.0 miles	SR 39/~2.5 miles
-018	I-40/~75 miles	US 183/~2.5 miles	SR 15/~7.75 miles
-019	I-40/~35 miles	US 283/~7.0 miles	SR 33/~4.0 miles
-020	I-35/~20.0 miles	US 377/~5.5 miles	SR 56/~5.0 miles

3.12 Recreation

With more than 12 different ecoregions across the state, Oklahoma offers a diverse collection of wildlife species to watch, hunt, or fish. Through intense habitat conservation and management ODWC is able to provide quality hunting opportunities across the state for species such as: antelope, bear, dove, crane, deer, elk, furbearers (e.g. coyotes, bobcat, raccoon), feral hogs, mountain lion, quail, peregrine, pheasant, rabbit, squirrel, turkey, and waterfowl. With more than 200 lakes and over one million surface acres of water, Oklahoma is well known for its fishing opportunities of more than 40 documented fish species the most common being bass, crappie, sunfish, and catfish.

Outdoor recreation occurs in or near each of the proposed parcels to some degree in the form of hunting, wildlife watching, off-highway vehicle driving, equestrian riding, biking and hiking. Because proposed parcels -001 through -009, -017, and -019 are on private land, the degree of recreation in or near each proposed parcel is limited by access. Recreation on these parcels typically is limited to individuals who have permission to access the land from the landowner. Parcels -015, -016, -018, and -020 is public land owned by another surface management agency and is accessible by all of the public. Proposed parcel -012 is owned by another surface management agency but access is not permitted to the general public.

Proposed parcel -012 is within the Oklahoma State University (OSU) Range Research Station focuses its research efforts on natural resources and ecological management with an emphasis on the effects of prescribed fire on vegetation, wildlife, and cattle grazing distributions in the Cross Timbers eco-region. Recreation to the general public is not permitted.

Proposed parcels -015 and -016 are near and in Lake Carl Blackwell (LCB). LCB includes a 3,350-acre lake as well as an 800 acre recreation area owned and operated by OSU. Fishing, boating, personal watercraft, sailing, and swimming are permitted on the lake. The recreation area includes a four-season fishing dock and seasonal trout pond. Cabin rentals, RV camgrounds, tent sites, and day-use picnic areas are available throughout the recreation area. Over 50 miles of hiking, mountain biking and equestrian trails are also on-site. Fishing at the lake includes Saugeye, hybrid bass, black bass, crappie and catfish. Migratory waterfowl and game hunting is permitted at LCB during the legal season. Hunting is regulated through a public drawing and auction process held by OSU.

Proposed parcel -018 is under Fort Supply Lake. The man-made lake offers extensive opportunities for outdoor recreation including: camping, picnicking, boating, fishing, and hunting. A major attraction for campers is the numerous campsites located on the water's edge providing easy access to the lake. Swimming and sunbathing opportunities abound at the designated swim beach, or the sand dunes that are located on the east side of the lake. Numerous boat ramps are available to serve the recreational boater. The ACOE operates two multi-use recreation areas, which offer a variety of activities ranging from overnight camping, and various day-use activities to the visiting public. The ACOE also operates one access point for hunting and fishing purposes. The 1,800-acre lake provides excellent fishing opportunities for a variety of species including, crappie, walleye, white bass, hybrid bass, channel catfish, and flathead catfish. There is approximately 6,000 acres of public hunting land managed by the ACOE and the ODWC (Fort Supply Wildlife Management Area), which provides hunting for bobwhite quail, deer, wild turkey, pheasant, dove, waterfowl, squirrel and rabbit. There are two maintained shooting ranges on the lake, which see extensive use.

Proposed parcel -020 is within Hagerman National Wildlife Refuge (NWR). Hagerman NWR is owned and managed by the US Fish and Wildlife Service—Refuge System. Hagerman NWR was established in 1946 as an overlay of a portion of the Big Mineral arm of Lake Texoma in north-central Texas. The establishment of Hagerman is to provide and manage for migratory birds, wildlife, and plants native to the area, and to provide an opportunity for outdoor recreation that is compatible on the 12,000-acre refuge. The refuge offers wildlife-dependent recreational opportunities, including wildlife observation and photography, fishing, hunting, hiking, and education programs. Fishing on the refuge includes catfish, sandbass, stripers, crappie, and pan fish. Hunting includes white-tailed deer, feral hog, turkey and small game such as dove, squirrel and rabbit.

3.13 Socioeconomics and Environmental Justice

3.13.1 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.

In and near all of the proposed parcels, the economy is very dependent on agricultural and livestock production. Crops grown include wheat, corn, grain sorghum, forage sorghum and alfalfa. Beef cattle are the predominant livestock produced in some of the proposed parcels. Oil and gas production is widespread and very important to each proposed parcel county. Other minerals, except for coal in Coal and Le Flore County, are of minor importance.

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).

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 19 describes the demographics of each proposed parcel county.

Table 19. Demographics of proposed lease parcel counties.

	Population	Identified as Hispanic or Latino Origin	Not Identified as White or of Hispanic or Latino Origin	White Alone, not Hispanic or Latino	Median Household Income	Living Below the Poverty Level
Oklahoma	3,850,568	9.6%	24.7%	67.5%	\$44,891	16.6%
Cimarron	2,335	20%	3.8%	76.5%	\$37,261	21.6%
Coal	5,867	3.5%	26.7%	71.0%	\$33,512	21.0%
Beaver	5,566	22.0%	5.6%	74.2%	\$50,460	10.3%
Le Flore	49,774	6.8%	21.8%	72.5%	\$36,084	22.3%
Woods	9,041	5.9%	9.9%	85.1%	\$50,690	16.4%
Ellis	4,170	7.5%	4.9%	87.9%	\$45,017	15.3%
Roger Mills	3,743	6.0%	10.0%	85.3%	\$53,952	16.6%
Payne	79,066	4.3%	18.6%	78.1%	\$36,762	24.3%
Grady	53,685	5.1%	13.5%	82.5%	\$48,963	14.6%
Woodward	21,221	11.7%	8.8%	80.1%	\$52,048	11.9%
Texas	26,448,193	38.4%	19.6%	44.0%	\$51,563	17.4%
Grayson	122,353	12.2%	11.5%	77.3%	\$46,587	15.4%

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 Oklahoma and 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.

The surface of proposed lease parcels -012, -015, -016, -018 and -020 are all managed by other surface management agencies, which have added No Surface Occupancy stipulations to parcels under their jurisdiction. 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, all of 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.

All proposed parcels except -003 and -020 are a significant distance (>50 miles) from any nonattainment areas, while all proposed parcels except for -005 are a significant distance (>50 miles) from any Class I airsheds. 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 Dallas-Ft. Worth “non-attainment” area near parcel -020. The increase in particulate matter is also expected to be too small to have a significant effect on the overall air quality of the Class I airsheds or to the overall PM₁₀ levels of the Lamar, CO “non-attainment” 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 17 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 20. 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 Oklahoma and 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 BLM and allow for comparison with other sources in a broad sense.

Table 18 shows the estimated greenhouse gas emissions for oil and gas field production for the U.S., Oklahoma, Texas, and Federal leases in Oklahoma and 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 18 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).

Table 21. 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

To estimate the potential emissions from the proposed lease sale, an estimate of emission per well is useful (Table 19). 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 22. 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	10,363,590	0.16%
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 (16 wells)	3,338.8	0.0000052%
Oil & Gas Field Production at Full Development For Proposed Action (1 Well)	24.93	0.00000004%

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 soil 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; or 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 4.3.10 – 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).

4.3.2.1 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 1,070.2 acres (32.7%) of eleven proposed lease parcels could be impacted and/or removed as prime farmland, while all acreage within five proposed parcels and portions of five proposed parcels totaling 2,203.3 acres (67.3%) 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.

4.3.3 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 would likely be greater.

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/or 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.

Mitigation

ORA-1 and ORA-LN-3 would be attached to proposed lease -005, -008, and -009. 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).

Controlled surface use requiring special mitigation measures may be required and will be developed during the APD process.

4.3.4.2 Wetlands, Riparian Areas

While the act of leasing Federal minerals would produce no direct impacts to wetlands or riparian areas; no adverse impacts are expected for wetlands or riparian areas if exploration/development occurred on this lease parcel in the future.

Mitigation

Potential mitigation is deferred to site-specific development at the APD stage. Protective stipulation ORA-2 would be attached to the lease of a tract which falls within a wetland/riparian. 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."

4.3.6 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 archeologist 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) recommends

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

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.”

Mitigation

All tracts within this lease sale will have WO-ESA-7 attached to it. In addition, NM-201504-004 - Beaver County, Oklahoma, NM-201504-008 - Ellis County, Oklahoma, NM-201504-009 – Roger Mills County, Oklahoma, NM-201504-010 - Beckham County, Oklahoma, NM-201504-018 - Woodward County, Oklahoma, and NM-201504-019 – Roger Mills County, Oklahoma; will have ORA-3 Season of Use stipulation attached.

NM-201504-020 will have WO-ESA-7: Threatened and Endangered Species protection.

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

All tracts will also require the Wildlife Resource General Conditions of Approval (WRGCOAs) which will be included in an approved APD along with the use of standard Best Management Practices (BMPs), this 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.

4.3.9.3 Migratory Birds

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 phase of the operation 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. 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-8 has been attached to proposed parcels -003 and -005, which indicates that the lease is over a Federal coal and that they oil and gas operator must coordinate with the Federal coal lease. The stipulation is used to protect the value of Federal coal reserves.

NM-10 has been attached to proposed parcels -004 and -020, 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 20 parcel nominations (4002.76 acres) for consideration in the April 2015 Oil & Gas Lease Sale, and is proposing to lease 17 (3281.89 acres) of the 20 parcels. If these 17 parcels were leased, the percentage of Federal minerals leased wouldn't change. Only parcels in OK and TX will be offered for sale.

