United States Department of the Interior

Bureau of Indian Affairs

Eastern Oklahoma Region

Osage Agency

Osage County Oil and Gas
Draft Environmental Impact Statement

November 2015

BIA Mission Statement

The Bureau of Indian Affairs' mission is to enhance the quality of life, to promote economic opportunity, and to carry out the responsibility to protect and improve the trust assets of American Indians, Indian tribes, and Alaska Natives.

United States Department of the Interior
BUREAU OF INDIAN AFFAIRS
EASTERN OKLAHOMA REGION
OSAGE AGENCY
POST OFFICE BOX 1539
PAWHUSKA, OKLAHOMA 74056-1539

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Executive Direction

October 28, 2015

We are pleased to announce the release of the Osage County Oil and Gas Draft Environmental Impact Statement (DEIS) for the management of oil and gas resources owned by the United States (US) in trust for the Osage in Osage County, Oklahoma. The US Department of the Interior, Bureau of Indian Affairs (BIA) is the lead agency for this DEIS. Cooperating agencies are the Osage Nation and the US Environmental Protection Agency.

The proposed action for this DEIS is to update and provide additional analysis on the impacts of the BIA lease and permit approval program and to facilitate the development of oil and gas in Osage County in an efficient manner that prevents pollution. All of the subsurface mineral estate in Osage County is administered by the BIA's Eastern Oklahoma Region, Osage Agency. Barring extraordinary circumstances, completion of this DEIS will fulfill the BIA's obligations under the National Environmental Policy Act of 1969 (NEPA) associated with lease approvals and workover (i.e., wellbore maintenance) and other maintenance permits, allowing the BIA to approve such leases and issue such permits without further NEPA compliance (assuming issuance of a record of decision authorizing such actions). For drilling permits, this DEIS is programmatic; thus, the BIA will be required to prepare site-specific NEPA analyses that will tier off of this DEIS. This DEIS analyzes three alternatives for managing oil and gas development in Osage County, one of which is the No Action Alternative. The alternatives represent the range of reasonable actions that could be taken to satisfy the purpose of and need for the BIA's action. The BIA has not identified a preferred alternative at this time.

Copies of the DEIS are available at the BIA Osage Agency, 813 Grandview Avenue, Pawhuska, OK 75820. The DEIS may also be accessed on the Internet at http://www.bia.gov/WhoWeAre/RegionalOffices/EasternOklahoma/WeAre/Osage/OSAGEOilGasEIS/.

A 45-day public comment period will begin when the Notice of Availability is published in the *Federal Register*. The comment period will close on Monday December 21, 2015.

For more information on this DEIS, please contact Ms. Jeannine Hale, Director, Division of Environmental and Cultural Resource Management, BIA Eastern Oklahoma Regional Office, 3100 W. Peak Blvd., Muskogee, OK 74401; tel. (918) 781-4660; fax (918) 781-4667; e-mail osagecountyoilgaseis@bia.gov.

Sincerely,

Robin Phillips
Superintendent, Osage Agency

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EXECUTIVE SUMMARY

ES.1 INTRODUCTION

The United States Department of the Interior (DOI), Bureau of Indian Affairs (BIA) Eastern Oklahoma Regional Office is preparing an environmental impact statement (EIS) under the National Environmental Policy Act of 1969 (NEPA). The BIA will use this EIS to guide the management of oil and gas resources owned by the United States in trust for the Osage in Osage County, Oklahoma. It will replace the 1979 Environmental Assessment for the Oil and Gas Leasing Program of the Osage Indian Tribe (BIA 1979).

The Osage Tribe retained all mineral rights in Osage County when the surface was allotted in 1906. The Osage Minerals Council negotiates and executes leases for oil and gas development. The Superintendent of the BIA Osage Agency is responsible for managing oil and gas operations on the Osage mineral estate. This responsibility includes the following:

- Approval of all oil and gas mining leases
- Approval of drilling, workover, and plugging operations
- Maintaining accurate records of all production and income received
- Appraising damages and collecting compensation for damages on restricted and tribal trust lands
- Reviewing all incoming well records to ensure that they comply with BIA standards
- Monitoring overall lease operations to ensure that lessees do not cause surface or subsurface pollution
- Ensuring that lessees carry out lease operations in a prudent manner

The Superintendent also is responsible for managing all aspects of other mining and mineral operations on the Osage mineral estate, which include sandstone, gravel, clay, sand, and limestone mining permits. A complete list of the responsibilities of the Superintendent of the Osage Agency is presented in 25 Code of Federal Regulations (CFR), Parts 226 and Part 214.

Analysis in this EIS addresses impacts on both the surface and the subsurface mineral estate in the planning area. The proposed action for this EIS is to update and provide additional analysis on the impacts of the BIA lease and permit approval program and to facilitate the development of oil and gas in Osage County in an efficient manner that prevents pollution.

Figure ES-1, Planning Area, represents the area subject to environmental analysis in this EIS. The planning area covers all of the subsurface mineral estate in Osage County, approximately 1,474,500 acres. Osage County is in northeast Oklahoma, bordering Kansas. The BIA's Eastern Oklahoma Regional Office manages all of the subsurface mineral estate in the county. **Table ES-1** and **Figure ES-2** show the acreage in each type of surface ownership in the planning area.

Table ES-1
Planning Area Surface Ownership

Landowner/Surface Management Agency[1]	Acres	Percentage of Total
Allotted	121,500	8
Private or other (not including The Nature Conservancy)	1,231,000	83
State	14,500	1
The Nature Conservancy	35,200	2
Tribal[2]	1,600	< 1
US Army Corps of Engineers (includes water)	70,700	5
Total	**1,474,500**	**100**

Sources: BIA NIOGEMS GIS 2015; OK GAP GIS 2008

[1]Land not identified as state, allotted, or tribal land was assumed to be privately owned.
[2]Tribal acreage is likely larger than the acreage shown. The Osage Nation is working to determine the correct acreage of tribal lands in the planning area based, on the historic reservation boundaries.

ES.2 Purpose of and Need for the BIA Action

Under the Osage Allotment Act of 1906, the United States reserved all rights to the mineral estate in Osage County for the benefit of the Osage. The mineral estate is held in trust, and the BIA approves oil and gas leases, applications for permits to drill (APDs), and other site-specific permit applications in Osage County under the authority of the 1906 Act, as amended, and 25 CFR, Part 226.

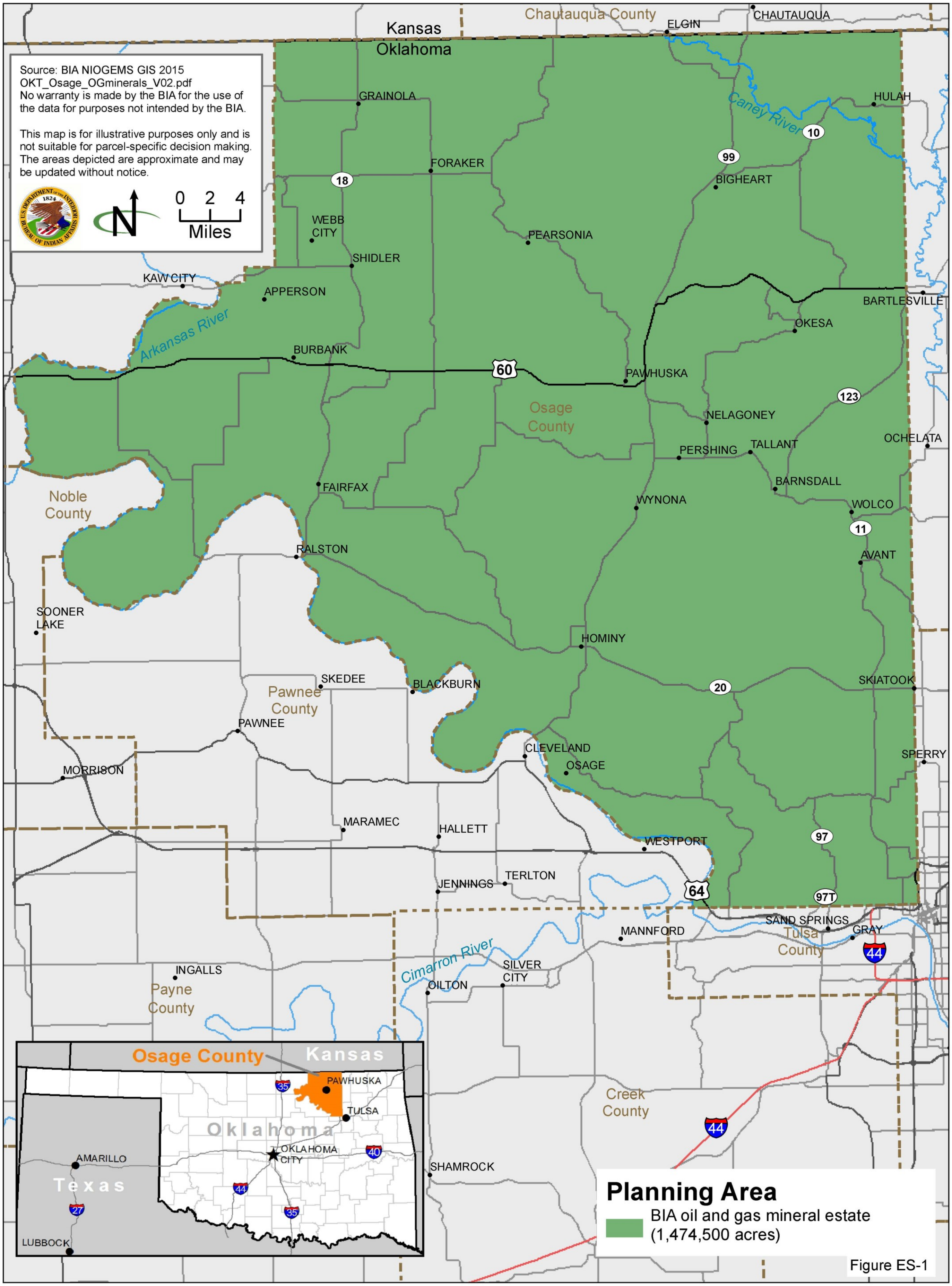

Source: BIA NIOGEMS GIS 2015
OKT_Osage_OGminerals_V02.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
ELGIN
CHAUTAUQUA
GRAINOLA
HULAH
Caney River
10
99
FORAKER
18
BIGHEART
WEBB CITY
PEARSONIA
SHIDLER
KAW CITY
APPERSON
BARTLESVILLE
OKESA
Arkansas River
BURBANK
60
PAWHUSKA
123
Osage County
NELAGONEY
OCHELATA
PERSHING
TALLANT
FAIRFAX
BARNSDALL
Noble County
WYNONA
WOLCO
11
RALSTON
AVANT
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
SKIATOOK
Pawnee County
20
PAWNEE
CLEVELAND
SPERRY
OSAGE
MORRISON
MARAMEC
HALLETT
97
WESTPORT
TERLTON
JENNINGS
64
97T
SAND SPRINGS
MANNFORD
Tulsa County
GRAY
44
INGALLS
Cimarron River
SILVER CITY
Payne County
OILTON
Osage County
Kansas
PAWHUSKA
35
TULSA
Oklahoma
OKLAHOMA CITY
40
AMARILLO
Texas
44
27
35
LUBBOCK
Creek County
SHAMROCK
Planning Area
BIA oil and gas mineral estate (1,474,500 acres)

Figure ES-1

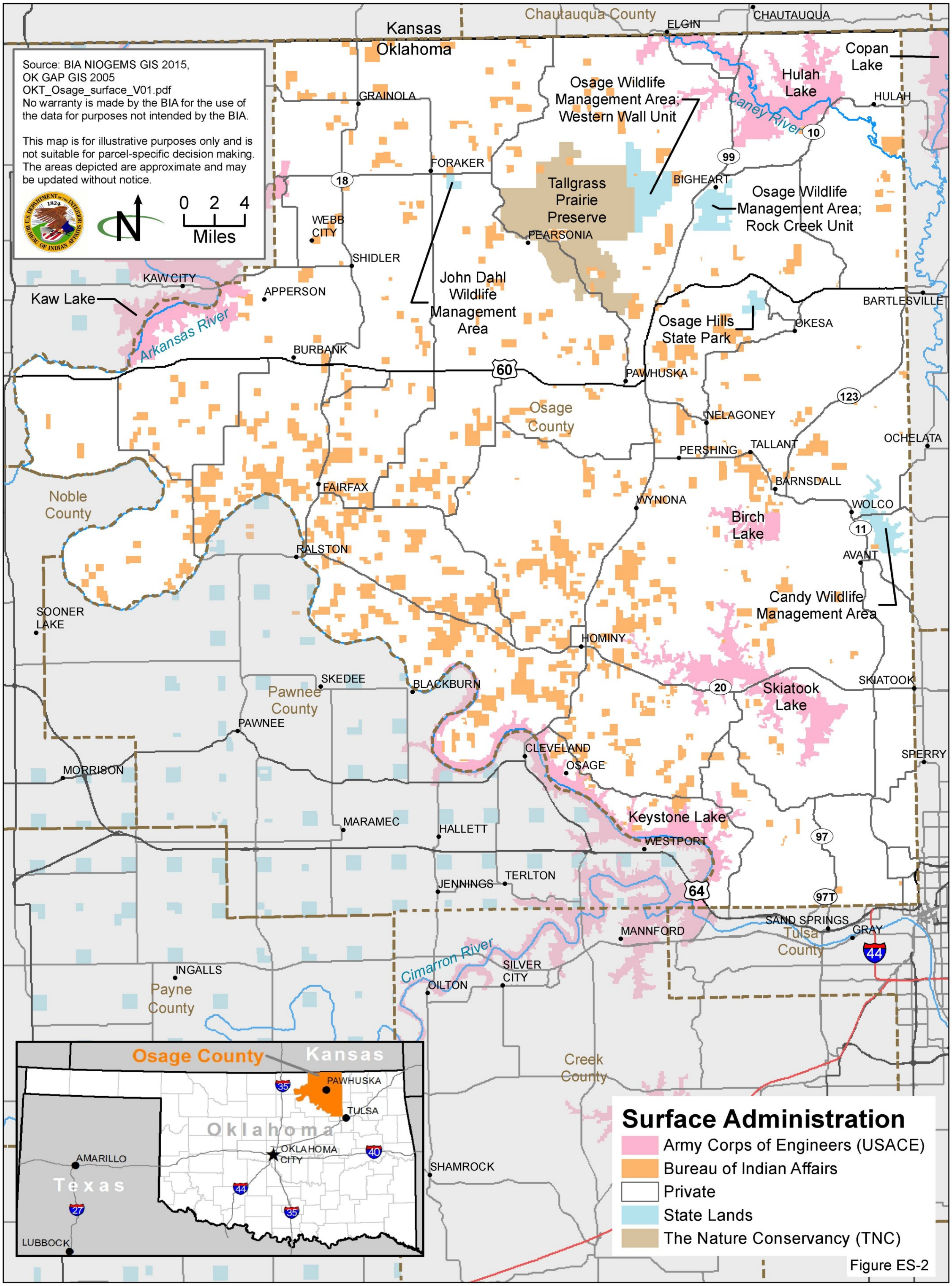

Source: BIA NIOGEMS GIS 2015,
OK GAP GIS 2005
OKT_Osage_surface_V01.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
ELGIN
CHAUTAUQUA
Copan Lake
Hulah Lake
HULAH
Caney River
Osage Wildlife Management Area; Western Wall Unit
Tallgrass Prairie Preserve
BIGHEART
Osage Wildlife Management Area; Rock Creek Unit
GRAINOLA
FORAKER
WEBB CITY
SHIDLER
PEARSONIA
John Dahl Wildlife Management Area
KAW CITY
Kaw Lake
APPERSON
Arkansas River
BURBANK
Osage Hills State Park
OKESA
BARTLESVILLE
PAWHUSKA
Osage County
NELAGONEY
PERSHING
TALLANT
OCHELATA
BARNSDALL
FAIRFAX
WYNONA
WOLCO
Noble County
Birch Lake
RALSTON
AVANT
Candy Wildlife Management Area
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
Pawnee County
SKIATOOK
Skiatook Lake
PAWNEE
CLEVELAND
OSAGE
SPERRY
MORRISON
Keystone Lake
MARAMEC
HALLETT
WESTPORT
JENNINGS
TERLTON
SAND SPRINGS
GRAY
Tulsa County
MANNFORD
Cimarron River
INGALLS
SILVER CITY
OILTON
Payne County
Creek County
SHAMROCK
Osage County
Kansas
PAWHUSKA
TULSA
Oklahoma
OKLAHOMA CITY
AMARILLO
Texas
LUBBOCK
Surface Administration
Army Corps of Engineers (USACE)
Bureau of Indian Affairs
Private
State Lands
The Nature Conservancy (TNC)

Figure ES-2

The BIA, under delegation from the Secretary of the Interior, is responsible for administering the development of oil and gas resources in Osage County for the benefit of the Osage. The federal actions, including approving leases and issuing permits, are needed for the BIA to fulfill a portion of its trust responsibility to the Osage and to promote the development of the mineral estate.