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 April 2015 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	19	3929.56	16	3208.69
Texas	1	73.20	1	73.20
Totals	15	4002.76	14	3281.89

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	125,091	20%
NM	34,774,457	29,751,242	4,839,255	16%
OK	1,998,932	1,668,132	327,281	20%
TX	3,404,298	3,013,207	425,584	14%
Totals/Average	40,921,687	35,067,167	5,717,211	16%

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 Oklahoma and Texas were 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 September 4, 2014, the Railroad Commission of Texas lists 287,550 current oil wells statewide including 218,582 active wells and 68,968 inactive wells (RRC 2014). The RRC lists 132,914 current gas wells in the state including 104,973 active wells and 27,941 inactive wells. In 2013, a total oil production of 757,548,412 bbl of oil and 16,298,326,842 mcf of gas (natural gas, gas well gas, and casinghead gas) was produced in the state (RRC 2014a). 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 11 counties in which the proposed lease parcels occur.

The primary activities that contribute to levels of air pollutants in the 11 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 2014). 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 or violating the Class I airshed protections. 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 (BLM 2014). 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
Ryan Howell	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 September 16, 2014, 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 September 2, 2014. No comments were received. This EA will be made available for public review and comment for 30 days beginning October 30, 2014.

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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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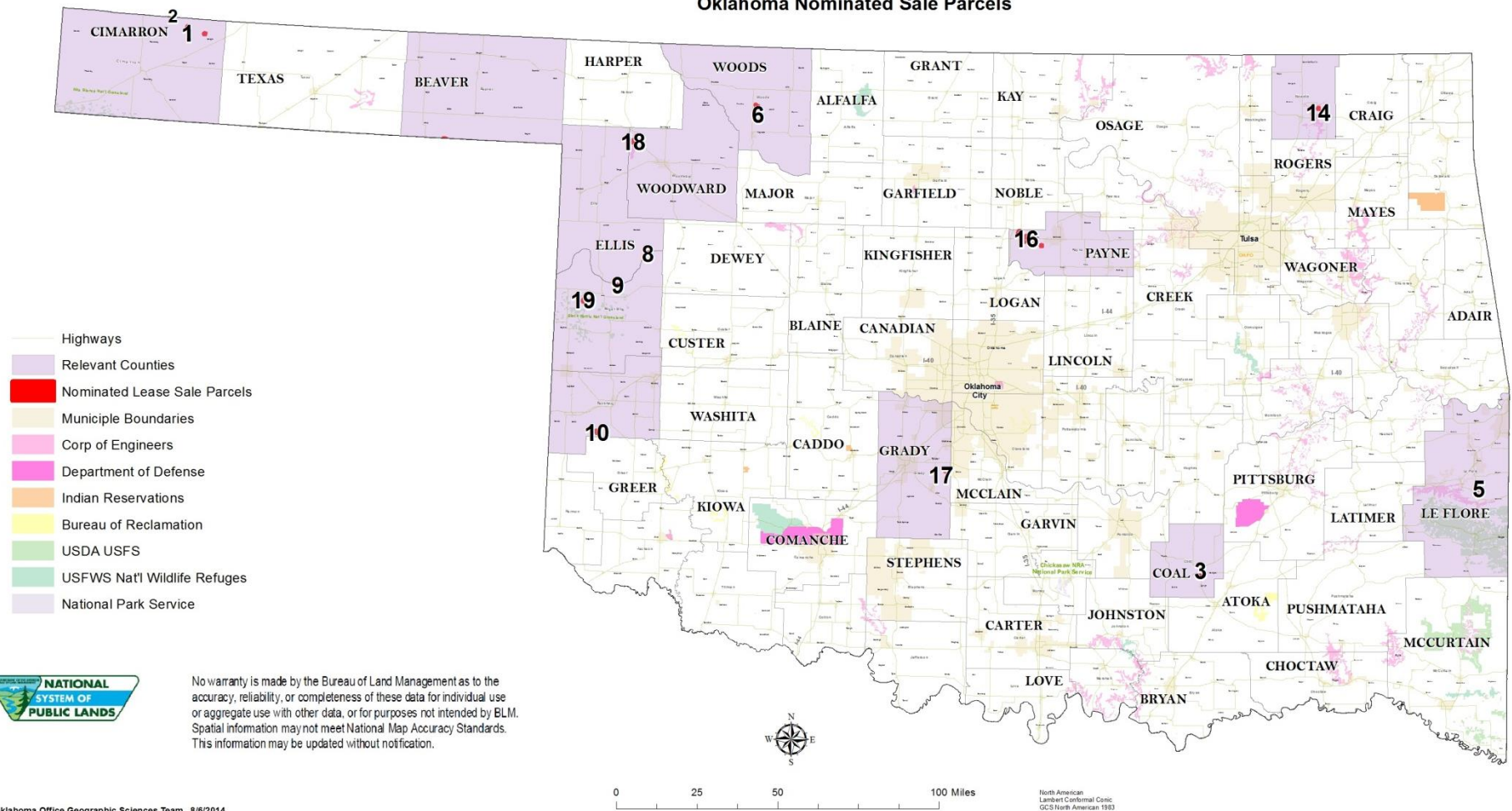
The Federal Land Policy and Management Act, as amended. Public Law 94-579.

APPENDIX 1. OKLAHOMA FIELD OFFICE LEASE STIPULATION SUMMARY

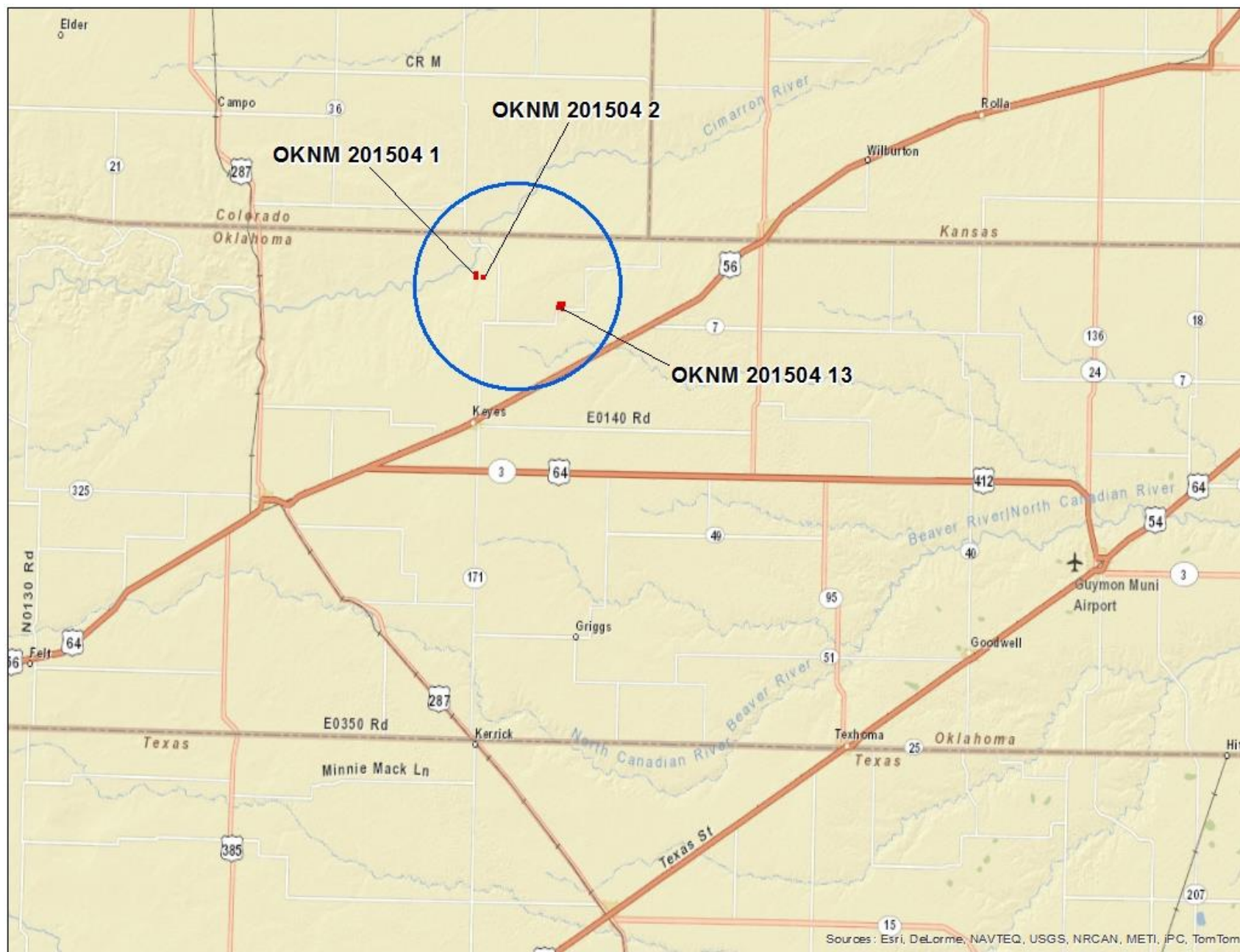
Stipulation	Description/Purpose
ORA-1 OK, TX	FLOODPLAIN PROTECTION: A result of EO 11988 Floodplain Management of May 24, 1977. All or portions of the lands under this lease lie in and or adjacent to a major watercourse and are subject to periodic flooding. Surface occupancy of these areas will not be 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	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.
NM-10 OK	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.
LN-3	FLOODPLAIN MANAGEMENT: All or portions of the lands under this lease lie in and/or adjacent to a major watercourse and may be subject to periodic flooding. 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. Controlled surface use requiring special mitigation measures may be required and will be developed during the application for permit to drill. These would be required as part of the environmental analysis, approval for drilling or any other operation on this lease. These measures could include modifications or relocation of proposed well locations; burial of linear facilities such as pipelines; modifications in surface activities; minimizing surface disturbance by co-locating roads, utilities and pipelines in common rights-of-ways; interim reclamation of all surface disturbance initiated immediately after construction; reduction of long term noise producing activities; suitable off-site mitigation or other reasonable measures to mitigate impacts to floodplains.

Stipulation	Description/Purpose
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 OK, TX	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.
OSU #1 OK	No Surface Occupancy Lake Carl Blackwell: This no surface occupancy stipulation is to protect Lake Carl Blackwell and associated facilities owned by Oklahoma State University (OSU).
OSU #2 OK	Lake Carl Blackwell: Prior to conducting operations on these lands, a plan of operations must be approved by the Tulsa District Office of the Bureau of Land Management. Any drilling, construction, or operations on the leased lands are subject to site-specific stipulations as may be necessary to assure reasonable protection of Lake Carl Blackwell and associated facilities owned by the OSU. A plan shall not be approved if it will result in unacceptable impacts on any land use or the environment.
COE-SS-1 (USACE) OK	NO SURFACE USE OCCUPANCY: No surface occupancy is allowed on this lease in order to protect the reservoir. All areas within 2,000 feet of any major structure, including but not limited to the dam, spillway, or embankment, are restricted areas. The restricted areas including public use areas, recreation areas, wildlife refuges, etc. are not to be used for any purpose. Drilling operations in, on, or under the restricted areas, including drilling outside of the restricted areas which would cause a bore hole to be under the restricted area, will not be permitted. Structures and appurtenances shall be of material or construction determined to not create floatable debris and construction and operations of the structures should not cause pollution of the soils and waters of the project. All storage tanks and slush pits will be protected by dikes of sufficient capacity to protect the reservoir from pollution.
NSO (USFWS) TX	NO SURFACE OCCUPANCY: To protect and preserve significant cultural and other resource values of this lease. The tract could be leased for inclusion in a drilling unit and may be drilled directionally from an off-site location where occupancy is allowed.

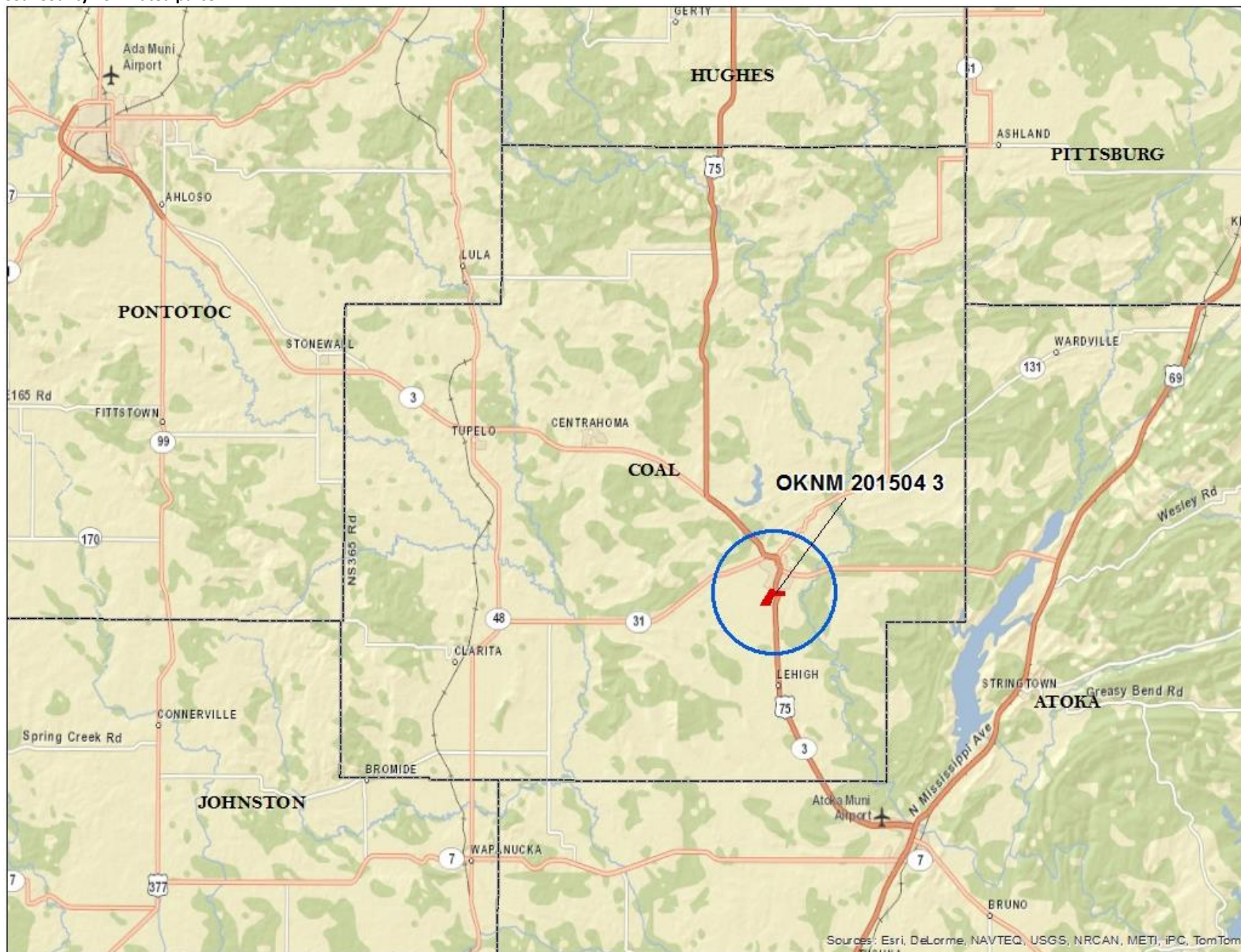
**BLM New Mexico Competitive Oil and Gas Lease Sale
April 2015
Oklahoma Nominated Sale Parcels**



Cimarron County nominated parcels.



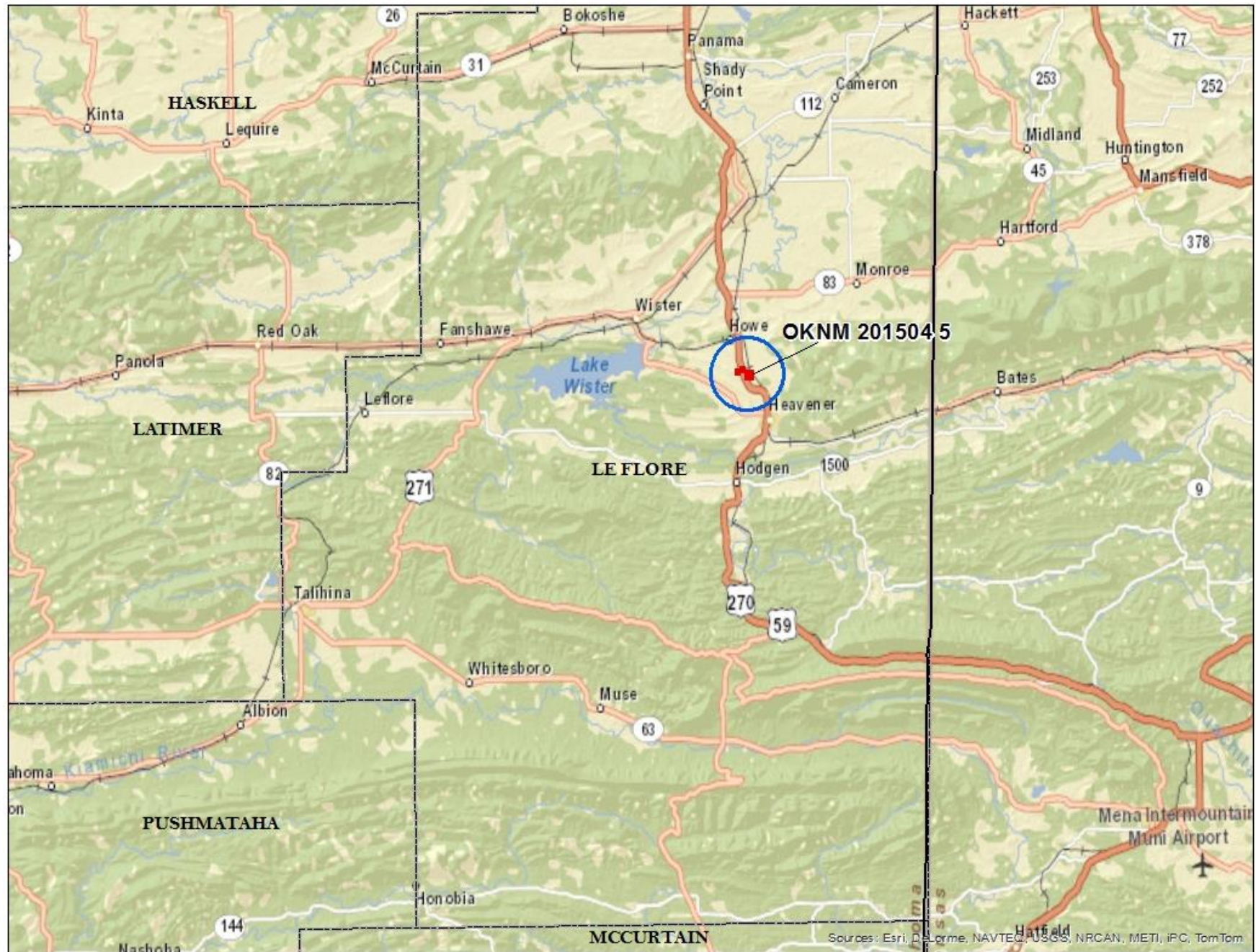
Coal County nominated parcel.