The purpose of the BIA's action is to promote oil and gas production in a manner that is efficient, that prevents pollution, and that is consistent with the mandates of federal law, in coordination with the Osage Minerals Council. Through this action, the BIA also intends to streamline the permitting process and provide certainty to developers on permit conditions and restrictions.

ES.3 Public Involvement and Scoping

In accordance with BIA and Council on Environmental Quality policies and guidance, the BIA provided opportunities for meaningful and substantive input and comments during the preparation of this EIS. Those invited to participate in the process were the public, various groups, other federal agencies, Native American tribal members, and state and local governments.

Public involvement is a vital and legally required component of the EIS process. It vests the public in the decision-making process and allows for full environmental disclosure. Guidance for implementing public involvement under NEPA is codified in 40 CFR, Subpart 1506.6, thereby ensuring that federal agencies make a diligent effort to involve the public in the process.

Public involvement for the Osage County Oil and Gas EIS consists of the following methods:

- Public scoping before NEPA analysis begins to determine the scope of issues and alternatives to be addressed in the EIS
- Public outreach via newsletters, news releases, public meetings, and a project website (http://www.bia.gov/WhoWeAre/RegionalOffices/EasternOklahoma/WeAre/Osage/OSAGEOilGasEIS/index.htm)
- A public listening session held in Pawhuska, Oklahoma, on March 9, 2015, to present preliminary alternative concepts and accept comments on the concepts
- Collaboration with federal, state, local, and tribal governments and cooperating agencies and entities
- Public review of and comment on the draft EIS, which analyzes likely environmental effects of each alternative

The public scoping phase of the process has been completed and is described in **Section 1.6.1**. The public listening session on preliminary alternatives was held on March 9, 2015. The public outreach and collaboration phases are ongoing, including public review of the draft EIS in fall 2015. The public can obtain information about the EIS process at any time on the project website at http://www.bia.gov/WhoWeAre/RegionalOffices/EasternOklahoma/WeAre/Osage/OSAGEOilGasEIS/index.htm. This website contains background information, documents, status updates, and other material.

Osage County is in the planning area for the Oklahoma, Kansas, and Texas (OKT) Joint EIS/Bureau of Land Management (BLM) resource management plan (RMP) and BIA Integrated RMP. The BIA's proposed action under consideration for the Osage County Oil and Gas EIS—oil and gas development in Osage County—was part of the OKT Joint EIS/BLM RMP and BIA Integrated RMP scoping.

ES.4 Issues

A planning issue is a major controversy or dispute regarding resource or use management that can be addressed in a variety of ways and that is within the BIA's authority to resolve. Based on internal BIA Eastern Oklahoma and Southern Plains Regional Offices and the BLM Oklahoma Field Office and external scoping, the BIA and BLM identified planning issues for the OKT Joint EIS/BLM RMP and BIA Integrated RMP. The only planning issue identified through this process relevant to the Osage County Oil and Gas EIS is the following:

> Energy development—How can the BIA allow development of federal and tribal oil and gas resources and honor valid existing lease rights, while protecting air, visual resources, wildlife, water, and the natural environment?

The BIA used this planning issue to develop a reasonable range of alternative management strategies for the EIS.

Because of its unique management authority and in response to the Osage's request, the BIA determined that a decision on managing oil and gas activities in the county should be reached as soon as possible. For this reason, the Osage County Oil and Gas EIS was separated from the OKT Joint EIS/BLM RMP and BIA Integrated RMP and was accelerated.

ES.5 Management Alternatives

This EIS analyzes three alternatives for managing oil and gas development in Osage County, including the No Action Alternative. These represent the range of reasonable actions that could be taken to satisfy the purpose of and need for the BIA's action. The objective of the alternatives is, to the extent possible, to minimize potential adverse impacts on landowners, wildlife, and natural and cultural resources from noise, traffic, excavations, dust, and other disturbance associated with construction and operations under oil and gas leases. The alternatives development process for the Osage County Oil and Gas EIS included public scoping, an alternatives development workshop with cooperating agencies and entities, and a draft alternatives concepts public listening session.

While Some ground-disturbing activities on a lease may not be associated with issuance of a drilling permit or performance of a workover review (such as changes to established access roads or burial or rerouting of existing flow lines),the lessee would be required to comply with all applicable laws and regulations, such as 25 CFR, Part 226, the Endangered Species Act, and the National Historic Preservation Act.

Throughout this document, activities on a lease that are not associated with issuance of a drilling permit or performance of a workover review are referred to as "non-permitted lease activities."

The BIA is considering applying resource conservation measures (RCMs) to three types of activities under oil and gas leases: 1) non-permitted lease activities, 2) activities within the scope of the 2015 Workover Programmatic Environmental Assessment (PEA; workover activities), and 3) APDs and other permitted activities.

ES.5.1 No Action Alternative

In accordance with the Indian Affairs National Environmental Policy Act Guidebook (59 IAM 3-H 2012), the BIA is required to consider the No Action Alternative, which would continue current management, or business as usual. This is the only alternative in an EIS analysis that does not have to respond to the purpose of and need for the BIA's action.

In 1979, the BIA prepared the PEA for the Oil and Gas Leasing Program of the Osage Indian Tribe. The BIA prepared the Leasing PEA in November 2014 and the Workover PEA in April 2015, which incorporated portions of the 1979 PEA by reference (BIA 2014, 2015a). Under the No Action Alternative, the BIA would continue to administer oil and gas development in Osage County according to the measures outlined in these PEAs for any activity within their scope.

For activities authorized in oil and gas leases (including non-permitted lease activities), the BIA may choose to apply appropriate best management practices (BMPs) listed in Appendix 1, Section 7.13 of the Leasing PEA (BIA 2014) as mandatory RCMs. If the BIA were to apply these measures to leases, it would do so through a notice to lessee (NTL) or Order of the Superintendent. The BIA would not apply measures that would prohibit development of an approved lease.

For activities within the scope of the Workover PEA, the BIA would apply the BMPs listed in Section 5.1 and Attachment A of the Workover PEA (BIA 2015a) as mandatory RCMs during workover reviews through conditions of workover approval. For APDs and other permit applications outside the scope of the Workover PEA, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs as mandatory permit conditions on a case-by-case basis. The BIA would ensure compliance with the regulations at 25 CFR, Part 226, and applicable laws.

Chapter 2 provides a list of RCMs that would be applied to workover permits under the No Action Alternative. The BIA may apply some or all of these RCMs to all activities on leases, including non-permitted lease activities, through an NTL or Order of the Superintendent. The BIA may also apply these RCMs as mandatory conditions to site-specific permits during analysis of specific permits.

ES.5.2 Action Alternative 1

Under Action Alternative 1, the BIA would identify a list of standardized RCMs to provide additional certainty to lessees and to streamline the permitting process. RCMs would be applied to permitted activities and workovers through mandatory permit conditions and conditions of workover approval, respectively. RCMs may be applied to all lease activities, including non-permitted lease activities, through an NTL or Order of the Superintendent, interpreting the regulations at 25 CFR, Part 226. RCMs included in an NTL or Order of the Superintendent would extend beyond the life of any permit and would govern reclamation and revegetation activities. These RCMs would protect sensitive resources and ensure compliance with applicable laws and regulations.

The BIA identified RCMs to comply with the ESA through consultation with the US Fish and Wildlife Service (USFWS) under Section 7 of the ESA. Permit applicants would be able to obtain an incidental take permit under the ESA by complying with these RCMs and the biological opinion issued by the USFWS; this is in lieu of going through the Section 7 consultation process for a separate incidental take permit for each oil and gas permit.

Similar to the No Action Alternative, site-specific NEPA analysis and site-specific consultation would ensure compliance with the Migratory Bird Treaty Act and National Historic Preservation Act. This alternative would also formalize protective measures already in practice by including them as RCMs.

The RCMs would be tailored to planning area-specific conditions and issues. Therefore, as a general rule, these measures would apply to all new permitted activities and workovers in the planning area. Similarly, if an NTL or Order of the Superintendent were issued requiring these measures, that NTL or Order of the Superintendent would apply to all leases in the planning area. However, the BIA would still have the flexibility to allow exceptions based on site-specific circumstances. Exceptions would be granted where a resource conservation measure was not applicable or where another measure proposed by the lessee would achieve the goals of the resource conservation measure, given site-specific conditions. **Chapter 2** provides a list of RCMs that could be applied under this alternative.

ES.5.3 Action Alternative 2

Similar to Action Alternative 1, Action Alternative 2 would apply a county-specific list of RCMs to ensure compliance with applicable laws and regulations. These RCMs would be applied to permitted activities and workovers through mandatory permit conditions and conditions of workover approval, respectively. Resource conservation may be applied to all lease activities, including non-permitted lease activities, through an NTL or Order of the Superintendent, interpreting the regulations at 25 CFR, Part 226. These RCMs would extend beyond the life of any permit and would govern reclamation and revegetation activities. The BIA would not apply measures that would prohibit development of an approved lease.

Action Alternative 2 builds on Action Alternative 1 by adding more specific RCMs that would be applied in specific areas, based on available information about where sensitive resources need to be protected. The BIA identified additional measures to protect other resources, such as special status species and water resources. This alternative is more protective of natural and cultural resources and includes measures to comply with requirements of the National Historic Preservation Act, the Migratory Bird Treaty Act, and the ESA.

As described under Action Alternative 1, as a general rule, these measures would apply to all new permitted activities and workovers in the planning area. Similarly, if an NTL or Order of the Superintendent were issued requiring these measures, that NTL or Order of the Superintendent would apply to all leases in the planning area. However, the BIA would still have the flexibility to allow exceptions, based on site-specific circumstances. **Chapter 2** provides a list of RCMs that could be applied under this alternative.

ES.6 ENVIRONMENTAL CONSEQUENCES

The purpose of the environmental consequences analysis is to describe the anticipated effects that would result from the management actions and RCMs under each alternative. This analysis identifies impacts that may result in some level of change to the resource, regardless of whether that change would be beneficial or adverse.

Chapter 4 objectively evaluates the likely direct, indirect, and cumulative impacts on the human and natural environment in terms of environmental, social, and economic consequences that are projected to occur from implementing the alternatives. The impact analysis does not include a subjective qualifier (beneficial or adverse) to the impact; instead, it states the nature, magnitude, and context for the change.

The evaluations in **Chapter 4** are confined to the actions that have more prominent, immediate, or direct effects. Some of the proposed management actions and potential future development may affect only certain resources and alternatives. If an activity or action is not addressed in a given section, no impacts are expected, or the impact is expected to be negligible. The scope of the analysis focuses on impacts on resources and uses on land overlying BIA-administered tribal mineral estate. This is because the decisions being made by the BIA apply only to oil and gas leasing and development administered by the BIA. Because leasing land for oil and gas development does not allow drilling, but merely sets the land aside for that use, the impacts of the management of leasing actions covered by this EIS are generally limited to the surface. Likewise, well workovers included in this EIS generally impact the surface only. This EIS analyzes the impacts of leasing and workover activities and includes a general analysis of the surface and underground impacts of drilling and other development activities. Specific surface and underground impacts of drilling and other development activities as a result of a proposed permit will be assessed in site-specific NEPA review tiered to this EIS.

CHAPTER 1
INTRODUCTION AND PURPOSE AND NEED

1.1 INTRODUCTION

The United States Department of the Interior (DOI), Bureau of Indian Affairs (BIA) Eastern Oklahoma Regional Office is preparing an environmental impact statement (EIS) under the National Environmental Policy Act of 1969 (NEPA). The BIA will use this EIS to guide the management of oil and gas resources owned by the United States in trust for the Osage in Osage County, Oklahoma. The EIS will replace the 1979 Environmental Assessment for the Oil and Gas Leasing Program of the Osage Indian Tribe (BIA 1979).

The Osage Tribe retained all mineral rights in Osage County when the surface was allotted in 1906. The Osage Minerals Council negotiates and executes leases for oil and gas development. The Superintendent of the BIA Osage Agency has been delegated the responsibility for managing oil and gas operations on the Osage mineral estate. This responsibility includes, but is not limited to, the following:

- Approving all oil and gas mining leases
- Approving drilling, workover, and plugging operations
- Maintaining accurate records of all production and income received
- Appraising damages and collecting compensation for damages on restricted and tribal trust lands
- Reviewing all incoming well records to ensure that they comply with BIA Osage Agency standards
- Monitoring overall lease operations to ensure that lessees do not cause surface or subsurface pollution
- Ensuring that lessees carry out lease operations in a prudent manner

The Superintendent also manages all aspects of other mining and mineral operations on the Osage mineral estate, which include sandstone, gravel, clay, sand, and limestone mining permits, among others. A complete list of the responsibilities of the Superintendent of the Osage Agency is presented in 25 Code of Federal Regulations (CFR), Parts 226 and 214.

The analysis in this EIS addresses impacts on both the surface and the subsurface mineral estate in the planning area. The proposed action for this EIS is to update and provide additional analysis on the impacts of the BIA lease and permit approval program and to promote the development of oil and gas in Osage County in an efficient manner that prevents pollution.

1.2 Purpose of and Need for the BIA Action

Under the Osage Allotment Act of 1906, the United States reserved all rights to the mineral estate in Osage County for the benefit of the Osage. The mineral estate is held in trust, and the BIA approves oil and gas leases, applications for permits to drill (APDs), and other site-specific permit applications in Osage County under the authority of the 1906 act, as amended, and 25 CFR, Part 226.

The BIA, under delegation from the Secretary of the Interior, administers the development of oil and gas resources in Osage County for the benefit of the Osage. The federal actions, including approving leases and issuing permits, are needed for the BIA to fulfill a portion of its trust responsibility to the Osage and to promote the development of the mineral estate.

The purpose of the BIA's action is to promote oil and gas production in a manner that is efficient, that prevents pollution, and that is consistent with the mandates of federal law, in coordination with the Osage Minerals Council. Through this action, the BIA also intends to streamline the permitting process and provide certainty to developers about permit conditions and restrictions.

1.3 Decision to Be Made

The decision to be made is how to manage oil and gas development in Osage County based on a new review and analysis of the impacts associated with oil and gas development. Depending on site-specific conditions and the alternative that is chosen, the BIA may also identify resource conservation measures that could be required for oil and gas leasing and development.

Barring extraordinary circumstances, this EIS will fulfill the BIA's NEPA obligations associated with lease approvals and workover reviews. This will allow the BIA to approve such leases and workovers without further NEPA compliance (assuming a record of decision authorizing such actions is issued). However, this EIS is not the final review that approval of all proposed oil and gas development activities in the project area would be based on.

Because the exact locations of well pads, roads, pipelines, and other facilities and activities associated with future drilling and other permitted activities are unknown, the analysis related to these activities in the EIS is programmatic. This EIS will provide an umbrella analysis that the analysis of subsequent federal actions (e.g., approval of APDs) proposed in the planning area would be tiered to.

The approval of these actions would require additional documentation of NEPA compliance, such as a tiered environmental assessment or EIS or a documentation of NEPA adequacy. Approval would be subject to on-site examinations of each proposed well, pipeline, and road location, including current resource surveys. The scope of this additional approval process would be streamlined and facilitated by the programmatic evaluation of impacts contained in this EIS.

1.4 DESCRIPTION OF THE PLANNING AREA

Figure 1-1, Planning Area, represents the area subject to environmental analysis in this EIS. The planning area covers all of the subsurface mineral estate in Osage County, approximately 1,474,500 acres.

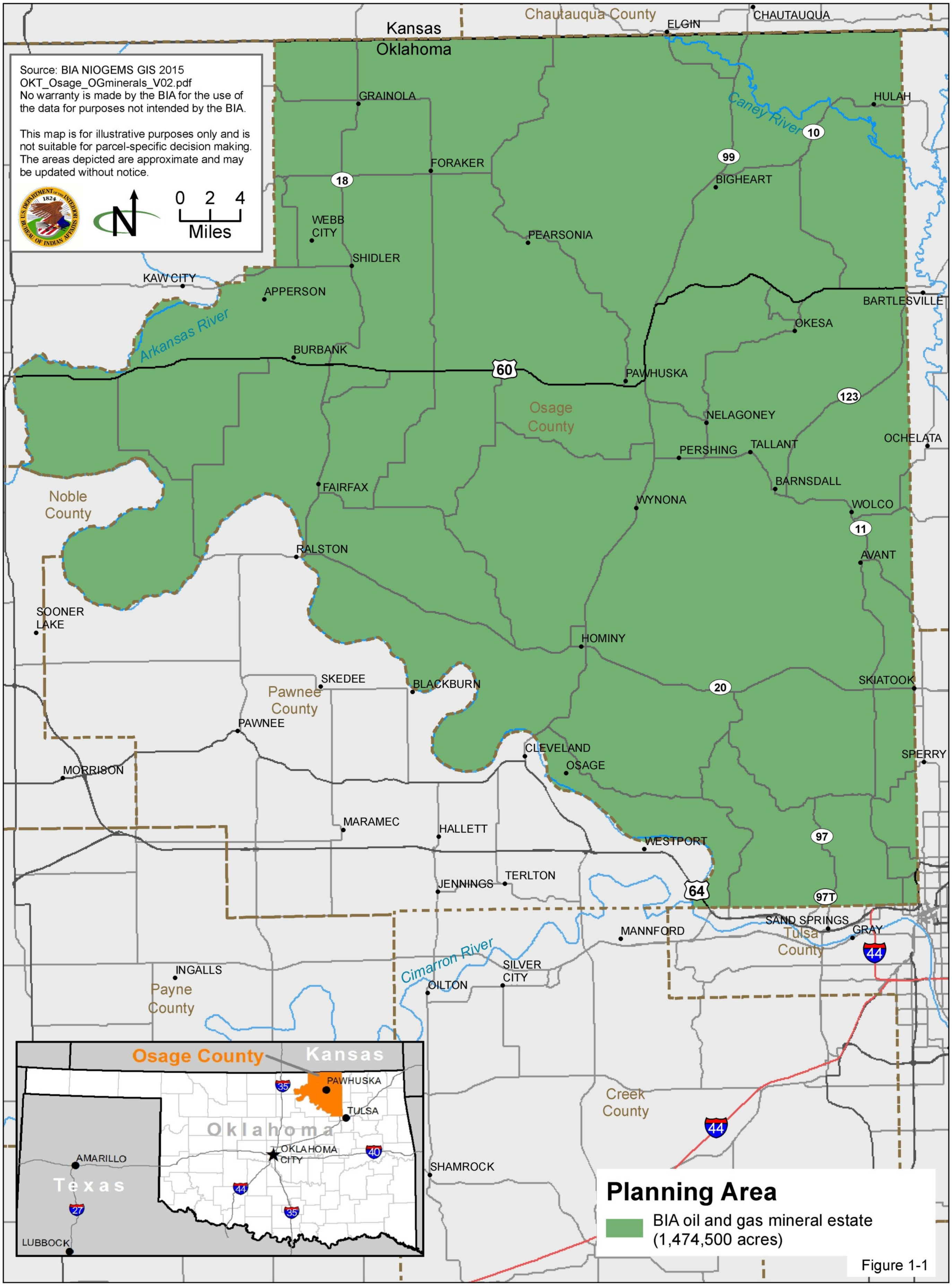
Osage County is in northeast Oklahoma, bordering Kansas. The BIA's Eastern Oklahoma Regional Office manages all of the subsurface mineral estate in the county. **Table 1-1**, Planning Area Surface Ownership, and **Figure 1-2**, Surface Administration, show the acreage in each type of surface ownership in the planning area.

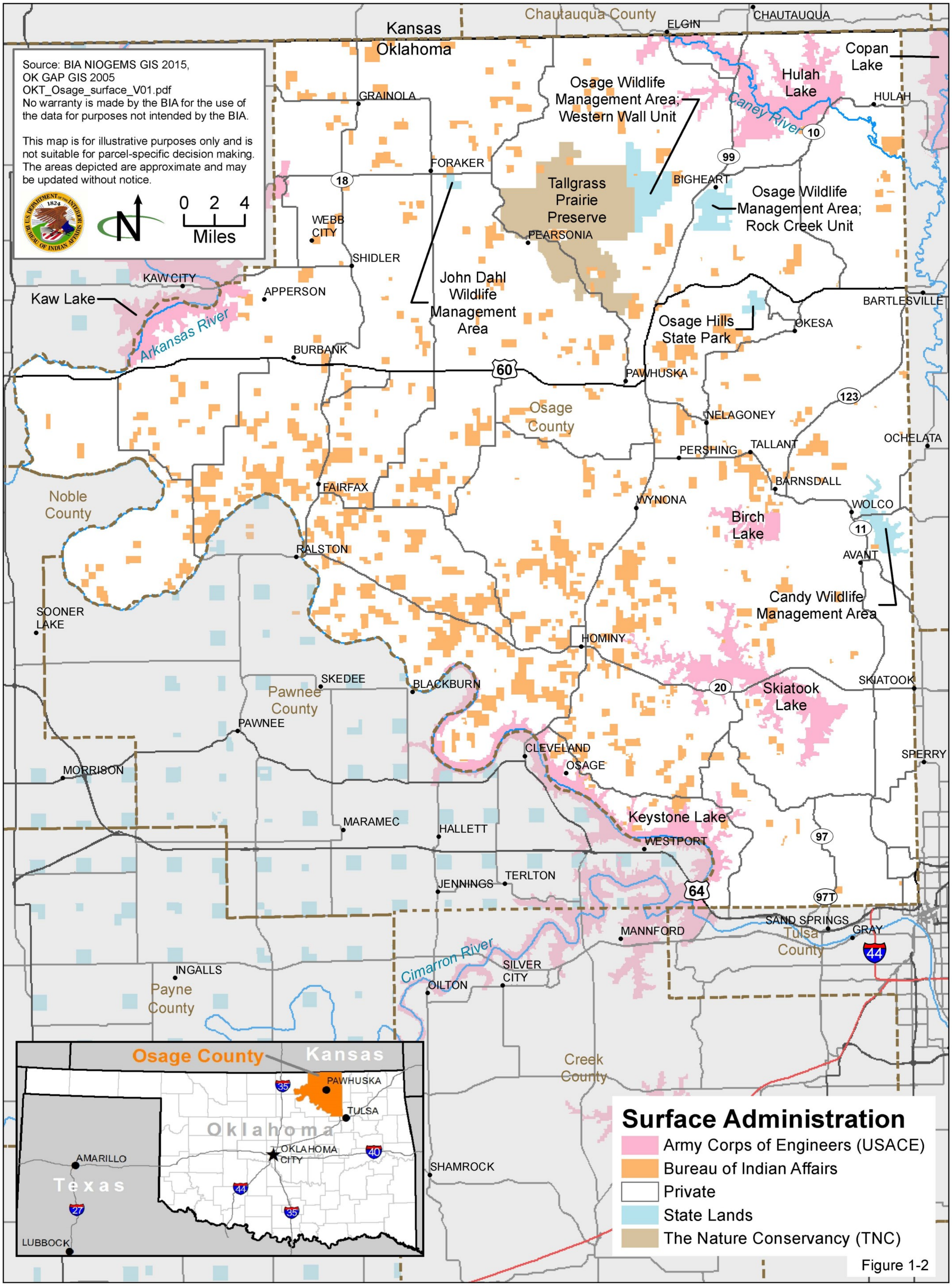
Table 1-1
Planning Area Surface Ownership

Landowner/Surface Management Agency[1]	Acres	Percent of Total
Allotted	121,500	8
Private or other (not including The Nature Conservancy)	1,231,000	83
State	14,500	1
The Nature Conservancy	35,200	2
Tribal[2]	1,600	<1
US Army Corps of Engineers (includes water)	70,700	5
Total	**1,474,500**	**100**

Sources: BIA NIOGEMS GIS 2015; OK GAP GIS 2008

[1]Land not identified as state, allotted, or tribal land was assumed to be privately owned.
[2]Tribal acreage is likely larger than that shown. The Osage Nation is working to determine the correct acreage of tribal lands in the planning area based on the historic reservation boundaries.


Source: BIA NIOGEMS GIS 2015
OKT_Osage_OGminerals_V02.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
ELGIN
CHAUTAUQUA
GRAINOLA
HULAH
Caney River
FORAKER
BIGHEART
WEBB CITY
PEARSONIA
SHIDLER
KAW CITY
APPERSON
BARTLESVILLE
OKESA
Arkansas River
BURBANK
PAWHUSKA
NELAGONEY
Osage County
OCHELATA
PERSHING
TALLANT
BARNSDALL
FAIRFAX
Noble County
WYNONA
WOLCO
RALSTON
AVANT
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
SKIATOOK
Pawnee County
PAWNEE
CLEVELAND
OSAGE
SPERRY
MORRISON
MARAMEC
HALLETT
WESTPORT
JENNINGS
TERLTON
SAND SPRINGS
MANNFORD
Tulsa County
GRAY
INGALLS
Payne County
Cimarron River
OILTON
SILVER CITY
Osage County
Kansas
PAWHUSKA
TULSA
Oklahoma
OKLAHOMA CITY
AMARILLO
Texas
LUBBOCK
Creek County
SHAMROCK
Planning Area
BIA oil and gas mineral estate (1,474,500 acres)
Figure 1-1


Source: BIA NIOGEMS GIS 2015,
OK GAP GIS 2005
OKT_Osage_surface_V01.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
Osage County
Noble County
Pawnee County
Payne County
Creek County
Tulsa County
Osage Wildlife Management Area; Western Wall Unit
Osage Wildlife Management Area; Rock Creek Unit
Tallgrass Prairie Preserve
John Dahl Wildlife Management Area
Osage Hills State Park
Candy Wildlife Management Area
Copan Lake
Hulah Lake
Kaw Lake
Birch Lake
Skiatook Lake
Keystone Lake
Caney River
Arkansas River
Cimarron River
Surface Administration
Army Corps of Engineers (USACE)
Bureau of Indian Affairs
Private
State Lands
The Nature Conservancy (TNC)
Figure 1-2

1.5 EIS PROCESS

This EIS describes the components of, reasonable alternatives to, and environmental consequences of managing development of oil and gas resources in Osage County. Chapters in the EIS are as follows:

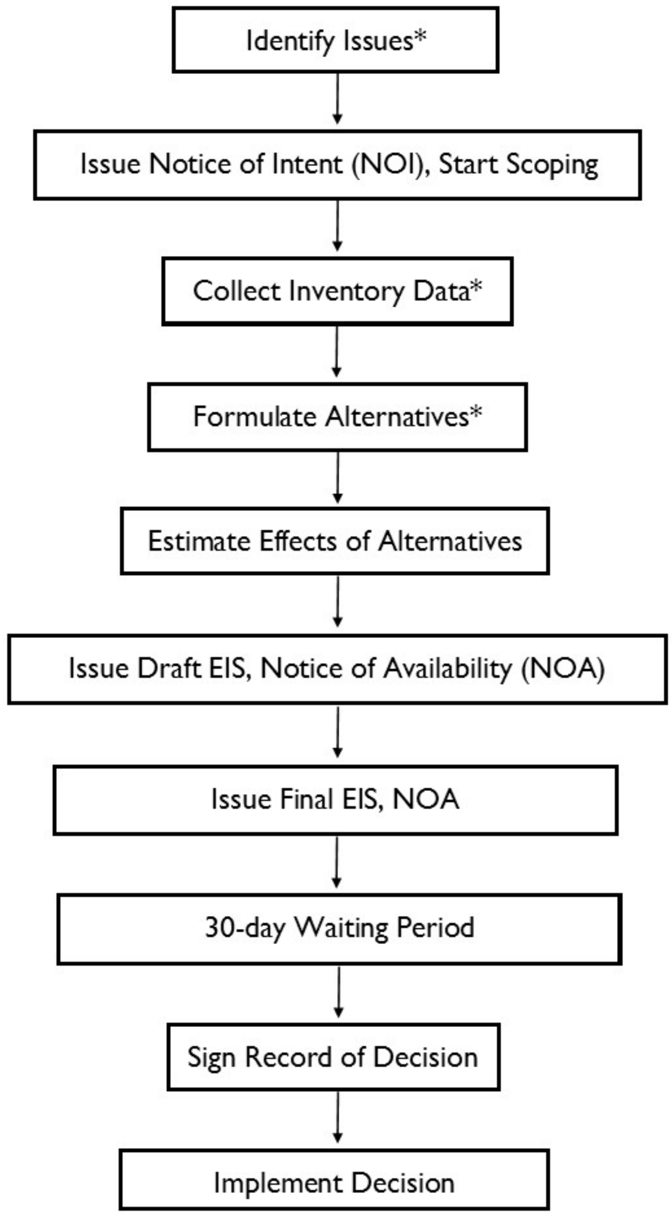
- **Chapter 1**, Introduction and Purpose and Need, describes the purpose of and need for action, authorizing actions, and public participation in the EIS process. The BIA collaborated with the Osage Nation and other cooperating agencies and entities with jurisdiction or expertise in the county to develop alternatives in Chapter 2, Alternatives.
- **Chapter 2**, Alternatives, describes the alternatives considered for detailed analysis and those considered but eliminated from further analysis.
- **Chapter 3**, Affected Environment, describes the existing social and environmental conditions in the planning area.
- **Chapter 4**, Environmental Consequences, details potential direct and indirect impacts associated with the alternatives. Potential cumulative impacts of the alternatives, as they relate to other projects in the region, are also discussed in Chapter 4.
- **Chapter 5**, Consultation and Coordination, lists the state and federal agencies and entities that the BIA consulted and coordinated with during preparation of this EIS; it also lists authorized users who were notified.
- **Chapter 6**, List of Preparers, identifies those who prepared this EIS.
- References cited in the EIS are provided in **Chapter 7**.
- A list of acronyms and a glossary are provided in **Chapter 8**.

Figure 1-3, BIA EIS Process, illustrates the major steps the BIA is taking in developing this EIS. Throughout the process, the BIA is following the public involvement requirements documented in Council on Environmental Quality regulations implementing NEPA (40 CFR, Subpart 1501.7, for scoping and Subpart 1506.6 for public involvement) and Section 8.3 of the Indian Affairs NEPA Guidebook (59 IAM 3-H; BIA 2012a; see **Section 1.6**, Public Involvement and Scoping, and **Section 1.9**, Collaboration).

1.6 PUBLIC INVOLVEMENT AND SCOPING

In accordance with BIA and Council on Environmental Quality policies and guidance, the BIA provided opportunities for meaningful and substantive input and comments during the preparation of this EIS. Those invited to participate in the process were the public, various groups, other federal agencies, Native American tribal members, and state and local governments.

Figure 1-3
BIA EIS Process



*These steps may be revised throughout the EIS process and may overlap other steps

Public involvement is a vital and legally required component of the EIS process. It vests the public in the decision-making process and allows for full environmental disclosure. Guidance for implementing public involvement under NEPA is codified in 40 CFR, Subpart 1506.6, thereby ensuring that federal agencies make a diligent effort to involve the public in the process.

Public involvement for the Osage County Oil and Gas EIS consists of the following five methods:

1. Public scoping before NEPA analysis begins to determine the scope of issues and alternatives to be addressed in the EIS
2. Public outreach via newsletters, news releases, public meetings, and a project website (http://www.bia.gov/WhoWeAre/ RegionalOffices/ EasternOklahoma/WeAre/Osage/OSAGEOilGasEIS/index.htm)
3. A public listening session held in Pawhuska, Oklahoma, on March 9, 2015, to present preliminary alternatives concepts and to accept comments on the concepts
4. Collaboration with federal, state, local, and tribal governments and cooperating agencies and entities
5. Public review of and comment on the draft EIS, which analyzes likely environmental effects of each alternative

The public scoping phase of the process has been completed and is described below. The public listening session on preliminary alternatives was held on March 9, 2015. The public outreach and collaboration phases are ongoing, including the public's review of the draft EIS in fall 2015. The public can obtain information about the EIS process at any time on the project website at http://www.bia.gov/WhoWeAre/RegionalOffices/EasternOklahoma/WeAre/Osage/OSAGEOilGasEIS/index.htm. This website contains background information, documents, status updates, and other material.

1.6.1 Public Scoping

The BIA held a formal scoping period to involve the public in identifying significant issues related to the agency's potential land use management actions. Osage County is in the planning area for the Oklahoma, Kansas, and Texas (OKT) Joint EIS/Bureau of Land Management (BLM) Resource Management Plan (RMP) and BIA Integrated RMP. The BIA's proposed action under consideration for the Osage County Oil and Gas EIS—oil and gas development in Osage County—was part of the OKT Joint EIS/BLM RMP and BIA Integrated RMP scoping. The scoping period began on July 26, 2013, with the publication of a Notice of Intent in the *Federal Register*, and concluded on January 31, 2014. The scoping period provided an opportunity for individuals from federal, state, and local agencies, tribes, interest groups, and the general public to express their comments and to provide meaningful input via e-mail, letters, and participation in 17 public scoping meetings.

As part of the scoping period, the BIA held a public meeting in Pawhuska, Oklahoma, on January 15, 2014. Six people attended. Meeting materials and the final scoping report are available at the public website for the OKT Joint EIS/BLM RMP and BIA Integrated RMP (http://www.blm.gov/nm/oktrmp). The BIA used the information collected during this scoping period to formulate the alternatives for this EIS.

During the public scoping period, the BLM and BIA received 143 unique written submissions and 2 different form letters, which included 683 unique comments. A breakdown is as follows:

- Members of the general public provided 118 written submissions (82.5 percent).
- Organizations or nonprofit groups submitted 10 comments (7.0 percent).
- Businesses submitted 10 comments (7.0 percent).
- A federal agency provided one written submission (0.7 percent), state agencies provided two written submissions (1.4 percent), and an elected official provided one written submission (0.7 percent). These represent a total of 2.8 percent of the submissions.
- One anonymous comment was received (0.7 percent).

No written submissions were received from tribal governments, educational organizations, or local governments.