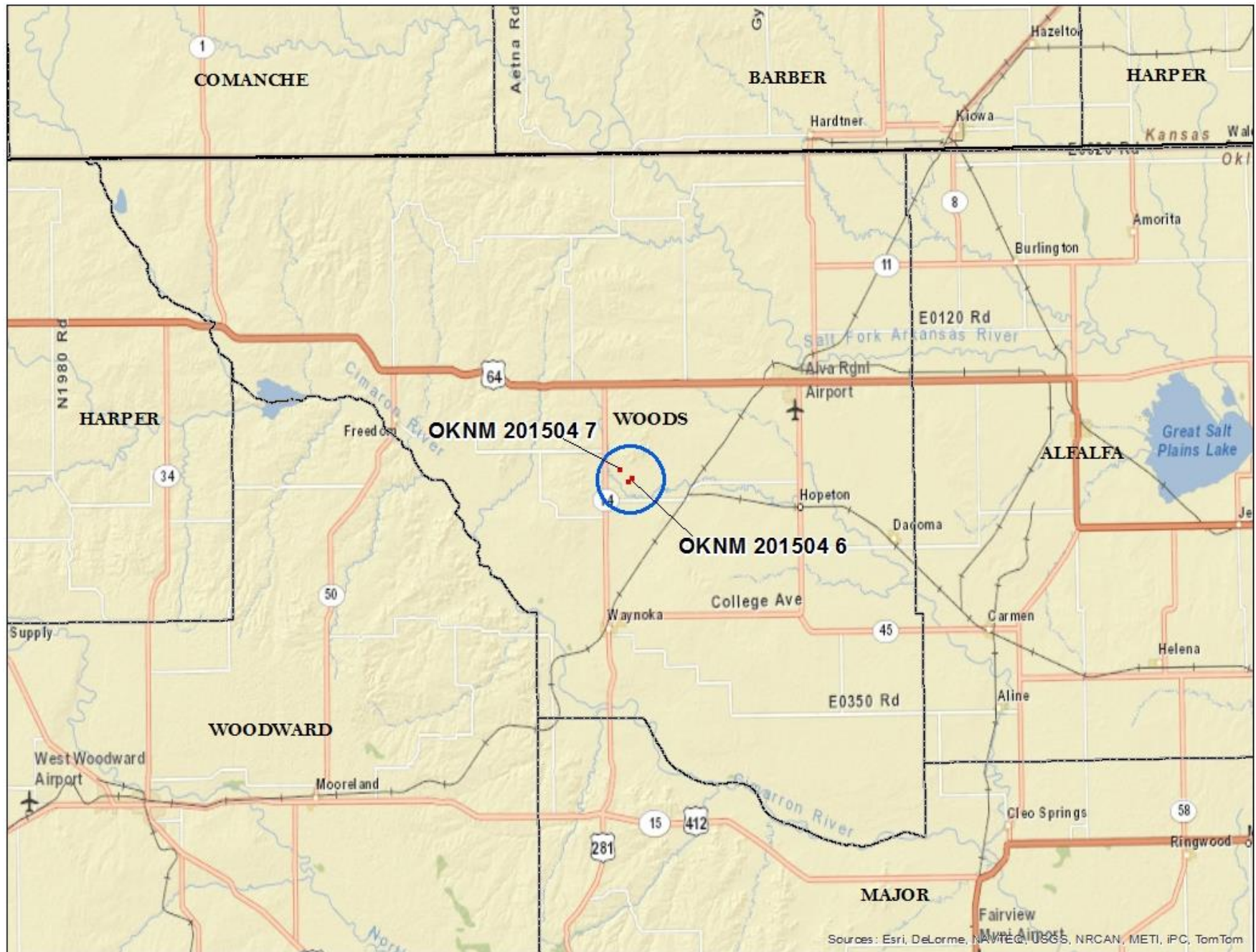


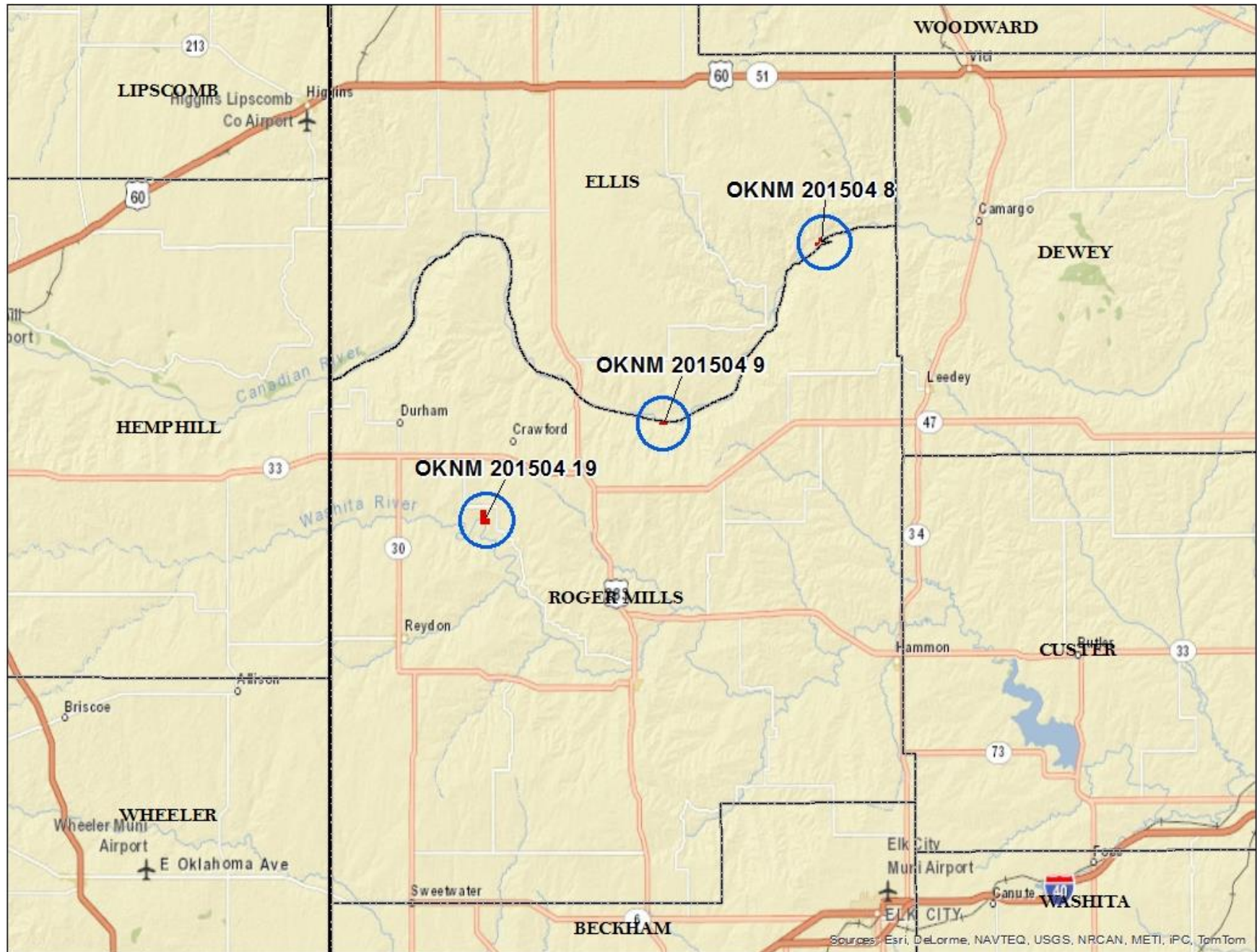
Beaver County nominated parcel.



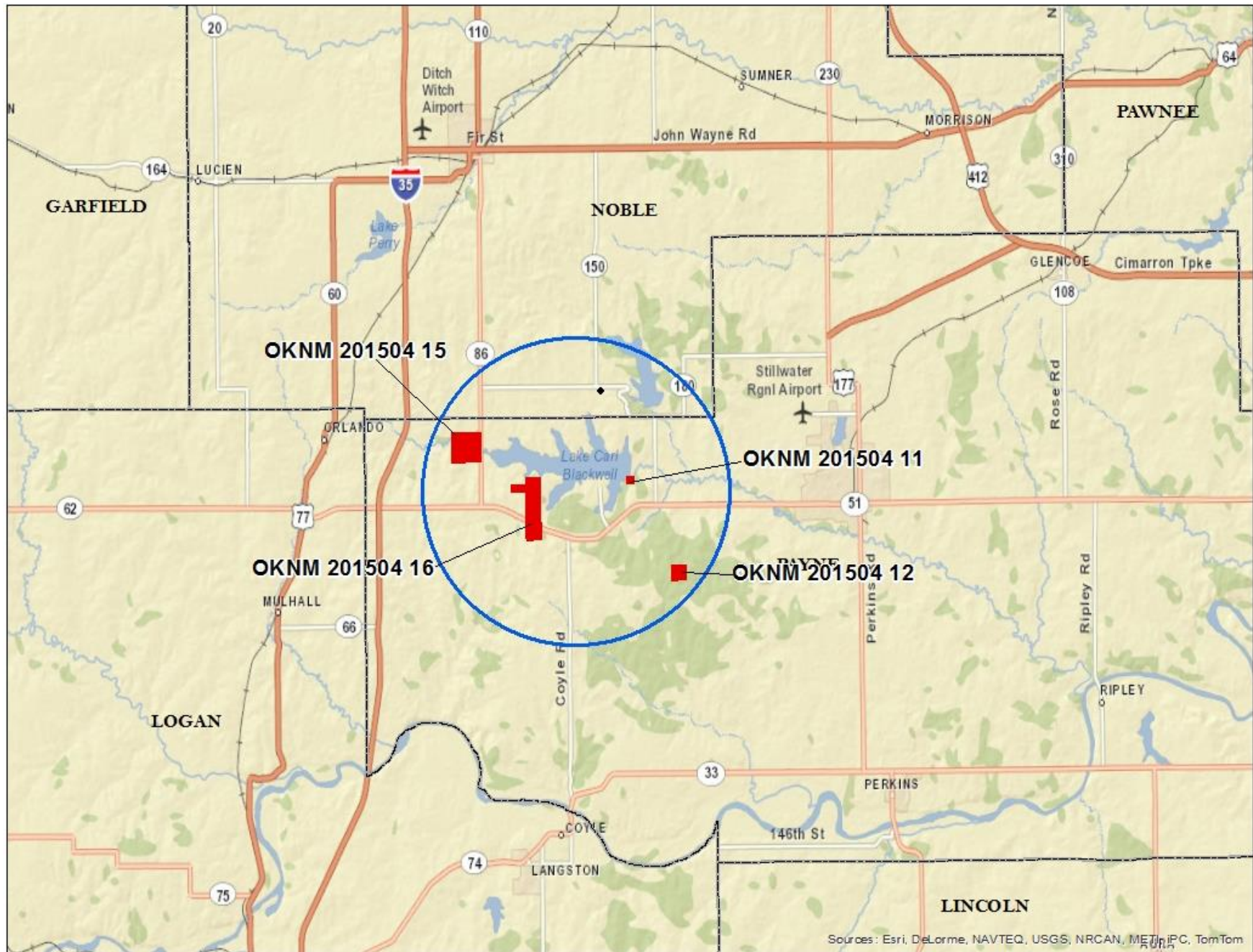
Le Flore County nominated parcel.