To ensure that public comments were properly registered and that none were overlooked, the BLM and BIA used a multiphase management and tracking system. First, written submissions were logged and numbered. Once all comments were received and documented, the BLM and BIA assigned a planning classification to each issue. These classifications detail which issues raised will be resolved through the planning effort. Planning classifications are as follows:

1. Issues that will be resolved in the Joint EIS/BLM RMP and BIA Integrated RMP
2. Issues that will be addressed through BLM or BIA policy or administrative action
3. Issues that are beyond the scope of the Joint EIS/BLM RMP and BIA Integrated RMP that will be considered but not addressed
4. Issues about the Oklahoma/Texas boundary

To assist with the analysis, the BLM and BIA entered comments into a public input and comment tracking database. Staff then organized comments by planning issue categories and commenter affiliation. Finally, these identifiers were queried and tallied to provide information on planning and other issue categories. Issues relevant to the Osage County Oil and Gas EIS are presented below.

1.7 Issues

1.7.1 Issue Identification

The purpose of external and internal scoping (within the BIA Eastern Oklahoma and Southern Plains Regional Offices and BLM Oklahoma Field Office staff) was to identify planning issues for the OKT Joint EIS/BLM RMP and BIA Integrated RMP. The only planning issue identified through this process relevant to the Osage County Oil and Gas EIS is the following:

> Energy development—How can the BIA allow development of federal and tribal oil and gas resources and honor valid existing lease rights, while protecting air, visual resources, wildlife, water, and the natural environment?

The BIA used this planning issue to develop a reasonable range of alternative management strategies for the EIS.

In order to be responsive to the issue statement above as it relates to Osage County, and at the request of the Osage, the BIA determined that the NEPA analysis of oil and gas leasing development in the county should be accelerated beyond that for the OKT Joint EIS/BLM RMP and BIA Integrated RMP.

The BIA has unique management authority in Osage County compared with the rest of the planning area for the OKT Joint EIS/BLM RMP and BIA Integrated RMP. Specifically, the BIA is the sole federal agency with management responsibility for oil and gas development in the county. Elsewhere in the OKT Joint EIS/BLM RMP and BIA Integrated RMP planning area, the BIA and BLM share management responsibility for Indian mineral estate.

Because of its unique management authority and in response to the Osage's request, the BIA determined that a decision on managing oil and gas activities in the county should be reached as soon as possible. For this reason, the Osage County Oil and Gas EIS was separated from the OKT Joint EIS/BLM RMP and BIA Integrated RMP and accelerated.

The BIA may be making decisions on other scoping issues in relation to Osage County as part of the OKT Joint EIS/BLM RMP and BIA Integrated RMP process; however, the scope of this EIS is limited to the impacts of oil and gas development in the county. The effects of oil and gas decisions in Osage County under this EIS will be considered in the cumulative analysis of the OKT Joint EIS/BLM RMP and BIA Integrated RMP.

1.8 LEGISLATIVE CONSTRAINTS

The BIA's proposed action is subject to other applicable laws and regulations governing land management or sensitive resources in the planning area. The primary legislative constraints affecting this EIS are the Endangered Species Act of 1973 (ESA; 7 US Code [USC], Section 136, and 16 USC, Section 1531 et seq.) and the National Historic Preservation Act of 1966 (NHPA; 54 USC, Section 300101 et seq.).

Under Section 7 of the ESA, the BIA is required to consult with the US Fish and Wildlife Service (USFWS) when any action the agency carries out, funds, or authorizes may affect a listed endangered or threatened species. If the BIA determines that its action is likely to adversely affect a listed species, it must formally consult with the USFWS. Formal consultation may result in the BIA adopting reasonable and prudent measures recommended by the USFWS in order to implement the proposed action.

Section 106 of the NHPA requires the BIA to take into account the effects of its undertakings on historic properties; it must afford the Advisory Council on Historic Preservation a reasonable opportunity to comment. Consultation under Section 106 may result in a memorandum of agreement that outlines agreed on measures that the BIA will take to avoid, minimize, or mitigate any adverse effects on identified historic properties.

1.9 COLLABORATION

In March 2014, the BLM and BIA wrote to all appropriate local, state, federal, and tribal representatives, inviting them to participate as cooperating agencies and entities for the OKT Joint EIS/BLM RMP and BIA Integrated RMP. At the time these invitations were sent, oil and gas leasing and development in Osage County was within the scope of the OKT Joint EIS/BLM RMP and BIA Integrated RMP.

After deciding to separate and accelerate the Osage County Oil and Gas EIS, the BIA sent separate written invitations to eligible federal agencies, state and local governments, the Osage Nation, and the Osage Minerals Council to participate as cooperating agencies and entities during the development of the EIS. These invitations were sent on January 2, 2015. Those who accepted cooperating agency or entity status for this EIS and signed memoranda of understanding with the BIA are the US Environmental Protection Agency and The Osage Nation.

Cooperating agencies and entities are engaged throughout the planning process, including participating in alternatives development and reviewing and commenting on sections of this draft EIS.

The BIA is engaging in formal government-to-government consultation with the Osage. It also is conducting formal Section 7 consultation with the USFWS and

Section 106 consultation with the State Historic Preservation Officer (SHPO) and Osage Nation Tribal Historic Preservation Officer.

1.10 Related Land Use Plans

This EIS is not in conflict with any federal, local, county, or state laws or plans. The record of decision for this EIS will replace that for the 1979 Environmental Assessment for the Oil and Gas Leasing Program of the Osage Indian Tribe, the 2014 Programmatic Environmental Assessment for Leasing Activities, and the 2015 Programmatic Environmental Assessment for Approving Workover Operations (BIA 1979, 2014, and 2015a). Other relevant land use plans considered during development of the EIS are listed below.

1.10.1 Other Federal Plans

Osage County is in the planning area for the OKT Joint EIS/BLM RMP and BIA Integrated RMP. That document covers all of Oklahoma, Kansas, and Texas and is being prepared jointly by the BLM and BIA. The final EIS is expected to be published in fall 2017.

Based on a request of the Osage during internal and external scoping (see **Section 1.6.1**, Public Scoping), the BIA decided to accelerate the NEPA analysis for oil and gas leasing and development in Osage County before the analysis for the OKT Joint EIS/BLM RMP and BIA Integrated RMP. Accelerating the Osage County Oil and Gas EIS schedule will allow updated guidance for oil and gas management in the county to be prepared in a more timely fashion.

The following federal plans were also considered during the development of the draft EIS:

- Lakeshore Management Plan, Hulah Lake, Oklahoma and Kansas (USACE 1996)
- Oil and Gas Industry Conservation Plan Associated with Issuance of Endangered Species Action Section 10(a)(1)(B) Permits for the American Burying Beetle in Oklahoma (USFWS 2014a)

1.10.2 Local Government Plans

The local government plan considered during the development of the draft EIS was the 2030 Osage County Comprehensive Plan (Osage County 2011).

CHAPTER 2
ALTERNATIVES

2.1 INTRODUCTION

This chapter describes and compares the alternatives considered for the US Department of the Interior, Bureau of Indian Affairs' (BIA's) administration of oil and gas development in Osage County. It includes a description of each alternative considered. It also presents the alternatives in comparative form (see **Section 2.6**, Summary Comparison of Resource Conservation Measures), defining the differences between each alternative and providing the BIA with a clear basis for choice among the options.

The Council on Environmental Quality regulations implementing the National Environmental Policy Act (NEPA) require the BIA to evaluate all reasonable alternatives (or a range that includes the spectrum of reasonable alternatives) in the environmental impact statement (EIS; 40 Code of Federal Regulations [CFR], Section 1502.14). The BIA must also document any alternatives that were considered but eliminated from detailed analysis in the EIS and must explain the rationale for their elimination.

2.2 ALTERNATIVES DEVELOPMENT

Alternatives development is the heart of the EIS process. NEPA regulations require federal agencies to rigorously explore all reasonable alternatives that meet the purpose of and need for the proposed action.

Agencies develop a range of alternatives to be analyzed in the EIS. One of those must be a No Action Alternative, which analyzes the impacts of continuing current management without taking any action. The No Action Alternative and the two action alternatives are discussed further in **Section 2.3**, Alternatives Considered for Detailed Analysis.

The alternatives development process for the Osage County Oil and Gas EIS included public scoping, an alternatives development workshop, and a draft alternatives concepts public listening session.

The BIA held a formal public scoping period to involve the public in identifying significant issues related to its approval of oil and gas leases and permits. The public scoping period was completed as part of the Oklahoma, Kansas, and Texas Joint EIS/Bureau of Land Management (BLM) Resource Management Plan and BIA Integrated Resource Management Plan scoping period. It began on July 26, 2013, with the publication of a Notice of Intent in the *Federal Register* and concluded on January 31, 2014. Osage County is in the planning area for the OKT Joint EIS/BLM RMP and BIA Integrated RMP.

As part of the scoping process, the BIA held a public scoping meeting in Pawhuska, Oklahoma, on January 15, 2014. Public comments submitted during the scoping period were analyzed in a scoping summary report, which is available at the public website for the OKT Joint EIS/BLM RMP and BIA Integrated RMP (http://www.blm.gov/nm/oktrmp).

The BIA held an alternatives development workshop with cooperating agencies and entities on January 29 and 30, 2015. The goal of the workshop was to develop a range of reasonable alternatives for the BIA's administration of oil and gas development in Osage County. In addition to BIA staff, attendees were representatives of the Osage Nation, the Osage Minerals Council, and the Oklahoma Department of Wildlife Conservation.

Based on public scoping and the alternatives development workshop, the BIA developed preliminary alternatives concepts. The agency presented these concepts in a newsletter and posted them to the project website on March 5, 2015. The newsletter, along with newspaper advertisements published in the *Fairfax Chief*, *Hominy News Progress*, *Pawhuska Journal Capital*, and *Tulsa World*, advertised a public listening session, which was held in Pawhuska, Oklahoma, on March 9, 2015. Public comments were accepted during and after the listening session, where attendees were given the opportunity to provide both written and verbal input. Based on the public input, the BIA refined the alternatives concepts into the alternatives presented in this chapter.

2.3 Alternatives Considered for Detailed Analysis

This EIS is an analysis of three alternatives for managing oil and gas development in Osage County, including the No Action Alternative. These represent the range of reasonable actions that could be taken to satisfy the purpose of and need for the BIA's action. The objective of the alternatives is, to the extent possible, to minimize potential adverse impacts on landowners, wildlife, and natural and cultural resources from noise, traffic, excavations, dust, and other disturbances associated with construction and operations under oil and gas leases. Regarding the management under each alternative, reference to lessees include the lessees and their employees, contractors, and other representatives.

While some ground-disturbing activities on a lease may not be associated with issuance of a drilling permit or performance of a workover review (such as making changes to established access roads or burying or rerouting flow lines), the lessee would be required to comply with all applicable laws and regulations, such as 25 CFR, Part 226, the Endangered Species Act (ESA), and the National Historic Preservation Act (NHPA). Throughout the rest of this document, activities on a lease that are not associated with issuance of a drilling permit or performance of a workover review are referred to as non-permitted lease activities.

Under each alternative, the BIA is considering applying resource conservation measures (RCMs) to three types of oil and gas activities: 1) Non-permitted lease activities, 2) Activities within the scope of the 2015 Workover Programmatic Environmental Assessment (PEA) (workover activities), and 3) Applications for permit to drill (APDs) and other permitted activities.

2.3.1 Management Common to All Alternatives

Under all alternatives, lessees must comply with and obtain any necessary permits or authorizations required under federal law, including the Clean Water Act (1972), Clean Air Act (1963), Safe Drinking Water Act (1974), Endangered Species Act (1973), and NHPA (1966).

Additionally, all lessees must comply with the requirements of 25 CFR, Part 226. The BIA is authorized to apply requirements in the form of notices to lessees (NTLs) or Orders of the Superintendent to ensure that all operations are conducted in a manner that protects natural resources, environmental quality, and life and property (see 25 CFR, Subparts 226.19[a], 226.22[a], and 226.30). Through these NTLs and orders, the BIA may specify applicable requirements and practices that are interpreted as necessary or considered to be appropriate measures to protect natural resources in compliance with the regulations. The BIA would not apply measures that would prohibit development of an approved lease.

2.3.2 No Action Alternative

In accordance with the Indian Affairs National Environmental Policy Act Guidebook (59 IAM 3-H; BIA 2012a), the BIA is required to consider the No Action Alternative, which would continue current management, or business as usual. This is the only alternative in an EIS analysis that does not have to conform to the purpose of and need for the BIA's action.

In 1979, the BIA prepared the PEA for the Oil and Gas Leasing Program of the Osage Indian Tribe. The BIA prepared a Leasing PEA in November 2014 and a Workover PEA in April 2015, which incorporated portions of the 1979 PEA by reference (BIA 2014, 2015a). Under the No Action Alternative, the BIA would continue to administer oil and gas development in Osage County according to the measures outlined in these PEAs for any activity within the scope of the PEAs.

For activities authorized in oil and gas leases (including non-permitted lease activities), the BIA may choose to apply appropriate best management practices

(BMPs) listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures to leases, it would do so through an NTL or Order of the Superintendent, as described under **Section 2.3.1**, Management Common to All Alternatives. The BIA would not apply measures that would prohibit development of an approved lease.

For activities within the scope of the Workover PEA, the BIA would apply the BMPs listed in Section 5.1 and Attachment A of the Workover PEA as mandatory RCMs during workover reviews (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). These RCMs would be included as conditions of workover approval.

For APDs and other permit applications outside the scope of the Workover PEA, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs as mandatory permit conditions on a case-by-case basis. The BIA would ensure compliance with the regulations at 25 CFR, Part 226, and applicable laws, such as the ESA and Section 106 of the NHPA, also on a case-by-case basis.

For drilling and other oil and gas development outside the scope of the Workover PEA, the No Action Alternative would not provide a county-wide framework, including a county-specific list of RCMs, that site-specific NEPA analyses could be tiered to. Instead, the BIA would need to approve drilling and other non-workover permits on a case-by-case basis; each drilling permit would require its own NEPA analysis. As a result, lessees would continue to face uncertainty and possible delays associated with determining the RCMs that would be applied to a given permit.

In addition, the No Action Alternative would not allow the BIA to take advantage of streamlined processes to comply with the ESA and Section 106 of the NHPA. For example, for lessees developing within the habitat of the American burying beetle (ABB), the BIA would need to consult separately with the US Fish and Wildlife Service (USFWS) under Section 7 of the ESA each time before approving a permit application rather than complying with one biological opinion issued for all oil and gas development activities in Osage County.

Similarly, the No Action Alternative would not allow for proactive application of measures to identify, preserve, and mitigate impacts on cultural resources in Osage County, in accordance with Section 106 of the NHPA. Rather, these measures would be developed on an individual basis during site-specific Section 106 consultation.

Lessees would also continue to face uncertainty due to the lack of a definition for what is considered an established watering place under 25 CFR, Subpart 226.33. Its requirements would be applied on a case-by-case basis, and consistency in application would not be assured.

Taking no action would not facilitate or improve agency processes involved in the management of the oil and gas development program and would not meet the stated purpose and need (see **Section 1.2**); however, the No Action Alternative is analyzed in detail to provide a baseline against which to evaluate the other alternatives, in accordance with Council on Environmental Quality guidance.

The No Action Alternative would apply the RCMs listed below to workover permits only. (The BIA may apply some or all of these RCMs to all activities on leases, including non-permitted lease activities, through an NTL or Order of the Superintendent. The BIA may also apply these RCMs as mandatory conditions to site-specific permits during analysis of each specific permit.)

Topic—Water Resources

- Prohibit activities in stream channels or wetlands without proper authorization. Authorization may be required from the BIA or from the US Army Corps of Engineers (USACE) under its Clean Water Act (CWA) Section 404 permit program. Avoid discharging soil or contaminants or removing stream water that could violate applicable federally approved water quality standards.

Topic—Visual Resources

- On conclusion of operations, promptly reclaim all areas of surface disturbance (e.g., well pad, access road, and pipeline), as described in the workover review form, permit, and/or approved NEPA document.
- After a well is no longer in production, reclaim the site no later than 90 days after rig removal, well abandonment, and final well plugging, unless otherwise approved by the BIA.

Topic—Spill Prevention and Public Health and Safety

- Store and label chemicals properly (including secondary containment). Do not store equipment or chemicals on-site if they are not being used on-site. Do not leave open containers of chemicals or wastes on-site.
- Keep sites clean and free of any litter, trash, old equipment, contaminated soil, or unused containers. Promptly dispose of any wastes at an appropriate recycling facility, approved landfill, or other approved location. Remove any unused equipment not necessary to the operation of the lease after drilling activities have been completed.
- Tank batteries must have a spill prevention and control and countermeasure plan (SPCC) in compliance with US Environmental Protection Agency (EPA) regulations under 40 CFR, Part 112. A fluid impermeable secondary containment dike/berm must be

constructed around any tank battery and facilities, according to 40 CFR, Section 112.7. The dike/berm and entire containment area must be graveled. No water collected within the secondary containment shall be discharged. In accordance with the SPCC plan and the BIA regulations, the lessee will immediately notify the BIA of all spill incidents.