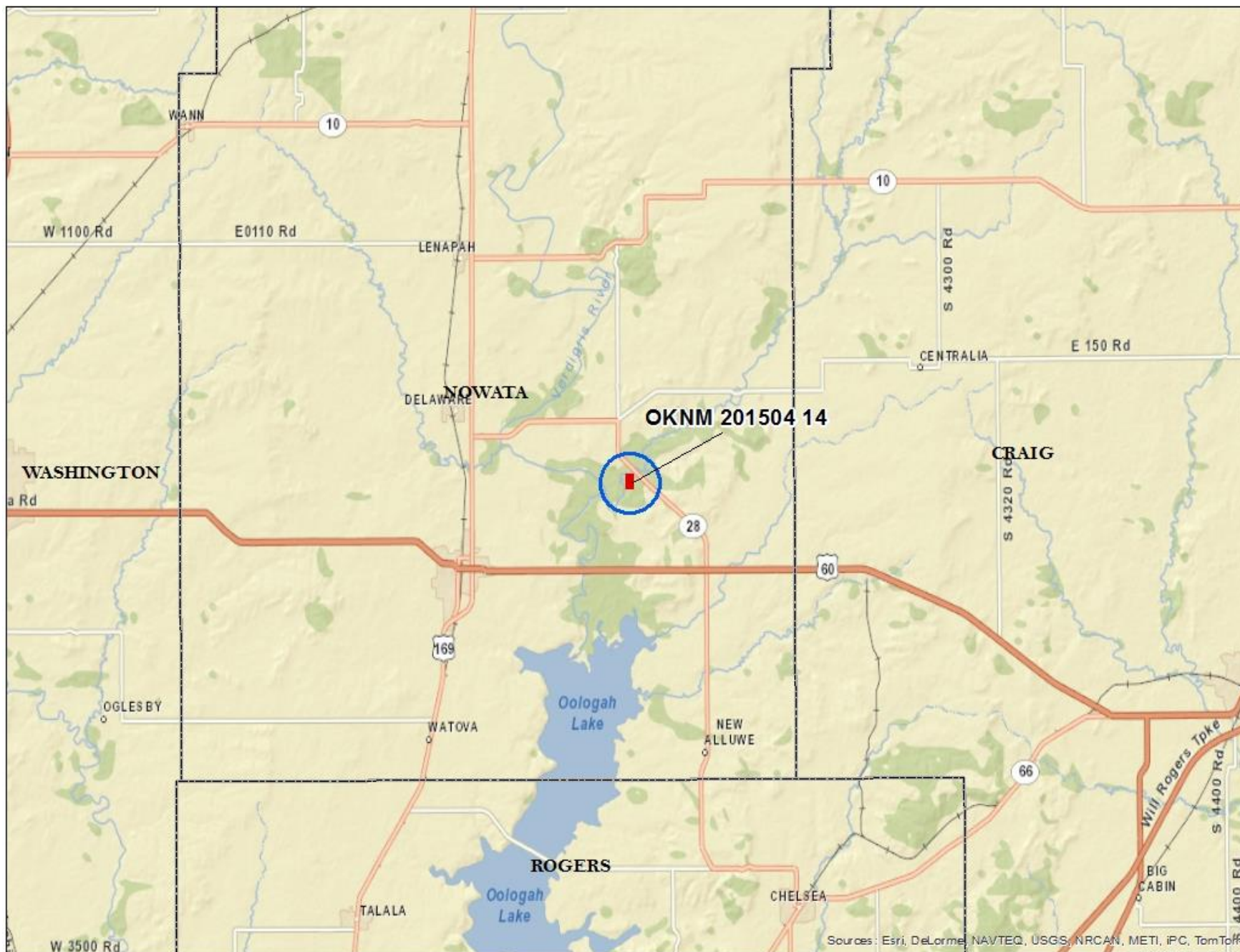




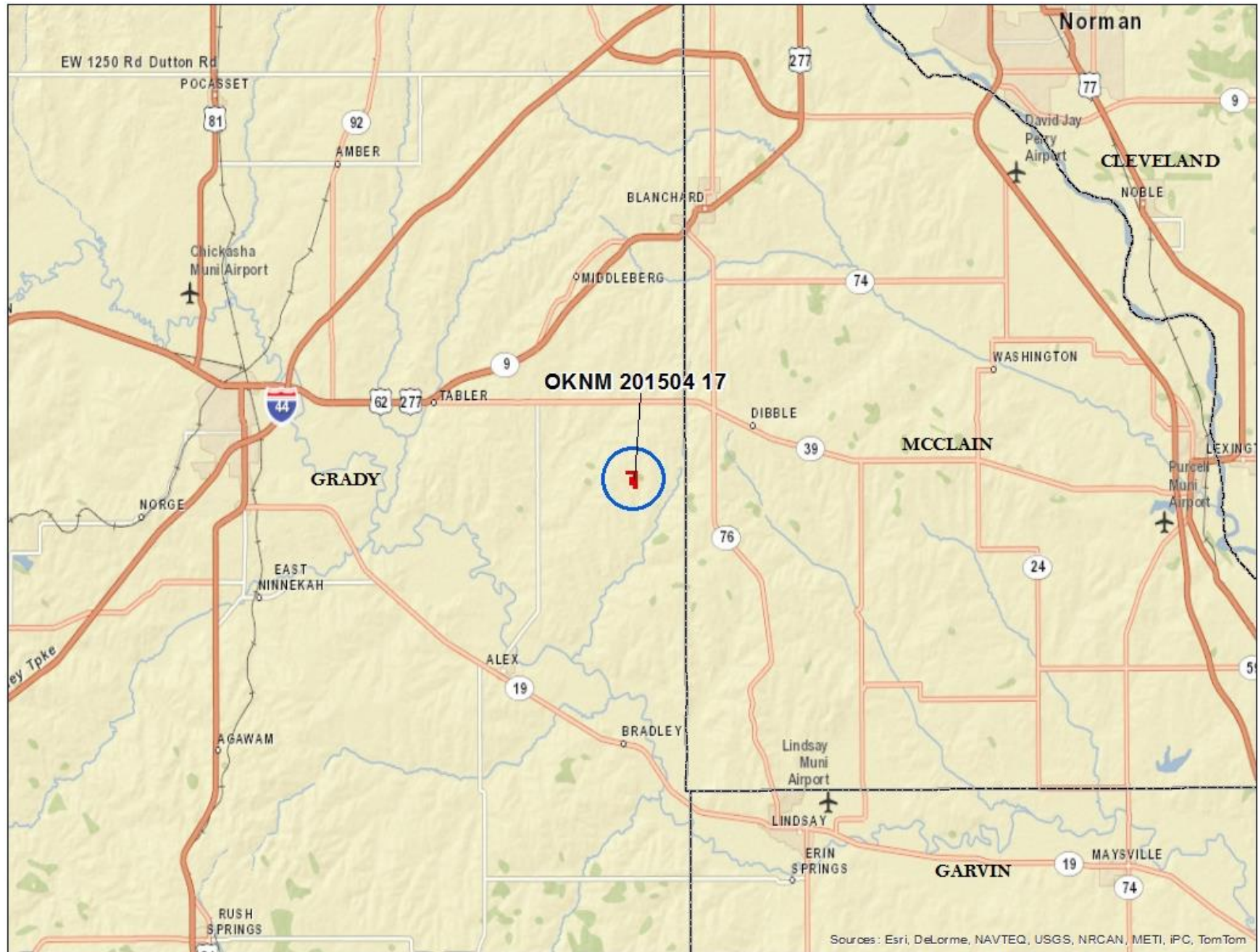




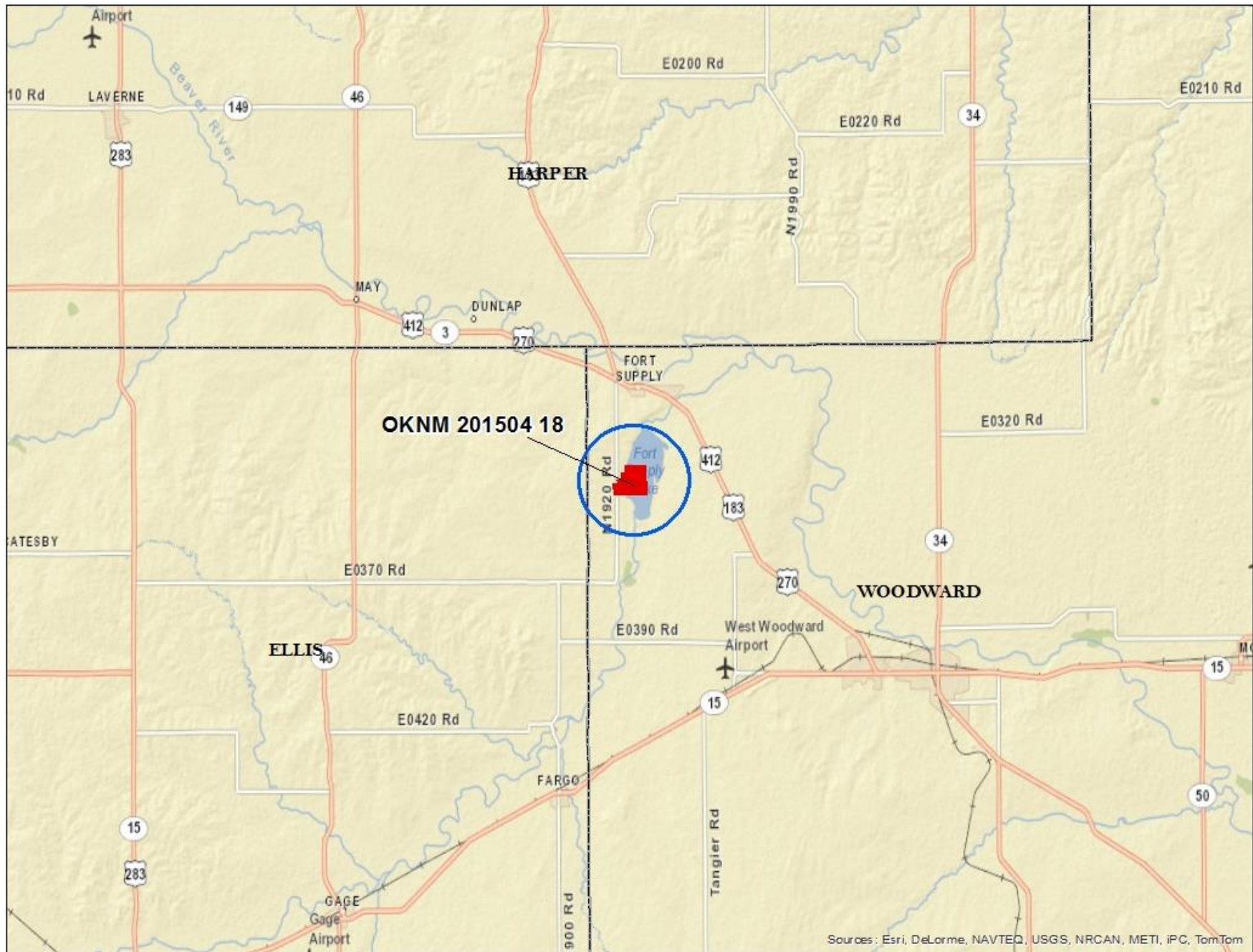
Nowata County nominated parcel.



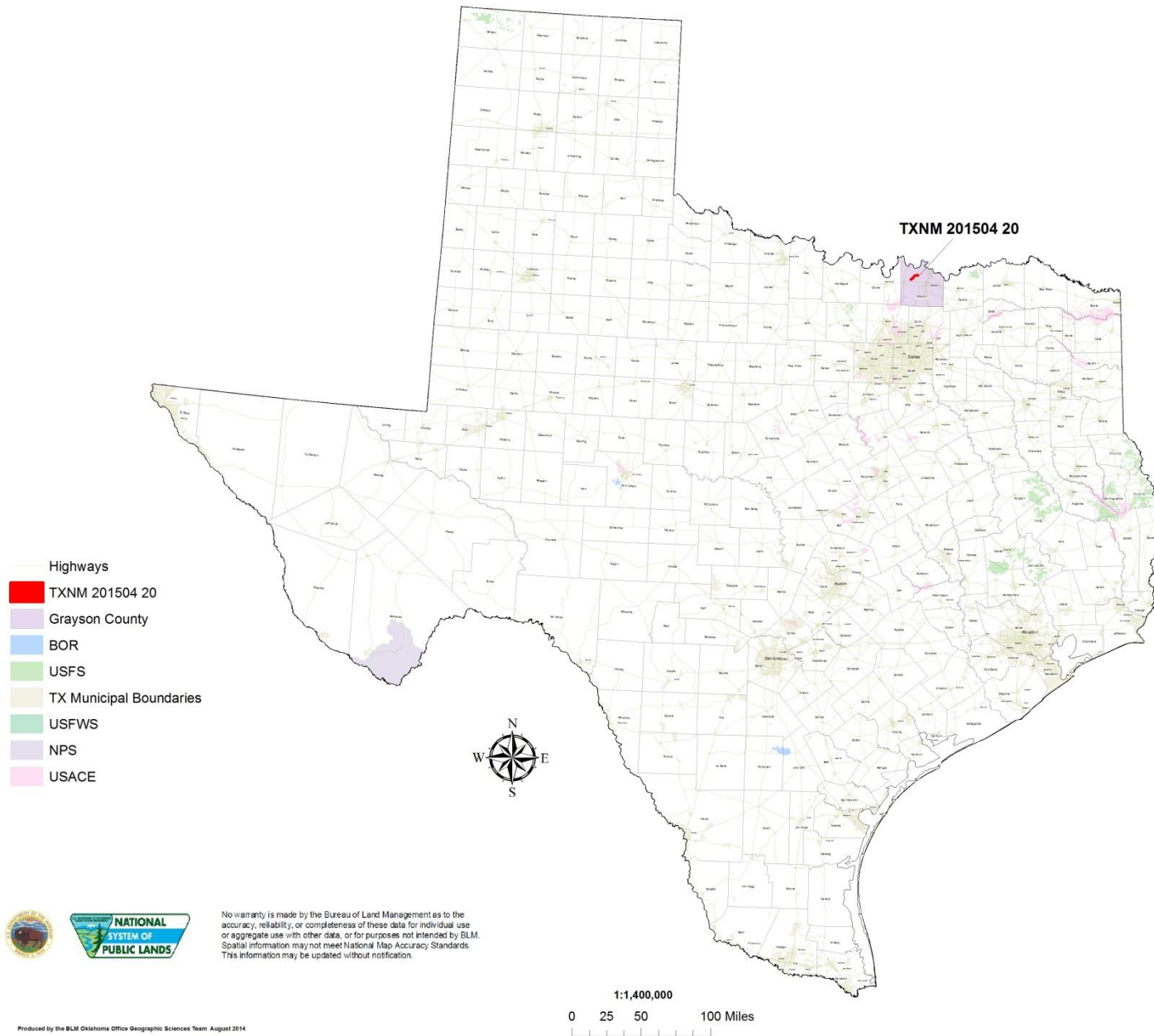
Gray County nominated parcel.



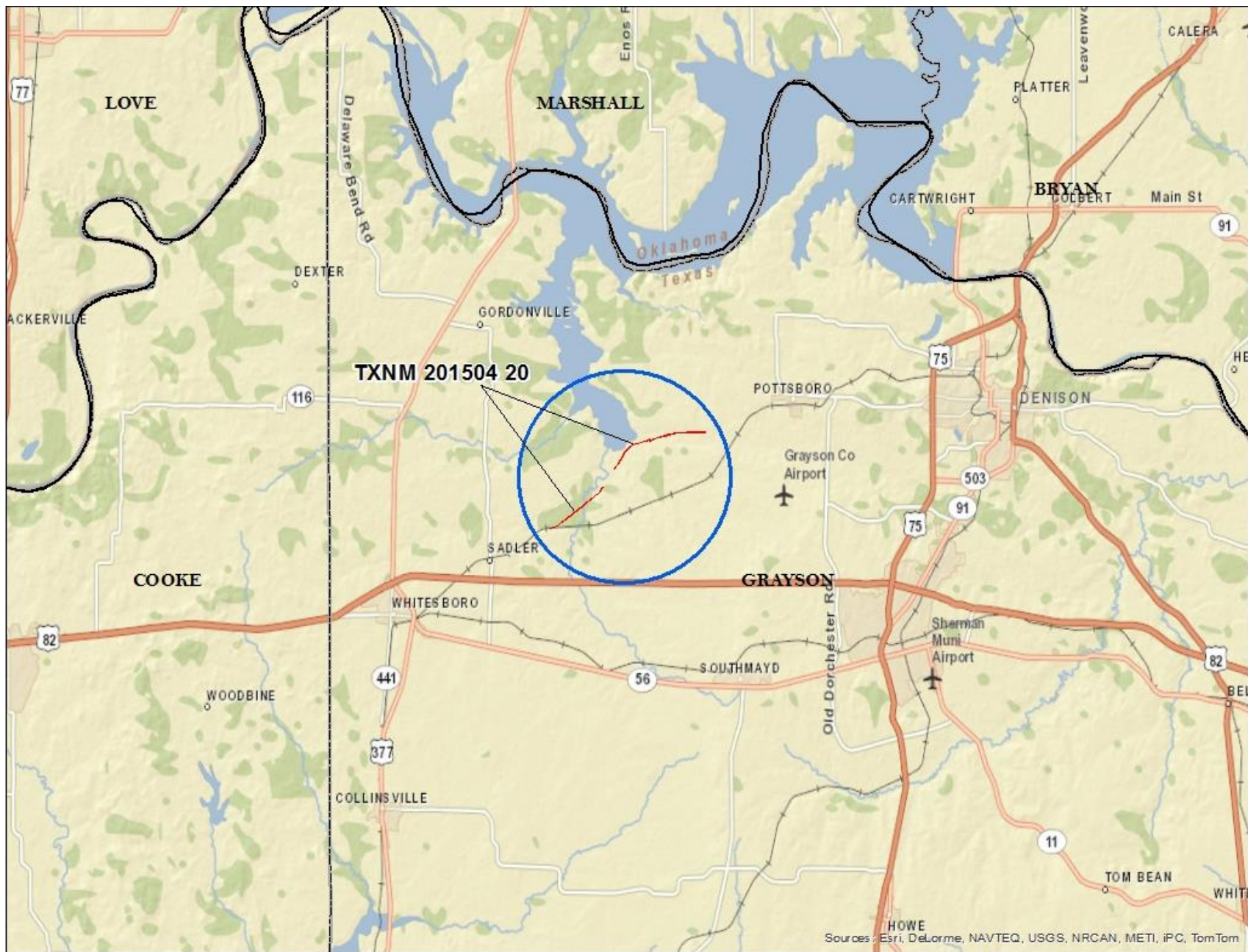
Woodward County nominated parcels.



**BLM New Mexico Competitive Oil and Gas Lease Sale
April 2015
Texas Nominated Parcels**



Grayson County nominated parcel.