- Enclose all pits (including tank batteries contained within a dike or berm) with a fence of at least four strands of barbed wire or approved substitute. Line all earthen pits to be used for storing saltwater or other deleterious substances with an impermeable layer to prevent soil and groundwater contamination. Fill and level temporary pits immediately on completion of the activity.

Topic—Soils, Erosion, and Geology

- Erosion control measures are required for the duration of all implementation phases of the proposed project. Erosion control measures must effectively minimize the movement of soil, debris, or contaminants from the project site to adjacent lands and waterways.
- Obtain an appropriate underground injection control permit from the EPA before workover operations begin for underground injection or conversion to saltwater injection or disposal wells. Lessees must comply with requirements found at 40 CFR, Part 144, and obtain any appropriate permits or authorizations from the EPA.
- All vehicles and equipment must use and stay confined to existing and new roads described in the approved NEPA document. These roads must be maintained and upgraded as needed according to BIA direction and agreements between the lessee and surface owners.

Topic—Special Status Species

- Follow USFWS established protocol regarding areas where the ABB is known or suspected to occur (see http://www.fws.gov/southwest/es/oklahoma/ABBICP.htm). If proposed operations require construction of a drilling pit or other excavation activity by heavy equipment, then the lessee must ensure that suitable habitat for the ABB is not present. If proposed operations would impact suitable habitat for the ABB, it would be the responsibility of the lessee to obtain authorization from the USFWS to proceed with that portion of the project.
- Conduct activities in a manner that avoids any potential incidental take of or harm to federally threatened and endangered species or in a manner that complies with any permit or authorization issued by the USFWS.
- Follow guidance in the USFWS Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for

Actions Associated with Oil and Gas Projects (April 2014), found at the following website: http://www.fws.gov/southwest/es/oklahoma/documents/abb/abb_icp/migbird%20and%20eagle%20avoidance%20measures%20april2014.pdf.

Topic—Livestock Grazing

- To exclude any livestock, properly enclose all pumping units (both submersible pumps and pump jacks), tank batteries, and other equipment with valves or other moving parts with the potential to be accidentally opened.

Topic—Vegetation

- Avoid or minimize soil and vegetation disturbance. Avoid removing or damaging trees, shrubs, and groundcover to the extent possible. Avoid or minimize alteration of the natural topography, and limit activities on steep slopes.
- Restore disturbed areas by reestablishing vegetation using seed, sod, or other approved method, and add clean soil to disturbed areas if necessary. Restore with native species unless otherwise directed by the surface owner in writing and approved by the BIA. Do not use noxious or invasive species.

Topic—Air Quality

- No venting or flaring of gas is allowed without prior written approval from the BIA Osage Agency Superintendent.

Topic—Cultural Resources

- Avoid impacts on National Register-eligible or unevaluated cultural resources on well sites and access roads. If cultural resources are discovered during construction or operation, stop work immediately, secure the affected site, and notify the BIA and Tribal Historic Preservation Officer. In the event of a discovery, work in that area shall halt and not resume until written authorization to proceed has been received from the BIA.
- Keep all surface disturbance within the confines of the historic well pad described in the permit application package or the proposed ground disturbance area described in the NEPA document. Do not expand or relocate well pads or access roads or engage in other activities not included in the approved NEPA document without first submitting an appropriate cultural resources survey to the BIA Osage Agency, having it approved, and obtaining all appropriate permits.

2.3.3 Action Alternative 1

Under Action Alternative 1, the BIA would identify a list of standardized RCMs to provide additional certainty to lessees and to streamline the permitting process. RCMs would be applied to permitted activities and workovers through mandatory permit conditions and conditions of workover approval, respectively. RCMs may be applied to all lease activities, including non-permitted lease activities, through an NTL or Order of the Superintendent interpreting the regulations at 25 CFR, Part 226.

RCMs included in an NTL or Order of the Superintendent would extend beyond the life of any permit and would govern reclamation and revegetation activities. These RCMs would protect sensitive resources and ensure compliance with applicable laws and regulations, such as the Endangered Species Act of 1973 (16 US Code [USC], Section 1531 et seq.), the Migratory Bird Treaty Act of 1918 (16 USC, Sections 703-712), and the NHPA of 1966 (54 USC, Section 300101 et seq.).

RCMs to comply with the ESA were determined through consultation with the USFWS under Section 7 of the ESA. Permit applicants would be able to obtain an incidental take permit under the ESA by complying with these RCMs and the biological opinion issued by the USFWS instead of going through the Section 7 consultation process for a separate incidental take permit for each oil and gas permit.

Similar to the No Action Alternative, Migratory Bird Treaty Act compliance would be ensured through site-specific NEPA analysis and enforcement. Also similar to the No Action Alternative, NHPA compliance would continue to be governed by site-specific consultation under Section 106 of the NHPA. However, uncertainty about the outcome of Section 106 consultation would be reduced by the identification of no-disturbance buffers based on cultural site types. This alternative would also formalize protective measures already in practice by including them as RCMs.

The RCMs would be tailored to planning area-specific conditions and issues; therefore, as a general rule, these measures would apply to all new permitted activities and workovers in the planning area. Similarly, if an NTL or Order of the Superintendent were issued requiring these measures, that NTL or Order of the Superintendent would apply to all leases in the planning area. However, the BIA would still have the flexibility to allow exceptions based on site-specific circumstances. Exceptions would be granted where an RCM was not applicable or where another measure proposed by the lessee would achieve the goals of the RCM, given site-specific conditions.

Action Alternative 1 would apply the following RCMs:

Topic—Water Resources

- Lessees are encouraged to implement measures to minimize the use of virgin (i.e., non-recycled) surface water and groundwater needed for drilling and hydraulic fracturing of wells.[1]
- Prohibit activities in stream channels or wetlands without proper authorization and avoid discharging soil or contaminants or removing stream water that could violate applicable federally approved water quality standards. Special water quality standards apply in Sensitive Public and Private Water Supplies and Wellhead Protection Areas.[2]
- Avoid creating new crossings over streams (including ephemeral streams), lakes, and wetlands. Where new crossings are deemed necessary based on site conditions, incorporate culverts or other appropriate drainage structures to ensure the free flow of water when drainage ways are intersected.

Topic—Visual Resources

- Before constructing a new facility that is anticipated to cause new visual impacts, attempt to consult with the surface owner to determine how to mitigate those impacts.[3]
- Remediate all brine scarring and remove all unused drilling equipment and infrastructure.
- If drilling, completion, and development are successful, promptly reclaim all areas of surface disturbance (e.g., well pad, access road, and pipeline) that are not needed or used in the production or operation of the well, as described in the approved NEPA document.
- If well drilling, completion, and development are not successful, promptly reclaim the entire area.
- On conclusion of operations, promptly reclaim all areas of surface disturbance (e.g., well pad, access road, and pipeline), as described in the workover review form, permit, and/or approved NEPA document.

[1]Nothing in this or any other RCM, or in any provision of an alternative set forth in this EIS or adopted in the record of decision or similar document, shall limit, impair, or otherwise affect the reserved or other water rights of the Osage Nation or any sovereign or governmental authority of the Osage Nation over such water rights.
[2]For information on Sensitive Public and Private Water Supplies, see Oklahoma Administrative Code, Title 785, Chapter 45 (http://water.epa.gov/scitech/swguidance/standards/upload/okwqs_chapter45.pdf). For a map of wellhead protection areas, see the Oklahoma Department of Environmental Quality's Flex Viewer (http://gis.deq.ok.gov/flexviewer/).
[3]The BIA will consider reasonable input by surface owners regarding mitigation of visual impacts, along with other factors, such as the need to develop mineral resources. The Osage Agency Superintendent will retain authority in disputes.

- After a well is no longer in production, reclaim the site not later than 90 days after rig removal, well abandonment, and final well plugging, unless otherwise approved by the BIA.

Topic—Noise

- In situations where noise could disturb wildlife, livestock, and private landowners or neighbors, take affirmative steps to reduce sound levels. Where appropriate given surrounding vegetation, place natural buffers (e.g., trees or shrubs) as close to the noise source as possible. Use artificial barriers or landforms, such as berms, and maximize distance from sensitive noise receptors to decrease noise disturbance. Install suitable mufflers on all internal combustion engines and certain compressor components (e.g., single-cylinder engines).
- Use submersible pumping units for all production wells, where three-phase electricity is available and where such units are cost effective.

Topic—Spill Prevention and Public Health and Safety

- Confirm that the construction contractor has implemented an environmental and safety program that includes construction personnel training. This program should include training on requirements associated with permit conditions and compliance with applicable laws and procedures for spill reporting.
- Place warning signs where necessary to protect public safety and sensitive resources. Examples of situations where signs could be necessary are turnoffs from high traffic areas, roads close to schools, low water crossings, and overhead power lines.
- Identify existing wellbores, pipelines, and other surface or underground utilities before construction. For existing wellbores, lessees should coordinate with the BIA to determine measures necessary to prevent accidental damage. For existing utilities, lessees should coordinate with the utility owner to determine measures necessary to prevent accidental damage.
- Store and label chemicals properly (including secondary containment). Do not store equipment or chemicals on-site if they are not being used on-site. Do not leave open containers of chemicals or wastes on-site.
- Keep sites clean and free of litter, trash, old equipment, contaminated soil, and unused containers. Promptly dispose of any wastes at an appropriate recycling facility, approved landfill, or other approved location. Remove any unused equipment not necessary for the operation of the lease after drilling has been completed.

- The lessee will conduct regular monitoring and inspection of drilling and production activities. The lessee is the responsible party for monitoring in advance of any incidents.
- Tank batteries must have an SPCC in compliance with EPA Regulations under 40 CFR, Part 112. A fluid impermeable secondary containment dike or berm must be constructed around any tank battery and facilities, according to 40 CFR, Subpart 112.7. The dike or berm and entire containment area must be graveled and lined with clay or another appropriate impermeable barrier. No water collected within the secondary containment shall be discharged. In accordance with the SPCC plan and BIA regulations, the lessee will immediately notify the BIA of all spill incidents.
- Enclose all pits (including tank batteries contained within a dike or berm) with a fence of at least four strands of barbed wire or approved substitute. Line all earthen pits to be used for storing saltwater or other deleterious substances with an impermeable layer to prevent soil and groundwater contamination. Fill and level temporary pits immediately on completion of the activity.

Topic—Soils, Erosion, and Geology

- When designing and constructing new roads, incorporate an adequate drainage system that effectively diverts water off the road and avoids rutting.
- Salvage and stockpile topsoil in a safe and accessible location protected from erosion. Use the stockpiled material for spill containment, stabilization, revegetation, or reclamation.
- Return the disturbed area to its original contour or recontour it as authorized by the Superintendent.
- Use erosion control measures for the duration of the construction, drilling, implementation, and completion phases of the (proposed) project. Erosion control measures must effectively minimize the movement of soil, debris, or contaminants from the project site to adjacent lands and waterways.
- In reviewing and approving injection well conversion permits, the BIA will consult with BIA, Division of Energy and Mineral Development to identify requirements or restrictions to address potential seismicity impacts or other issues.
- Obtain an appropriate underground injection control permit from the EPA before workover operations begin for underground injection or conversion to saltwater injection or disposal wells. Lessees must comply with requirements found at 40 CFR, Part 144, and obtain any appropriate permits or authorizations from the EPA.

- All vehicles and equipment must use and stay confined to existing and new roads described in the approved NEPA document. These roads must be maintained and upgraded as needed according to BIA direction and agreements between the lessee and surface owners.

Topic—Fish and Wildlife

- Bury power lines where feasible and appropriate given other resource protection needs (e.g., fish and wildlife and cultural resources).

Topic—Special Status Species

- Follow USFWS established protocol regarding areas where the ABB is known or suspected to occur (see http://www.fws.gov/southwest/es/oklahoma/ABBICP.htm). If proposed operations require construction of a drilling pit or other excavation activity by heavy equipment, then the lessee must ensure that suitable habitat for the ABB is not present. If proposed operations would impact suitable habitat for the ABB, it would be the responsibility of the lessee to obtain authorization from the USFWS to proceed with that portion of the project.

- Conduct activities in a manner that avoids any potential incidental take of or harm to federally threatened and endangered species, or in a manner that complies with any permit or authorization issued by the USFWS.

- Follow guidance in the USFWS Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects (April 2014), found at the following website: http://www.fws.gov/southwest/es/oklahoma/documents/abb/abb_icp/migbird%20and%20eagle%20avoidance%20measures%20april2014.pdf.

Topic—Livestock Grazing

- To exclude any livestock, properly enclose all pumping units (both submersible pumps and pump jacks), tank batteries, and other equipment with valves or other moving parts with the potential to be accidentally opened.

Topic—Vegetation

- Avoid or minimize soil and vegetation disturbance. Avoid removing or damaging trees, shrubs, and groundcover to the extent possible. Avoid or minimize alteration of the natural topography, and limit activities on steep slopes.

- Restore disturbed areas by reestablishing vegetation using seed, sod, or other approved method, and add clean soil to disturbed areas if necessary. Restore with native species unless otherwise directed by the surface owner in writing and approved by the BIA. Do not use noxious or invasive species.

Topic—Air Quality

- No venting or flaring of gas is allowed without prior written approval from the BIA Osage Agency Superintendent.

Topic—Cultural Resources

- Emphasize block cultural resource lease surveys that include the identification of proposed well sites, facilities, and access roads. This will allow early input from the State Historic Preservation Office (SHPO) and Osage Nation Historic Preservation Office.
- Avoid impacts on National Register-eligible or unevaluated cultural resources on well sites and access roads. If cultural resources are discovered during construction or operation, stop work immediately, secure the affected site, and notify the BIA and Osage Nation Historic Preservation Office. In the event of a discovery, stop work in that area until written authorization to proceed has been received from the BIA.
- Keep all surface disturbance within the confines of the historic well pad described in the permit application package or the proposed ground disturbance area described in the NEPA and NHPA documents. Do not expand or relocate well pads or access roads or engage in other activities not included in the approved NEPA and NHPA documents without first submitting an appropriate cultural resources survey to the BIA Osage Agency, having it approved, and obtaining all appropriate permits.

Under Action Alternative 1, the BIA would clarify what is considered an established watering place under 25 CFR, Subpart 226.33. An established watering place would be defined as the following: lakes, streams (perennial and intermittent), pools created by ephemeral or intermittent streams and drainage ways, wetlands, marshes, sloughs, springs, man-made ponds, natural ponds, and tributaries to any of these surface waters.

2.3.4 Action Alternative 2

Action Alternative 2 is similar to Action Alternative 1 in that it would apply a county-specific list of RCMs to ensure compliance with applicable laws and regulations. RCMs would be applied to permitted activities and workovers through mandatory permit conditions and conditions of workover approval, respectively. Resource conservation may be applied to all lease activities, including non-permitted lease activities, through an NTL or Order of the Superintendent interpreting the regulations at 25 CFR, Part 226. RCMs included in an NTL or Order of the Superintendent would survive the life of any permit and would govern reclamation and revegetation activities. The BIA would not apply measures that would prohibit development of an approved lease.

Action Alternative 2 builds on Action Alternative 1 by adding more specific RCMs, which would be applied in specific areas, based on available information about where sensitive resources need to be protected. For example, the BIA and the Osage Nation cooperated to identify sensitive cultural resource types that could be proactively protected by buffer zones and other protective measures. The BIA identified additional measures to proactively protect other resources, such as special status species and water resources.

This alternative is more protective of natural and cultural resources and includes proactive measures to comply with requirements of the NHPA, the Migratory Bird Treaty Act, and the ESA. The goal of these measures is to provide more certainty to lessees regarding leasing and development requirements and to streamline the permitting process by completing more of the analysis upfront in this EIS. In addition, these measures would reduce the permitting, monitoring, and enforcement burden on the BIA Osage Agency. Action Alternative 2 would be the most restrictive on oil and gas development out of the three alternatives.

As described under Action Alternative 1, as a general rule, these measures would apply to all new permitted activities and workovers in the planning area. Similarly, if an NTL or Order of the Superintendent were issued requiring these measures, that NTL or Order of the Superintendent would apply to all leases in the planning area. However, the BIA would still have the flexibility to allow exceptions based on site-specific circumstances. Exceptions would be granted where a RCM would not be applicable or where another measure proposed by the lessee would achieve the goals of the RCM, given site-specific conditions.

Action Alternative 2 would apply the following RCMs:

Topic—Water Resources

- Same as Action Alternative 1, plus the following:
  - Collect and report to the BIA results of pre-drilling samples of all drinking water wells within 300 feet of proposed conventional wells or within 1,500 feet of proposed horizontal wellheads. Collect additional samples from the same wells used for baseline sampling. Obtain these additional samples one year after completing drilling or fracturing (whichever is later) and again one year later.