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 1. 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

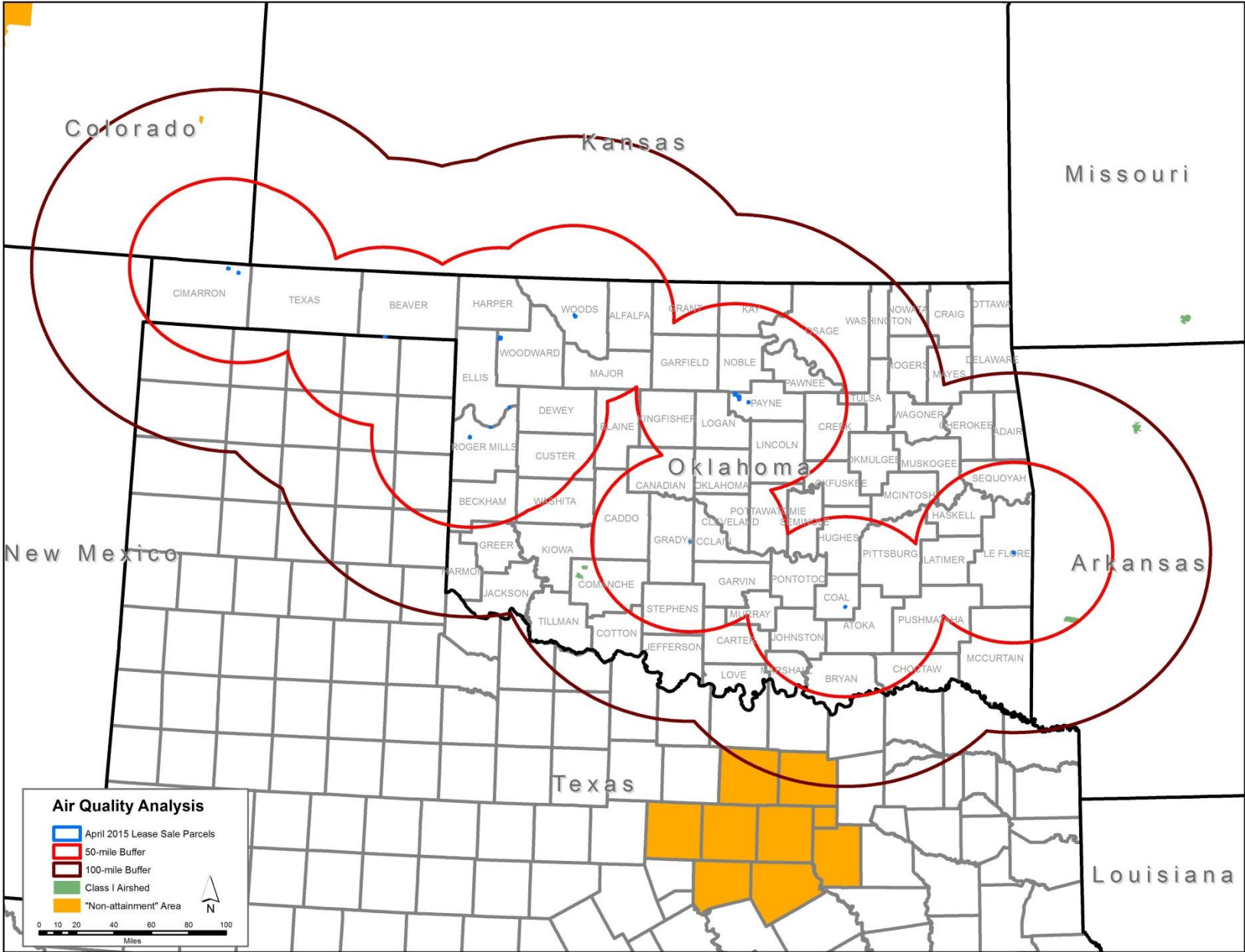
concentration of a specific compound (GWPC 2009).

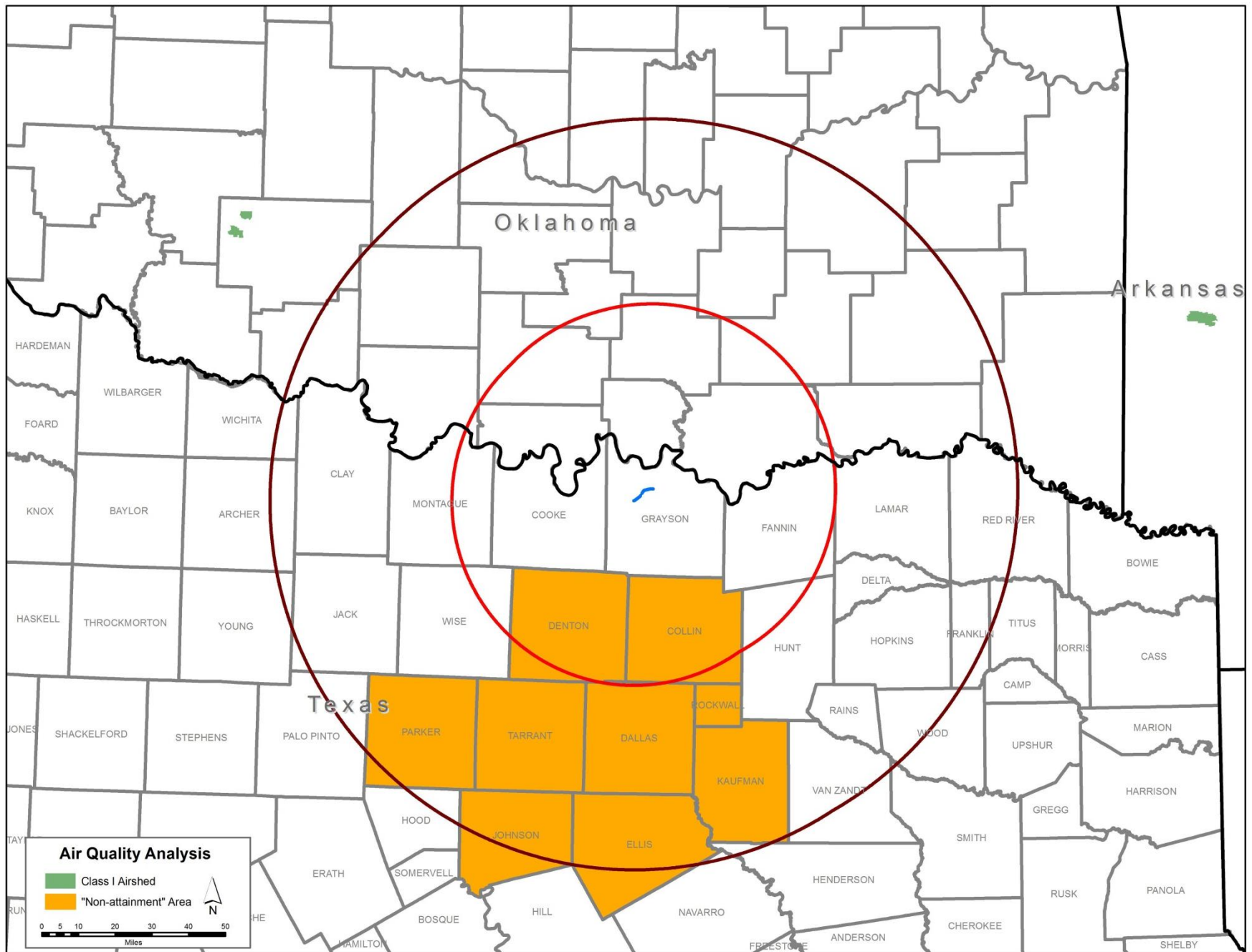
Typically, the fracturing fluids consist of about 99 percent water and sand and about 1 percent chemical additives. The chemical additives are essential to the process of releasing gas trapped in shale rock and other deep underground formation.

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. AIR QUALITY ANALYSIS.





APPENDIX 5. SOILS OF THE PROPOSED PARCELS.

Parcel	Soil Name	Soil Symbol	Acres in area	% in area	Erosion K Factor	Wind Erodibility Index	Prime and Unique Farmland*
-001	Corlena loamy fine sand, 0-1% slopes, occasionally flooded	La	1.7	2.2	.17	134	N
	Manzano clay loam, 0-1% slopes, occasionally flooded	Sa	10.5	13.1	.24	86	N
	Vona-Valent complex, 3-5% slopes	Vb	68.1	84.7	.15	134	N
-002	Otero loamy fine sand, 1-5% slopes	Oa	22.4	55.7	.15	134	N
	Manzano clay loam, 0-1% slopes, occasionally flooded	Sa	17.8	44.3	.24	86	N
-003	Dennis loam, 1-3% slopes	BoB	0.5	0.6	.43	56	Y
	Dennis loam, 3-5% slopes	BoC	1.8	2.2	.43	56	Y
	Pharoah silt loam, 0-1% slopes	Ca	52.4	65.5	.49	48	N
	Choteau loam, 1-3% slopes	ChB	9.4	11.7	.43	48	Y
	Kanima very gravelly silty clay loam, 1-45% slopes	Mp	7.7	9.6	.15	0	N
	Dela and Wynona soil, 0-1% slopes, frequently flooded	Ra	0.9	1.1	.20	86	N
	Steedman-Dela complex, 5-30% slopes	SrE	1.7	2.2	.37	38	N
	Water	W	5.7	7.1	--	--	N
-004	Pullman clay loam, 0-1% slopes	Pm	5.8	100	.32	48	Y
-005	Bengal-Clebit association, 3-15%	2	15.7	5.6	.20	0	N
	Bengal-Pirum-Clebit complex, 5-15% slopes	5	34.1	12.2	.32	86	N
	Neff and Rexor soils, 0-1% slopes, frequently flooded	43	47.0	16.9	.43	48	N
	Pirum-Clebit complex, 3-5% slopes	51	17.0	6.1	.24	86	Y
	Sallisaw loam, 1-3% slopes	59	9.2	3.3	.37	56	Y
	Sallisaw loam, 3-5% slopes	60	56.8	20.4	.37	56	Y
	Sallisaw loam, 3-5% slopes, eroded	61	56.8	20.4	.37	86	N
	Shermore fine sandy loam, 3-5% slopes	66	1.0	0.4	.24	86	N
	Shermore fine sandy loam, 3-5% slopes, eroded	67	19.4	7.0	.24	86	N
	Stigler silt loam, 1-3% slopes	72	39.7	14.2	.49	56	Y
	Wister silt loam, 1-3% slopes	84	30.6	11.0	.49	48	N
-006	Conlen loam, 1-3% slopes	Mb	10.7	6.9	.32	86	N
	Conlen-Dalhart complex, 1-3% slopes	Md	144.4	93.1	.32	86	N
-007	Knoco-Badland complex, 1-12% slopes	KoBE	37.6	94.3	.32	86	N
	Vernon-Knoco complex, 1-12% slopes	VeKE	1.2	3.0	.37	86	N
	Vernon clay loam, 1-3% slopes	VerB	1.1	2.7	.43	86	Y