    If the water well owner denies access for sampling, provide proof of such denial and a list identifying the location of each water well where access was denied. If a single drinking water well falls within the sampling radius of two or more wells to be drilled within six months of each other on the same lease, duplicate pre- and post-drilling samples from that drinking water well need not be taken. The single sample collected pre-drilling, one year post-drilling, and two years post-drilling may be used for all qualifying wells, as defined in this paragraph.

Contract with a qualified professional for sampling, in accordance with recognized groundwater sampling and laboratory protocols, such as the US Geological Survey National Field Manual for the Collection of Water-Quality Data (http://water.usgs.gov/owq/FieldManual/); see **Table 2-1**, Water Quality Constituents to be Tested, for required constituents that must be sampled for.

- If a well associated with oil and gas development fails its mechanical integrity test or has other casing problems that may result in contamination of drinking water, work with the BIA, the EPA, and other appropriate entities to address the contamination. Collect and report to the BIA results of periodic samples of all drinking water wells within 300 feet of the well (for conventional wells) or within 1,500 feet of the wellhead (for horizontal wellheads). The first sample shall be collected within one month after the failed mechanical integrity test or discovery of the leakage issue. The lessee must immediately provide notification of the potential contamination to all people served by the drinking water wells to be sampled. Additional samples shall be collected from the same drinking water wells one year, three years, and five years after the initial samples. If any of these three subsequent samples show increased contaminants from oil and gas activities in the drinking water, the BIA will take additional measures to prevent further contamination.

  If the water well owner denies access for sampling, provide proof of such denial and a list identifying the location of each water well where access was denied.

  Contract with a qualified professional for sampling, in accordance with recognized groundwater sampling and laboratory protocols, such as the US Geological Survey National Field Manual for the Collection of Water-Quality Data (http://water.usgs.gov/owq/FieldManual/); see **Table 2-1** for required constituents that must be sampled for.

- Avoid changes to area hydrology (e.g., draining an area, blocking sheet flow, or blocking drainage way flows).
- On drilling sites subject to inundation due to over bank flooding, use a closed loop system to prevent drilling fluids from entering waterways during floods.

Table 2-1
Water Quality Constituents to be Tested

Constituent[1]	Notes
Arsenic	Commonly found in aquifers; may be mobilized during initial drilling.
Bromide	Common in brackish water and brines.
Barium	A principal component of many drilling muds. In the event that barite is not used in the drilling mud, a substitution should be made for a component that is present in the drilling mud.
Chloride	A measure of chloride anions in water. Chlorides and other salts are naturally occurring and can be found in many different geologic zones, but deep groundwater typically contains high levels of chloride. Flowback water contains high levels of chlorides; therefore, an increase in chlorides may be an indication that drilling has allowed communication between geologic zones or that flowback water has contaminated an aquifer.
Conductivity	A measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate anions (ions that carry a negative charge), or sodium, magnesium, calcium, iron, and aluminum cations (ions that carry a positive charge). Organic compounds like oil, phenol, alcohol, and sugar do not conduct electrical current very well and therefore have a low conductivity when in water. A change in water quality as a result of drilling is expected to affect the conductivity.
Iron	Commonly found in many aquifers and may be mobilized during initial drilling.
Manganese	Commonly found in many deep and shallow aquifers and may be mobilized during initial drilling.
Dissolved methane and ethane	Occur naturally in many aquifers but may also migrate into aquifers as a product of drilling and production. Additional analysis may be necessary to determine the source and percentages of dissolved gases.
Total dissolved solids (TDS)	A measure of all dissolved organic and inorganic species in water. TDS is a useful indicator of the presence of a broad array of chemical contaminants. An increase in TDS may indicate drilling operations introduced contaminants into the water supply.
pH	A measure of how acidic or basic water is. pH is sensitive to small changes in water chemistry such as those that may result from natural gas drilling.
Sodium	Sodium is naturally occurring and commonly found in most water. However, sodium is found in high concentrations in deep shale production brines and gas wells.

[1]Sources: Puls 2014, 2015; New York State Department of Environmental Conservation 2011

– Construct access roads using chemically inert materials (i.e., do not use byproducts of manufacturing or other processes that could contain toxics, nutrients, or other chemically active materials).

– Stabilize disturbed wetland buffers by replanting appropriate vegetation.

– Use directional drilling, when appropriate, to place pipelines under wetlands and other important aquatic resources.

Topic—Visual Resources

- Before BIA authorization of a workover or a new facility that is anticipated to cause new visual impacts, the BIA, the surface owner, and the lessee will attempt to consult to determine how to mitigate those impacts.[4]

  Additional measures may be applied as permit conditions based on this site-specific consultation, including but not limited to:

  - Use natural or other features, such as topography, vegetation, or an artificial berm, to help screen facilities from occupied residences and businesses.
  - Design structures to blend in with the natural environment, including potential modifications to height, location, and color.
  - Reduce nighttime lighting where there are dark sky preservation concerns by applying measures such as:
    - Light facilities only during actual hours of operation
    - Limit night lighting to those areas in the facility where nighttime work is occurring
    - Actuate lighting by motion detection, remote control, and other creative means so that lights illuminate exterior areas only when people are present
    - Do not continuously light entrances to facilities during dark sky hours but only when vehicles approach and during normal operating hours
- Remediate all brine scarring and remove all unused drilling equipment and infrastructure.

Topic—Noise

- Before BIA authorization of a workover or a new facility that is anticipated to emit noise that could disturb wildlife livestock, or the surface owner; the BIA, the surface owner, and the lessee will consult to determine how to mitigate those impacts.[5] If noise levels from the proposed activity would exceed 5 A-weighted decibels (dBA)[6] above daytime ambient sound levels or 3 dBA above

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[4]The BIA will consider reasonable input by surface owners for mitigating visual impacts, along with other factors, such as the need to develop mineral resources. The Osage Agency Superintendent will retain authority in disputes.
[5]The BIA will consider reasonable input by surface owners regarding mitigation of noise impacts, along with other factors, such as the need to develop mineral resources. The Osage Agency Superintendent will retain authority in disputes.
[6]A system for measuring sound as it is perceived by the human ear, which is less sensitive to low audio frequencies.

nighttime ambient sound levels, when measured at 200 feet from the activity, the BIA will require noise reduction measures (Behrens and Associates, Inc. 2006). Specific measures would be determined based on the site-specific consultation and could include but are not limited to:

  - Reduce or eliminate noise pollution, which can be disruptive to wildlife and birds. Where appropriate, given surrounding vegetation, place natural buffers (e.g., trees or shrubs) as close to the noise source as possible. Use artificial barriers or landforms, such as berms, and maximize distance from sensitive noise receptors to decrease noise disturbance.
  - Install high-quality noise-reduction mufflers on pump jacks and compressors that are powered by internal combustion engines, or shield such equipment and loud electric motors.

- Use submersible pumping units for all production wells where three-phase electricity is available and where such units are cost effective.
- When practicable, to reduce sleep interference, limit construction occurring within 0.25 mile of a residential dwelling or designated campground to a Monday through Friday work schedule of 7:00 a.m. to 7:00 p.m.

Topic—Spill Prevention and Public Health and Safety

- Same as Action Alternative 1.

Topic—Soils, Erosion, and Geology

- Same as Action Alternative 1.

Topic—Fish and Wildlife

- Same as Action Alternative 1, plus the following:
  - Reduce or eliminate habitat fragmentation from man-made features (e.g., power lines, pipelines, roads, tank batteries, and pumpjacks) in important grassland prairie habitat for migratory and nonmigratory birds.[7] If new infrastructure is necessary, locate it near other infrastructure or at the edge of the open prairie, where feasible. Avoid siting tall structures, such as power lines, tank batteries, and pump jacks, on prairie ridges and hilltops.
  - Avoid disturbing breeding prairie chickens by not allowing vehicle traffic on roads within 1,640 feet of booming

[7] Indicated by habitat ranked as 6 through 8 for greater prairie chicken importance, as shown in the Oklahoma Greater Prairie Chicken Spatial Planning Tool (http://www.wildlifedepartment.com/grpcdevelopmentplanning.htm).

grounds (leks) in the morning, from two hours before sunrise until three hours following sunrise from March 1 to May 31 (Oklahoma Department of Wildlife Conservation 2010; Pitman et al. 2005).

Topic—Special Status Species

- Same as Action Alternative 1, plus the following:
  - To protect the rattlesnake master (*Eryngium yuccifolium*), which is the sole food source for the rattlesnake-master borer moth, a USFWS candidate species, assess the presence of rattlesnake master before new surface-disturbing activities begin (see **Figure 2-1**). Avoid disturbance of rattlesnake master where possible. If rattlesnake master is identified in areas planned for disturbance, coordinate with the BIA and the USFWS to determine whether avoidance is possible.

Figure 2-1
Rattlesnake Master

Photo Credit: Bill Summers, hosted by the USDA-NRCS PLANTS Database/USDA SCS. 1991. Southern wetland flora: Field office guide to plant species. South National Technical Center, Fort Worth

Topic—Livestock Grazing

- Same as Action Alternative 1.

Topic—Vegetation

- Same as Action Alternative 1, plus the following:
  - Stockpile the upper foot of topsoil of areas to be disturbed separately from fill or spoil material. Replace the stockpiled topsoil following drilling as it contains native seed stock.

Topic—Air Quality

- Same as Action Alternative 1.

Topic—Cultural Resources

- Same as Action Alternative 1, plus the following:
  - Use guidance on minimum expected no-drilling buffer zones for particular site types to assist in development and access road planning. Siting in the vicinity of cultural resources would still be subject to site-specific review and approval.
  - Apply no-drilling buffers around cultural sites based on the results of the preconstruction survey. Buffer sizes vary based on site type (see **Table 2-2**). Buffer sizes may be adjusted as necessary based on site-specific conditions.

Table 2-2
Cultural Site Buffers[1]

Site Type	Buffer	Reason
Camps and villages (prehistoric and historic)	Minimum buffer zone of 160 feet around water bodies. The buffer would be extended up to 500 feet in the presence of higher ground found near undulating streams.	This site type is frequently close to water sources, such as creeks that trails followed. The cultural resources are often buried and are frequently found within 160 feet of the water's edge. Sites can extend 500 to 650 feet, particularly in the presence of ridges, terraces, knolls, and other areas of higher ground; some areas exhibiting erosion have deeply buried deposits.
Graves, rock cairns, and cemeteries (prehistoric and historic)	For graves, rock cairns, and family plots, a minimum 300-foot buffer zone; for cemeteries, a minimum 160-foot buffer zone.	Buffer zones are required for all graves, family plots, and cemeteries. Historic cemeteries are often located close to roads, in which case buffer zones may not be possible.
Historic bridges and other structures (such as barns)	No buffer is required unless the site is eligible for listing or is listed on the National Register of Historic Places. In that case, buffer size would be determined by the BIA in consultation with the SHPO and Osage Nation Historic Preservation Office.	Primarily a potential effect on visual setting, but there could be a direct or cumulative effect on the site as well. The need for a buffer would be site- and undertaking-specific.

Table 2-2
Cultural Site Buffers[1]

Site Type	Buffer	Reason
Historic farmsteads or building complexes	No buffer required unless site is eligible for listing or is listed on the National Register or if the household is occupied. In that case, the BIA would determine the buffer size, in consultation with the SHPO, the Osage Nation Historic Preservation Office, and the resident of the building, if any.	Primarily a potential effect on visual setting, but there could be a direct or cumulative effect on the site as well. The need for a buffer would be site- and undertaking-specific.
Lithic scatter	No buffer required	
Native American churches	Minimum 650 feet	Frequently near other sites, these should have a larger buffer zone than the minimum for graves, particularly for oil wells and access or high-traffic roads, because these will have auditory and visual effects on cultural practices.
Rock art	Minimum 650 feet	Frequently near other sites, these should have a larger buffer zone than the minimum for graves, particularly for oil wells and access or high-traffic roads; this is because these will have auditory and visual effects on cultural practices.
Rock shelters and caves	Minimum 330 feet	Potential to be associated with other sites.
Traditional cultural properties	Minimum 650 feet	Frequently near other sites, these should have a larger buffer zone than the minimum for graves, particularly for oil wells and access or high-traffic roads; this is because these will have auditory and visual effects on cultural practices.
Trails	Minimum 160 feet	Until the Osage Nation Historic Preservation Office for the Osage Indian Trail routes creates a geographic information system predictive model, the need for a buffer zone larger than 160 feet would be location- and undertaking-specific; however, trails should have sufficient protection from proposed buffer zones around waterways.
Waterways	Minimum 160 feet from the edge of the ordinary high water mark	Most of the site types discussed are close to waterways; sites on sand and gravel bars would also be protected by this buffer.

[1]All site buffers were developed in consultation with the Osage Nation.

Similar to Action Alternative 1, under Action Alternative 2, the BIA would clarify what is considered an established watering place under 25 CFR, Subpart

226.33; however, the BIA would expand this definition under Action Alternative 2. An established watering place would be defined as the following: lakes, streams (perennial and intermittent), pools created by ephemeral or intermittent streams and drainage ways, wetlands, marshes, sloughs, springs, man-made ponds, natural ponds, tributaries to any of these surface waters, and groundwater wells.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Federal agencies are required to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR, Subpart 1502.14). Alternatives that could not be implemented if they were chosen or that do not resolve the need for action and fulfill the stated purpose in taking action to a large degree, should be eliminated as unreasonable before impact analysis begins. Unreasonable alternatives may be those that are unreasonably expensive; that cannot be implemented for technical or logistical reasons; that do not meet BIA mandates; or that have severe environmental impacts.

Four alternatives were eliminated from detailed study because they would not meet the stated purpose of and need for the BIA's action (see **Section 1.2**, Purpose of and Need for the BIA Action) or because they would not be technically, economically, or legally feasible. Alternatives considered but eliminated from detailed study are summarized below.

2.4.1 No Leasing Alternative

The BIA considered an alternative under which it would not approve any new leases. While lease approval or denial is within the BIA's authority under the Osage Allotment Act of 1906 and 25 CFR, Part 226, this alternative would not meet the purpose of and need for the BIA action. This is because it is not consistent with the BIA's trust responsibility to facilitate the development of oil and gas resources held by the United States in trust for the Osage.

The 1929 amendment to the Osage Allotment Act of 1906 directs the BIA to "offer for lease for oil, gas, and other mining purposes any unleased portion of [the lands held in trust for the benefit of the Osage] in such quantities and at such times as may be deemed for the best interest of the Osage Tribe of Indians" (45 Stat. 1478).

Royalties from oil and gas development in Osage County are an important source of revenue for the Osage. The 1929 amendment further requires at least 25,000 acres of the mineral estate in Osage County to be offered for lease at all times (45 Stat. 1478). Therefore, this alternative was eliminated from further consideration.

2.4.2 Leasing with No Constraints

During alternatives development, the BIA considered an alternative under which it would approve oil and gas development permits and leases without any conditions or constraints. This would not be legally viable because the BIA would not be able to ensure compliance with applicable laws and regulations. Therefore, this alternative was eliminated from further consideration.

2.4.3 Transfer the BIA's Management Authority to Another Agency

Several public commenters suggested that the BIA transfer its management authority over oil and gas leasing and development in Osage County to another agency, such as the Oklahoma Corporation Commission or the US Department of the Interior, Bureau of Land Management.

The Department of the Interior's authority for managing oil and gas leasing and development in Osage County comes from the Osage Allotment Act of 1906. This authority could not be transferred without an act of Congress. The BIA does not have the ability to transfer its own management authority and trust responsibility to another agency.

Furthermore, the Secretary of the Interior has delegated authority for managing oil and gas leasing and development in Osage County to the BIA. Delegation to another bureau of the Department of the Interior is an administrative action outside the scope of this EIS. Therefore, this alternative was eliminated from further consideration.

2.4.4 Resource Conservation Measures Aimed at Facilitating Compliance with the Clean Water Act and Safe Drinking Water Act

During alternatives development, the BIA considered developing RCMs to facilitate lessee compliance with relevant provisions of the Clean Water Act of 1972 (33 USC, Section 1251 et seq.) and the Safe Drinking Water Act of 1974 (42 USC, Subsections 300f to 300j9). However, the BIA determined that existing water quality standards for sensitive public and private water supplies and wellhead protection areas are adequate and that additional restrictions imposed by the BIA would be redundant. Therefore, these measures were eliminated from further consideration.

2.5 Summary Comparison of Resource Conservation Measures

Table 2-3 compares the RCMs that would apply under each alternative. Under the No Action Alternative, RCMs would apply only to workover activities. Most RCMs that apply under Action Alternative 1 would also apply under Action Alternative 2. However, in some cases, a RCM that would apply under Action Alternative 1 would be replaced by a more detailed or more stringent measure under Action Alternative 2. Under Action Alternative 2, the BIA would also apply additional proactively protective RCMs. As discussed in **Section 2.3**, under any alternative, the BIA may choose to apply the RCMs listed under that alternative to activities on existing leases through an NTL or Order of the Superintendent.

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
Topic: Water Resources				
1.	Lessees are encouraged to implement measures to minimize the use of virgin (i.e., non-recycled) surface water and groundwater needed for drilling and hydraulic fracturing of wells.[9]		✓	✓
2.	Prohibit activities in stream channels or wetlands without proper authorization. Authorization may be required from the BIA or from the USACE under its CWA Section 404 permit program. Avoid discharging soil or contaminants or removing stream water that could violate applicable federally approved water quality standards.	*		
3.	Prohibit activities in stream channels or wetlands without proper authorization. Authorization may be required from the BIA or from the USACE under its CWA Section 404 permit program. Avoid discharging soil or contaminants or removing stream water that could violate applicable federally approved water quality standards. Special water quality standards apply in sensitive public and private water supplies and wellhead protection areas. For information on sensitive public and private water supplies, see Oklahoma Administrative Code, Title 785, Chapter 45 (http://water.epa.gov/scitech/swguidance/standards/upload/okwqs_chapter45.pdf). For a map of Wellhead Protection Areas, see the Oklahoma Department of Environmental Quality's Flex Viewer (http://gis.deq.ok.gov/flexviewer/).		✓	✓

[8]Measures are mandatory only for workovers. However, all leasing and development activities would be required to comply with applicable laws and regulations.

[9]Nothing in this or any other RCM, or in any provision of an alternative set forth in this EIS or adopted in the record of decision or similar document, shall limit, impair, or otherwise affect the reserved or other water rights of the Osage Nation or any sovereign or governmental authority of the Osage Nation over such water rights.

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
4.	Avoid creation of new stream (including ephemeral streams), lake, and wetland crossings. Where new crossings are deemed necessary based on site conditions, incorporate culverts or other appropriate drainage structures to ensure the free flow of water when drainage ways are intersected.		✓	✓
5.	Collect and report to the BIA results of pre-drilling samples of all drinking water wells within 300 feet of proposed conventional wells or within 1,500 feet of proposed horizontal wellheads. Collect additional samples from the same wells used for baseline sampling. Obtain these additional samples one year after completing drilling or fracturing activities (whichever is later) and again one year later. If the water well owner denies access for sampling, provide proof of such denial and a list identifying the location of each water well where access was denied. If a single drinking water well falls within the sampling radius of two or more wells to be drilled within six months of each other on the same lease, duplicate pre- and post-drilling samples from that drinking water well need not be taken. The single sample collected pre-drilling, 1 year post-drilling, and 2 years post-drilling may be used for all qualifying wells as defined in this paragraph. Contract with a qualified professional for sampling, in accordance with recognized groundwater sampling and laboratory protocols, such as the US Geological Survey National Field Manual for the Collection of Water-Quality Data (http://water.usgs.gov/owq/FieldManual/); see **Table 2-1**, Water Quality Constituents to be Tested, for required constituents that must be sampled for.			✓

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
6.	If a well associated with oil and gas development fails its mechanical integrity test or has other casing problems that may result in contamination of drinking water, work with the BIA, the EPA, and other appropriate entities to address the contamination. Collect and report to the BIA results of samples of all drinking water wells within 300 feet of the well (for conventional wells) or within 1,500 feet of the wellhead (for horizontal wellheads). The first sample shall be collected within one month after the failed mechanical integrity test or discovery of the leakage issue. The lessee must immediately provide notification of the potential contamination to all people served by the drinking water wells to be sampled. Additional samples shall be collected from the same drinking water wells one year, three years, and five years after the initial samples. If any of these three subsequent samples shows increased contaminants from oil and gas activities in the drinking water, the BIA will take additional measures to prevent further contamination. If the water well owner denies access for sampling, provide proof of such denial and a list identifying the location of each water well where access was denied. Contract with a qualified professional for sampling, in accordance with recognized groundwater sampling and laboratory protocols, such as the US Geological Survey National Field Manual for the Collection of Water-Quality Data (http://water.usgs.gov/owq/FieldManual/); see **Table 2-1**, Water Quality Constituents to be Tested, for required constituents that must be sampled for.			✓

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
7.	Avoid changes to area hydrology (e.g., draining an area, blocking sheet flow, or blocking drainage way flows).			✓
8.	On drilling sites subject to inundation due to over bank flooding, use a closed loop system to prevent drilling fluids from entering waterways during floods.			✓
9.	Construct access roads using chemically inert materials (i.e., do not use byproducts of manufacturing or other processes that could contain toxics, nutrients, or other chemically active materials).			✓
10.	Stabilize disturbed wetland buffers by replanting appropriate vegetation.			✓
11.	Use directional drilling, when appropriate, to place pipelines under wetlands and other important aquatic resources.			✓
Topic: Visual Resources				
12.	Before constructing a new facility that is anticipated to cause new visual impacts, attempt to consult with the surface owner to determine how to mitigate those impacts[10].		✓	
13.	Before BIA authorization of a workover or a new facility that is anticipated to cause new visual impacts, the BIA, the surface owner, and the lessee will attempt to consult to determine how to mitigate those impacts[10]. Additional measures may be applied as permit conditions based on this site-specific consultation, including but not limited to: • Use natural or other features such as topography,			✓

[10]The BIA will consider reasonable input by surface owners for mitigating visual impacts along with other factors, such as the need to develop mineral resources. The Osage Agency Superintendent will retain authority in disputes.

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
	vegetation, or an artificial berm to help screen facilities from occupied residences and businesses. • Design structures to blend in with the natural environment, including potential modifications to height, location, and color. • Reduce nighttime lighting where there are dark sky preservation concerns by applying measures such as: – Light facilities only during actual hours of operation. – Limit night lighting to those areas within the facility where nighttime work is occurring. – Actuate lighting by motion detection, remote control, and other creative means so that lights illuminate exterior areas only when people are present. – Do not continuously light entrances to facilities during dark sky hours but only when vehicles approach and during normal operating hours.			
14.	Remediate all brine scarring and remove all unused drilling equipment and infrastructure.		✓	✓
15.	If drilling, completion, and development are successful, promptly reclaim all areas of surface disturbance (e.g., well pad, access road, and pipeline) that are not needed or used in the production or operation of the well, as described in the approved NEPA document.		✓	✓
16.	If well drilling, completion, and development are not successful, promptly reclaim the entire area.		✓	✓

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
17.	On conclusion of operations, promptly reclaim all areas of surface disturbance (e.g., well pad, access road, and pipeline), as described in the workover review form, permit, and/or approved NEPA document.	*	✓	✓
18.	After a well is no longer in production, reclaim the site not later than 90 days after rig removal, well abandonment, and final well plugging, unless otherwise approved by the BIA.	*	✓	✓
	Topic: Noise			
19.	In situations where noise could disturb wildlife, livestock, and private landowners or neighbors, take affirmative steps to reduce sound levels. Where appropriate given surrounding vegetation, place natural buffers (e.g., trees or shrubs) as close to the noise source as possible. Use artificial barriers or landforms, such as berms, and maximize distance from sensitive noise receptors to decrease noise disturbance. Install suitable mufflers on all internal combustion engines and certain compressor components (e.g., single-cylinder engines).		✓	
20.	Before BIA authorization of a workover or a new facility that is anticipated to emit noise that could disturb wildlife livestock, or the surface owner; the BIA, the surface owner, and the lessee will consult to determine how to mitigate those impacts.[11] If noise levels from the proposed activity would exceed 5 dBA above daytime ambient sound levels or 3 dBA above nighttime ambient sound levels, when measured at 200 feet from the activity, the BIA will			✓

[11]The BIA will consider reasonable input by surface owners regarding mitigation of noise impacts, along with other factors, such as the need to develop mineral resources. The Osage Agency Superintendent will retain authority in disputes.

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
	require noise reduction measures (Behrens and Associates, Inc. 2006). Specific measures would be determined based on the site-specific consultation and could include, but are not limited to: • Reduce or eliminate noise pollution, which can be disruptive to wildlife and birds. Where appropriate given surrounding vegetation, place natural buffers (e.g., trees or shrubs) as close to the noise source as possible. Use artificial barriers or landforms, such as berms, and maximizing distance from sensitive noise receptors to decrease noise disturbance. • Install high-quality noise-reduction mufflers on pump jacks and compressors that are powered by internal combustion engines, or shield such equipment and loud electric motors.			
21.	Use submersible pumping units for all production wells, where three-phase electricity is available and where such units are cost effective		✓	✓
22.	When practicable, to reduce sleep interference, limit construction occurring within 0.25 mile of a residential dwelling or designated campground to a Monday through Friday work schedule of 7:00 a.m. to 7:00 p.m.			✓
	Topic: Spill Prevention and Public Health and Safety			
23.	Confirm that the construction contractor has implemented an environmental and safety program that includes construction personnel training. This program should include training on requirements associated with permit conditions and compliance with applicable laws and procedures for spill reporting.		✓	✓
24.	Place warning signs where necessary to protect public safety and sensitive resources. Examples of situations where signs could be		✓	✓

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
	necessary are turnoffs from high traffic areas, roads close to schools, low water crossings, and overhead power lines.			
25.	Identify existing wellbores, pipelines, and other surface or underground utilities before construction. For existing wellbores, lessees should coordinate with the BIA to determine measures necessary to prevent accidental damage. For existing utilities, lessees should coordinate with the utility owner to determine measures necessary to prevent accidental damage.		✓	✓
26.	Store and label chemicals properly (including secondary containment). Do not store equipment or chemicals on-site if they are not being used on site. Do not leave open containers of chemicals or wastes on site.	*	✓	✓
27.	Keep sites clean and free of litter, trash, old equipment, contaminated soil, and unused containers. Promptly dispose of any wastes at an appropriate recycling facility, approved landfill, or other approved location. Remove any unused equipment not necessary for the operation of the lease after drilling activities have been completed.	*	✓	✓
28.	The lessee will conduct regular monitoring and inspection of drilling and production activities. The lessee is the responsible party for monitoring in advance of any incidents.		✓	✓
29.	Tank batteries must have a SPCC in compliance with EPA Regulations under 40 CFR Part 112. A fluid impermeable secondary containment dike or berm must be constructed around any tank battery and facilities according to 40 CFR, Subpart 112.7. The dike or berm and entire containment area must be graveled and lined with clay or another appropriate impermeable barrier. No water collected within the secondary containment shall be discharged. In	*	✓	✓

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
	accordance with the SPCC plan and BIA regulations, the Lessee will immediately notify the BIA of all spill incidents.			
30.	Enclose all pits (including tank batteries contained within a dike or berm) with a fence of at least four strands of barbed wire or approved substitute. Line all earthen pits to be used for storing salt water or other deleterious substances with an impermeable layer to prevent soil and groundwater contamination. Fill and level temporary pits immediately on completion of the activity.	*	✓	✓
	Topic: Soils, Erosion, and Geology			
31.	When designing and constructing new roads, incorporate an adequate drainage system that effectively diverts water off of the road and avoids rutting.		✓	✓
32.	Salvage and stockpile topsoil in a safe and accessible location protected from erosion. Use the stockpiled material for spill containment, stabilization, revegetation, or reclamation.		✓	✓
33.	Return the disturbed area to its original contour or re-contour it as authorized by the Superintendent.		✓	✓
34.	Use erosion control measures for the duration of the construction, drilling, implementation, and completion phases of the (proposed) project. Erosion control measures must effectively minimize the movement of soil, debris, or contaminants from the project site to adjacent lands and waterways.	*	✓	✓
35.	In reviewing and approving injection well conversion permits, the BIA will consult with Department of Interior Indian Affairs, Department of Energy and Mineral Development to identify requirements or restrictions to address potential seismicity impacts or other issues.		✓	✓

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
36.	Obtain an appropriate Underground Injection Control permit from the Environmental Protection Agency before workover operations begin for underground injection or conversion to saltwater injection or disposal wells. Lessees must comply with requirements found at 40 CFR Part 144, and obtain any appropriate permits or authorizations from the Environmental Protection Agency.	*	✓	✓
37.	All vehicles and equipment must use and stay confined to existing and new roads described in the approved NEPA document. These roads must be maintained and upgraded as needed according to BIA direction and agreements between the lessee and surface owners.	*	✓	✓
Topic: Fish and Wildlife				
38.	Bury power lines where feasible and appropriate given other resource protection needs (e.g., fish and wildlife and cultural resources).		✓	✓
39.	Reduce or eliminate habitat fragmentation from man-made features (e.g., power lines, pipelines, roads, tank batteries, and pumpjacks) in important grassland prairie habitat for migratory and non-migratory birds (indicated by habitat ranked as 6 through 8 for greater prairie chicken importance as shown in the Oklahoma Greater Prairie Chicken Spatial Planning Tool [http://www.wildlifedepartment.com/grpcdevelopmentplanning.htm]). If new infrastructure is necessary, locate it near other existing infrastructure or at the edge of the open prairie, where feasible. Avoid siting tall structures, such as power lines, tank batteries, and pump jacks, on prairie ridges and hilltops.			✓
40.	Avoid disturbing breeding prairie chickens by not allowing vehicle traffic on roads within 1,640 feet of booming grounds (leks) in the morning from two hours before sunrise until three hours following			✓

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
	sunrise from March 1 – May 31 (Oklahoma Department of Wildlife Conservation 2010; Pitman et al. 2005).			
	Topic: Special Status Species			
41.	Follow USFWS established protocol regarding areas where the ABB is known or suspected to occur (see http://www.fws.gov/southwest/es/oklahoma/ABBICP.htm). If proposed operations require construction of a drilling pit or other excavation activity by heavy equipment, then the lessee must ensure that suitable habitat for the ABB is not present. If proposed operations would impact suitable habitat for the ABB, it would be the responsibility of the lessee to obtain authorization from the USFWS to proceed with that portion of the project.	*	✓	✓
42.	Conduct activities in a manner that avoids any potential incidental take or harm to federally threatened and endangered species, or in a manner that complies with any permit or authorization issued by the USFWS.	*	✓	✓
43.	Follow guidance in the USFWS Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects (April 2014), found at the following website: http://www.fws.gov/southwest/es/oklahoma/documents/abb/abb_icp/migbird%20and%20eagle%20avoidance%20measures%20april2014.pdf	*	✓	✓
44.	To protect the rattlesnake master (*Eryngium yuccifolium*), which is the sole food source for the rattlesnake-master borer moth, a USFWS candidate species, assess the presence of rattlesnake master before new surface-disturbing activities begin (see **Figure 2-1**). Avoid disturbance of rattlesnake master where possible. If rattlesnake master is identified in areas planned for disturbance,			✓

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
	coordinate with the BIA and the USFWS to determine whether avoidance is possible.			
	Topic: Livestock Grazing			
45.	To exclude any livestock, properly enclose all pumping units (both submersible pumps and pump jacks), tank batteries, and other equipment with valves or other moving parts with the potential to be accidentally opened.	*	✓	✓
	Topic: Vegetation			
46.	Avoid or minimize soil and vegetation disturbance. Avoid removing or damaging trees, shrubs, and groundcover to the extent possible. Avoid or minimize alteration of the natural topography, and limit activities on steep slopes.	*	✓	✓
47.	Restore disturbed areas by reestablishing vegetation using seed, sod, or other approved method, and add clean soil to disturbed areas if necessary. Restore with native species unless otherwise directed by the surface owner in writing and approved by the BIA. Do not use noxious or invasive species.	*	✓	✓
48.	Stockpile the upper foot of topsoil of areas to be disturbed separately from fill or spoil material. Replace the stockpiled topsoil following drilling as it contains native seed stock.			✓
	Topic: Air Quality			
49.	No venting or flaring of gas is allowed without prior written approval from the BIA Osage Agency Superintendent.	*	✓	✓
	Topic: Cultural Resources			
50.	Emphasize block cultural resource lease surveys that include the identification of proposed well sites, facilities, and access roads. This will allow early input from the State Historic Preservation Office (SHPO) and Osage Nation Historic Preservation Office.		✓	✓

Table 2-3
Summary Comparison of Resource Conservation Measures

Number	Resource Conservation Measure	No Action Alternative[8] (Business as Usual)	Action Alternative 1 (Streamlined Management)	Action Alternative 2 (Upfront Protective Management)
51.	Avoid impacts on National Register-eligible or unevaluated cultural resources on well sites and access roads. If cultural resources are discovered during construction or operation, stop work immediately, secure the affected site, and notify the BIA and Osage Nation Historic Preservation Office. In the event of a discovery, work in that area shall halt and not resume until written authorization to proceed has been received from the BIA.	*	✓	✓
52.	Keep all surface disturbance within the confines of the historic well pad described in the permit application package or the proposed ground disturbance area described in the NEPA and NHPA documents. Do not expand or relocate well pads or access roads or engage in other activities not included in the approved NEPA and NHPA documents without first submitting an appropriate cultural resources survey to the BIA Osage Agency, having it approved, and obtaining all appropriate permits.	*	✓	✓
53.	Use guidance on minimum expected no-drilling buffer zones for particular site types to assist in development and access road planning. Siting in the vicinity of cultural resources would still be subject to site-specific review and approval.			✓
54.	Apply no-drilling buffers around cultural sites based on the results of the preconstruction survey. Buffer sizes vary based on site type (see **Table 2-2**, Cultural Site Buffers). Buffer sizes may be adjusted as necessary based on site-specific conditions.			✓

2.6 Summary of Application of Resource Conservation Measures to Oil and Gas Activities

As described in **Section 2.3**, Alternatives Considered for Detailed Analysis, the BIA could apply RCMs to three types of activities under each alternative: 1) non-permitted lease activities, 2) workover activities, and 3) APDs and other permitted activities. The BIA would use differing mechanisms for applying RCMs depending on the type of activity. **Table 2-4** summarizes how RCMs would be applied to each type of activity under each alternative.