Parcel	Soil Name	Soil Symbol	Acres in area	% in area	Erosion K Factor	Wind Erodibility Index	Prime and Unique Farmland*
-008	Lincoln fine sandy loam, 0-1% slopes, occasionally flooded	LnnA	13.7	56.5	.20	86	N
	Westola fine sandy loam, 0-1% slopes, occasionally flooded	Ya	10.5	43.5	.20	86	Y
-009	Lincoln fine sandy loam, 0-1% slopes, occasionally flooded	LnnA	33.8	97.5	.20	86	N
	Water	W	0.9	2.5	--	--	N
-012	Darnell-Rock outcrop complex, 8-45% slopes	10	45.7	28.8	.20	86	N
	Stephenville fine sandy loam, 3-5% slopes, severely eroded	51	17.3	10.9	.24	86	N
	Grainola-Lucien complex, 5-12% slopes, rocky	GrLE	42.7	27.0	.37	38	N
	Stephenville-Darnell complex, 3-8% slopes, rocky	StDD	52.9	33.3	.24	86	Y
-013	Conlen loam, 1-3% slopes	Mb	10.7	6.9	.32	86	N
	Conlen-Dalhart complex, 1-3% slopes	Md	144.4	93.1	.32	86	N
-015	Coyle loam, 3-5% slopes	3	10.1	1.6	.37	48	Y
	Coyle loam, 3-5% slopes, eroded	4	0.3	0.0	.37	48	N
	Pulaski fine sandy loam, 0-1% slopes, frequently flooded	6	147.0	23.1	.28	86	N
	Darnell-Rock outcrop complex, 8-45% slopes	10	4.7	0.7	.20	86	N
	Norge loam, 1-3% slopes	33	34.1	5.4	.37	48	Y
	Norge loam, 3-5% slopes	34	15.1	2.4	.37	48	Y
	Norge loam, 3-5% slopes, eroded	35	31.6	5.0	.37	48	N
	Port silt loam, 0-1 percent slopes, occasionally flooded	39	35.8	5.6	.37	56	Y
	Ashport silty clay loam, 0-1% slopes, occasionally flooded	43	51.1	8.0	.32	86	Y
	Pulaski fine sandy loam, 0-1%, occasionally flooded	43	51.1	8.0	.28	48	Y
	Renfrow loam, 3-5% slopes, eroded	47	2.3	0.4	.49	86	N
	Masham-Rock outcrop complex, 20-45% slopes	48	15.4	2.4	.43	86	N
	Renfrow and Grainola soils, 3-8% slopes, severely eroded	49	0.1	0.0	.37	48	N
	Teller loam, 1-3% slopes	57	10.4	1.6	.43	48	Y
	Konawa and Teller soils, 3-8% slopes, eroded	59	23.8	3.7	.20	134	N
	Mulhall loam, 3-5% slopes, gullied	62	2.0	0.3	.37	48	N
	Grainola clay loam, 3-5% slopes	65	29.3	4.6	.37	38	Y
	Marsham silty clay loam, 5-20% slopes	66	48.5	7.6	.43	86	N
	Coyle and Zaneis soils, 3-5% slopes, severely eroded	76	2.5	0.4	.32	48	N
	Coyle loam, 1-3% slopes	CoyB	2.5	0.4	.37	48	Y

Parcel	Soil Name	Soil Symbol	Acres in area	% in area	Erosion K Factor	Wind Erodibility Index	Prime and Unique Farmland*
-015 (cont.)	Grainola-Ashport-Mulhall complex, 0-8% slopes	GAMD	16.1	2.5	.37	38	N
	Grainola-Lucien complex, 1-5% slopes	GrLC	10.4	1.6	.43	56	Y
	Grainola-Lucien complex, 5-12% slopes, rocky	GrLE	32.7	5.1	.37	38	N
	Kirkland silt loam, 1-3% slopes	KrDB	8.6	1.3	.49	56	Y
	Stephenville-Darnell complex, 3-8% slopes, rocky	StDD	10.9	1.7	.24	86	Y
	Water	W	27.8	4.4	--	--	N
	Zaneis-Huska complex, 1-5% slopes	ZaHC	1.6	0.3	.37	56	Y
-016	Coyle loam, 3-5% slopes	3	11.0	1.5	.37	48	Y
	Coyle loam 3-5% slopes, eroded	4	10.9	1.5	.37	48	N
	Pulaski fine sandy loam, 0-1% slopes, frequently flooded	6	46.3	6.5	.28	86	N
	Norge loam, 1-3% slopes	33	4.1	0.6	.37	48	Y
	Port silt loam, 0-1% slopes, occasionally flooded	37	45.6	6.4	.37	56	Y
	Ashport silty clay loam, 0-1% slopes, occasionally flooded	42	12.4	1.7	.32	38	Y
	Renfrow and Grainola soils, 3-8% slopes, severely eroded	49	33.4	4.7	.37	48	N
	Stephenville fine sandy loam, 3-5% slopes	54	6.3	0.9	.20	86	Y
	Teller loam, 1-3% slopes	57	2.4	0.3	.43	48	Y
	Mulhall loam, 3-5% slopes, gullied	62	0.5	0.1	.37	48	N
	Grainola clay loam, 3-5% slopes	65	20.5	2.9	.37	38	Y
	Masham silty clay loam, 5-20% slopes	66	15.1	2.1	.43	86	N
	Zaneis loam, 3-5% slopes, eroded	71	11.9	1.7	.37	56	N
	Dale silt loam, 0-1% slopes, rarely flooded	73	7.9	1.1	.37	56	Y
	Coyle and Zaneis soil, 3-5% slopes, severely eroded	76	53.2	7.5	.32	48	N
	Huska silt loam, 1-3% slopes	81	2.2	0.3	.49	56	N
	Coyle-Lucien complex, 1-5% slopes	CoLC	7.7	1.1	.37	48	Y
	Grainola-Ashport-Mulhall complex, 0-8% slopes	GAMD	9.0	1.3	.37	38	N
	Grainola-Lucien complex, 1-5% slopes	GrLC	60.6	8.5	.43	56	Y
	Grainola-Lucien complex, 5-12% slopes, rocky	GrLE	165.6	23.2	.37	38	N
	Harrah-Pulaski complex, 0-12% slopes, very rocky	HaPE	11.1	1.6	.24	86	N
	Mulhall loam, 3-5% slopes	MulC	9.5	1.3	.28	48	Y
	Stephenville-Darnell complex, 3-8% slopes, rocky	StDD	106.7	15.0	.24	86	Y

Parcel	Soil Name	Soil Symbol	Acres in area	% in area	Erosion K Factor	Wind Erodibility Index	Prime and Unique Farmland*
-016 (cont.)	Water	W	7.1	1.0	--	--	N
	Zaneis-Huska complex, 1-5% slopes	ZaHC	52.3	7.3	.37	56	Y
-018	Carey silt loam, 1-3% slopes	CaB	68.9	11.4	.37	48	Y
	Quinlan-Woodward complex, 5-12% slopes	QwD	39.4	6.6	.37	56	N
	Quinlan-Woodward complex, 5-12% slopes, eroded	QwD2	6.0	1.0	.37	56	N
	Water	W	381.8	63.4	--	--	N
	Waldeck fine sandy loam, 0-1% slopes, occasionally flooded	Wf	59.1	9.8	.28	86	Y
	Woodward loam, 1-3% slopes	WoB	2.6	0.4	.37	56	Y
	Woodward loam, 3-5% slopes	WoC	44.0	7.3	.37	56	Y
-019	Clairemont silt loam, 0-1% slopes, occasionally flooded	No	7.1	4.5	.43	86	Y
	Eda sand, 8-15%	PfE	5.6	4.5	.02	220	N
	Quinlan-Woodward complex, 5-12% slopes	QwE	42.3	26.6	.37	56	N
	Quinlan-Rock outcrop complex, 12-45% slopes	Rb	46.6	29.3	.37	56	N
	Waldeck fine sandy loam, 0-1% slopes, occasionally flooded	Wa	28.2	17.7	.20	86	Y
	Woodward fine sandy loam, 3-5% slopes	WdC	13.0	8.2	.20	56	Y
	Woodward loam, 3-5% slopes	WoC	16.4	10.3	.37	56	Y
-020	Bunyan and Whitesboro soils, frequently flooded	16	16.0	22.3	.43	86	N
	Heiden clay, 1-3% slopes	39	5.2	7.2	.32	86	Y
	Normangee clay loam, 1-4% slopes	52	11.3	15.7	.37	86	N
	Trinity clay, occasionally flooded	68	1.9	2.6	.32	86	Y
	Vertel clay, 1-3% slopes	70	1.2	1.7	.32	86	N
	Vertel clay, 3-5% slopes	71	9.1	12.6	.32	86	N
	Vertel clay, 5-12% slopes	72	0.6	0.8	.32	86	N
	Whitesboro loam, occasionally flooded	75	1.1	1.5	.28	48	Y
	Wilson silty clay loam, 0-1% slopes	79	3.5	4.8	.43	48	N
	Wilson silty clay loam, 1-4% slopes	80	7.0	9.7	.43	48	N
	Water	W	15.2	21.1	--	--	N

APPENDIX 6. BIOLOGICAL EVALUATION.