Table 2-4
Application of Resource Conservation Measures by Alternative

	No Action Alternative	Action Alternative 1	Action Alternative 2
Non-permitted Lease Activities	Must comply with 25 CFR, Part 226. Superintendent may issue orders or NTLs to ensure compliance. Required RCMs may include the BMPs listed in the Leasing PEA.	Must comply with 25 CFR, Part 226. Superintendent may issue orders or NTLs to ensure compliance. Required RCMs may include those identified in Action Alternative 1 of the EIS, including measures based on the Leasing PEA.	Must comply with 25 CFR, Part 226. Superintendent may issue orders or NTLs to ensure compliance. Required RCMs may include those identified in Action Alternative 2 of the EIS, including measures based on the Leasing PEA.
Workovers	The BIA performs workover reviews with conditions of workover approval, including RCMs listed in Attachment A of the Workover PEA (applies the BMPs from the Workover PEA).	The BIA performs workover reviews with conditions of workover approval, including applicable RCMs identified in Action Alternative 1 of the EIS. RCMs would incorporate measures based on the Workover PEA. If an NTL or Order of the Superintendent were issued, including applicable RCMs identified in this alternative, the RCMs would also apply to workover activities.	The BIA performs workover reviews with conditions of workover approval, including applicable RCMs identified in Action Alternative 2 of the EIS. RCMs would incorporate measures based on the Workover PEA. If an NTL or Order of the Superintendent were issued, including applicable RCMs identified in this alternative, the RCMs would also apply to workover activities.
APDs and Other Permits	The BIA applies RCMs and engages in required consultations on a case-by-case basis to ensure compliance with applicable laws and regulations.	Required RCMs would be applied as mandatory permit conditions, including applicable RCMs identified in Action Alternative 1 of the EIS. If an NTL or Order of the Superintendent were issued, including applicable RCMs identified in this alternative, the RCMs would apply to permitted activities and would survive the life of the permit and its conditions.	Required RCMs would be applied as mandatory permit conditions, including applicable RCMs identified in Action Alternative 2 of the EIS. If an NTL or Order of the Superintendent were issued, including applicable RCMs identified in this alternative, the RCMs would apply to permitted activities and would survive the life of the permit and its conditions.

2.7 Summary Comparison of Environmental Consequences

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
Topography, Geology, Paleontology, and Soils	Potential impacts may occur due to increased oil and gas development. Applying the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA could reduce erosion impacts on soils from these activities. These impacts may also be reduced for activities associated with new leases subject to the Leasing PEA. Impacts resulting from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.	Applying standardized RCMs to all oil and gas activities would reduce erosion and disturbance impacts on soil resources, compared to the No Action Alternative, if similar measures were not applied under that alternative.	Impacts would be similar to those under Action Alternative 1; however, additional RCMs, such as no-drilling buffers, applied to all oil and gas activities would further reduce erosion and disturbance impacts on soil resources.
Water Resources	Applying the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would help reduce the extent of surface disturbance and vegetation removal from these activities,	Applying standardized RCMs to all oil and gas activities would further reduce impacts on water resources, compared to the No Action Alternative, if similar measures were not applied under that alternative. RCMs would reduce erosion impacts on water quality and physical features of water bodies and would help	Impacts under Action Alternative 2 would be similar to those under Action Alternative 1; however, additional RCMs applied to all oil and gas activities under Action Alternative 2 would make this alternative the most protective of water

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
	thereby reducing impacts on runoff and surface water quality. Chemical storage restrictions and spill prevention measures required for tank batteries and storage pits would reduce the risk of shallow groundwater and surface water contamination from spills. These impacts may also be reduced for activities associated with new leases subject to the Leasing PEA. Impacts on water resources from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level. This is because the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. The BIA would continue to prohibit drilling within 200 feet of established watering places, in accordance with 25 CFR, Subpart 226.57. This restriction would protect some sensitive water	prevent damage to existing well bores. Defining "established watering place" to include lakes, streams (perennial and intermittent), pools created by ephemeral or intermittent streams and drainage ways, wetlands, marshes, sloughs, springs, man-made ponds, natural ponds, and tributaries to any of these surface waters would protect these water bodies from the impacts of surface disturbance by clarifying that they would be subject to the 200-foot no-drilling buffer, in accordance with 25 CFR, Subpart 226.57.	resources. Impacts of surface disturbance would be reduced. Requiring baseline and follow-up testing of drinking water wells near proposed well drilling would help identify sources of contamination earlier to facilitate more rapid containment and to reduce further contamination. Established watering places would be defined similarly to the definition under Action Alternative 1, except that groundwater wells would be included and would be protected by the 200-foot no-drilling buffer. Therefore, impacts on groundwater would be further reduced.

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
	bodies from the impacts of surface disturbance. However, because the BIA does not have a standard definition for "established watering place," some sensitive water bodies may be overlooked when applying the regulation.		
Air Quality and Climate	For activities within the scope of the Workover PEA, prohibiting the venting or flaring of gas from these activities without prior written approval from the BIA Osage Agency Superintendent could reduce emissions of carbon dioxide, methane (a greenhouse gas and a precursor to ozone), volatile organic compounds, hazardous air pollutants, and other criteria pollutants. The degree to which air quality and climate would be impacted under this alternative would depend on the amount of decrease in venting and flaring. Impacts on air quality and climate resulting from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-	Impacts would be similar to those described under the No Action Alternative. The major difference is that all oil and gas activities would be subject to RCMs, thereby further reducing impacts on air quality and climate. Additionally, measures that reduce surface disturbance would also reduce dust emissions.	RCMs for air quality and climate would be similar to those under Action Alternative 1; however, additional restrictions on surface disturbance, such as the requirement to minimize habitat fragmentation in important grassland prairie habitat, could further reduce dust emissions.

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
	specific NEPA analysis is conducted on the specific measures to be applied at the project level.		
Fish and Wildlife	Applying the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would help reduce the extent of habitat disturbance or direct disturbance to fish and wildlife from these activities. These impacts may also be reduced for activities associated with new leases subject to the Leasing PEA. Impacts resulting from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level. Habitat fragmentation, noise disturbance, and mortality or injury from oil and gas development could occur to fish and wildlife resources. The lack of a county-wide framework (including county-	Application of standardized RCMs to all oil and gas activities would limit the effects of direct disturbance on fish and wildlife and their habitats. Impacts from noise, habitat degradation, and risk of injury or mortality would still occur; however, these impacts would be less than the No Action Alternative if similar protective measures were not applied under that alternative.	Application of standardized RCMs to all oil and gas activities would provide the greatest level of protection to fish and wildlife under Action Alternative 2. Oil and gas development could result in direct effects on fish and wildlife, as described under the No Action Alternative; however, these impacts would be less than under the No Action Alternative and Action Alternative I.

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
	specific list of fish and wildlife conservation measures) would likely result in application of inconsistent RCMs.		
Vegetation, Wetlands, and Noxious Weeds	Applying the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would reduce the extent of surface-disturbing activities, reducing direct and indirect adverse impacts on vegetation and wetlands. These impacts may also be reduced for activities associated with new leases subject to the Leasing PEA. Impacts resulting from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level. The lack of standardized RCMs could result in fragmented decision-making, which may increase impacts on these resources.	Applying standardized RCMs to all oil and gas activities would reduce surface disturbance and resulting direct and indirect adverse impacts on vegetation, including wetlands, and would reduce the establishment and spread of noxious weeds, compared with the No Action Alternative, if similar measures were not applied under that alternative. "Established watering place" would be defined, thereby increasing the surface subject to no-drilling buffers and reducing the adverse impacts on vegetation, including wetlands.	Applying additional standardized RCMs would further reduce direct and indirect adverse impacts on vegetation, including wetlands, and would reduce the establishment and spread of noxious weeds. An expanded definition of "established watering place" would increase the surface subject to no-drilling buffers and would reduce the adverse impacts on vegetation, including wetlands.

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
Special Status Species	Applying the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would reduce impacts on the ABB from surface-disturbing activities. These impacts may also be reduced for activities associated with new leases subject to the Leasing PEA. Lessees, in cooperation with the BIA, would need to go through a separate ESA Section 7 consultation process to determine the measures required for each permit application; they would not be permitted to simply comply with one biological opinion issued for all oil and gas development in Osage County.	Application of standard RCMs to all oil and gas activities would limit direct disturbance to special status species habitat. Permit applicants would be able to obtain an incidental take permit under the ESA by complying with these RCMs instead of going through the ESA Section 7 consultation process for a separate incidental take permit for each oil and gas permit application. Impacts from habitat fragmentation and degradation, disturbance, injury, and mortality would still occur from oil and gas and infrastructure development; however, these impacts could be reduced, compared to the No Action Alternative.	Under this alternative, measures to protect special status species and habitat would include providing buffers for prairie chicken leks and avoiding disturbance to the candidate plant species, the rattlesnake master borer moth. The measures under this alternative would be more protective of special status species and habitat and would do the most to reduce impacts from oil and gas and infrastructure development. Direct impacts on special status species would still occur but would be reduced, compared to the No Action Alternative and Action Alternative 1.
Agriculture	Applying the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would indirectly protect agricultural resources. These impacts may also be reduced for activities associated with new leases subject to the Leasing PEA.	The application of BMPs and standardized RCMs would indirectly protect agricultural resources. Additional noise control may reduce overall sound levels, which would minimize impacts on livestock. Livestock conflicts would also be reduced by excluding livestock from well pads. Impacts on agriculture would be reduced compared with the No Action	Impacts under Action Alternative 2 would be similar to those under Action Alternative 1. However, because more specific RCMs would be applied and proactive protective buffers would be added around specific resources, additional indirect beneficial impacts on agriculture could occur. This would be

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
		Alternative if similar measures were not applied on a site-specific basis under that alternative.	especially true if the buffers were to coincide with agricultural lands or prime farmlands.
Historical, Cultural, and Archaeological Resources	Applying the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would continue to help protect cultural resources. Impacts may also be reduced for activities associated with new leases subject to the Leasing PEA. For other activities, the BIA would continue to issue permits based on site-specific NEPA analysis and RCMs. Section 106 compliance would continue for all activities. Resolving adverse effects through the Section 106 process would mitigate any significant impacts on cultural resources under NEPA. RCMs to comply with applicable laws and regulations and to reduce environmental degradation would continue to constrain infrastructure siting; however, these measures would not prevent lease development	Applying standardized RCMs through inventory, avoidance, and restrictions on ground disturbance for all oil and gas activities would reduce the potential for direct and indirect impacts on historical, cultural, and archaeological resources compared with the No Action Alternative if similar measures were not applied on a site-specific basis under that alternative. By consistently applying RCMs to all permitted oil and gas activities in the planning area, additional constraints would be placed on developing the mineral estate held in trust by the federal government. However, these RCMs are designed to add certainty regarding compliance requirements through standards that are applicable county-wide, which would assist in developing and using the Osage's mineral estate.	Action Alternative 2 adds proactive guidance to the standardized RCMs on minimum expected no-drilling buffer zones for cultural resource protection to assist in development planning. Siting in the vicinity of cultural resources would still be subject to site-specific review and approval. Applying these additional RCMs would have a beneficial impact on cultural resources by providing more predictable guidance and standards for siting facilities and avoiding impacts on cultural resources. Additional RCMs beyond those in Action Alternative 1 would be in place, resulting in more constraints on developing the mineral estate. However, predictable guidance and standards would assist the BIA in meeting its trust responsibilities for the benefit of the Osage.

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
	or impact the use of the mineral estate held in trust by the federal government.		
Socioeconomics and Environmental Justice	Applying the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA could add site-specific restrictions and additional costs and time for development, which could subsequently reduce oil and gas economic contributions. Applying these measures could also minimize impacts on quality of life factors and nonmarket values, as well as other land uses. These impacts may also be reduced for activities associated with new leases subject to the Leasing PEA. The lack of a consistent approach could result in uncertainty and delays in determining the RCMs that would be applied to a given permit. This could reduce overall production levels and related economic impacts and result in inconsistent mitigation of impacts on traffic, water quality, and noise, which could impact the quality of life for area residents.	Applying standardized RCMs to all oil and gas activities could represent restrictions and additional costs and time for development, which may impact production and economic contributions. However, consistent standards would also reduce uncertainty for developers, supporting continued oil and gas operations and related economic contributions. Applying RCMs would also result in more uniform mitigation of impacts on other resources and land uses, reducing potential impacts on quality of life, nonmarket values, and economic contributions from other land uses.	Impacts would be similar to those under Action Alternative 1, but additional RCMs that would be applied under this alternative could further reduce production and related economic contributions from the oil and gas industry. The potential for impacts of development on quality of life, nonmarket values, and economic contributions from other land uses would be lowest under this alternative.

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
Public Health and Safety	Applying the BMPs listed in Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would reduce public health and safety risks associated with leasing and workover activities. It would do this by helping prevent spills and requiring unused equipment to be removed. These impacts may also be reduced for activities associated with new leases subject to the Leasing PEA. Impacts resulting from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.	Applying standardized RCMs to all oil and gas activities would reduce impacts on public health and safety, compared to the No Action Alternative, if similar measures were not applied on a site-specific basis under that alternative. For example, RCMs would provide consistent and predictable reductions in impacts from hazardous material exposure and injury, spills, risks to worker and public safety, noise, fire, and air pollutants.	Impacts under Action Alternative 2 would be similar to those under Action Alternative 1, with additional measures to reduce adverse impacts on public health and safety. For example, there would be greater reductions in impacts from groundwater contamination and noise.
Visual Resources	BMPs in the 2015 Workover PEA and 2014 Leasing PEA would be applied to oil and gas activities within the scope of these documents. Several of these measures would incidentally minimize impacts on visual resources, such as reclamation requirements and avoidance of	This alternative would apply RCMs that would specifically offer protection of visual resources beyond those under the No Action Alternative. Some measures applied to protect other resources would incidentally exaggerate impacts on visual resources. Overall, RCMs applied under this alternative would be more protective than destructive of the visual landscape.	Impacts would be similar to those under Action Alternative 1, but additional RCMs would be applied under this alternative that would further minimize impacts on visual resources, such as limitations on surface disturbance.

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
	impacts to protect other resources. Impacts resulting from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.		
Noise	BMPs in the 2015 Workover PEA and 2014 Leasing PEA would be applied to oil and gas activities within the scope of these documents. These measures would indirectly minimize noise impacts by concentrating and avoiding noise impacts in certain areas. Impacts resulting from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.	This alternative would apply RCMs that would specifically limit noise impacts beyond the measures in the No Action Alternative, unless such measures were applied on a site-specific basis under that alternative. Noise impacts would be reduced by noise buffers, noise mufflers, and submersible pumping units.	Impacts would be similar to those under Action Alternative 1, but additional RCMs would be applied that would further minimize noise impacts, including noise reduction measures and limiting construction operations (and thus its associated noise) to daytime hours.

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
Land Use Plans, Utilities, and Timber Harvesting	Applying the BMPs listed in the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would help ensure lands used for workovers are reclaimed for other land uses and developments in a timely manner. These impacts may also occur for activities associated with new leases subject to the Leasing PEA. Impacts resulting from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.	Limitations on fluid mineral leasing under Action Alternative 1 could result in changed siting or an overall reduction in the production capacity of oil and gas wells developed, compared to the No Action Alternative, if similar measures are not applied on a site-specific basis under that alternative. Changes in siting could change the demand for new utilities, such as pipelines, compared to the No Action Alternative.	Additional restrictions on oil and gas development could result in a slightly lower demand for new utilities and a slightly lower potential for conflict with timber harvesting and wind energy development, compared to Action Alternative 1.
Traffic and Transportation	Applying the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would reduce impacts on traffic and transportation by requiring roads to be maintained and upgraded as needed. For new oil and gas leases, the BIA may apply BMPs in the 2014	Applying standardized RCMs to all oil and gas activities would further reduce impacts on traffic and transportation, compared to the No Action Alternative. There would also be additional RCMs that would reduce public road damage and improve motorist safety.	Impacts under Action Alternative 2 would be similar to those under Action Alternative 1, except there would be an RCM to seasonally restrict vehicle traffic in the vicinity of prairie chicken booming grounds (leks). Prairie chicken concentrations are highest in the northwest portion of Osage County, and impacts on traffic

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
	Leasing PEA, which would help reduce impacts on traffic and transportation from new oil and gas leases in a manner similar to that described for activities within the scope of the Workover PEA. Impacts on traffic and transportation resulting from applications for permits to drill and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.		and transportation would be greater in this area. Roads that may be impacted by the booming grounds restriction are US Highway 60 and State Highways 11 and 18 in the northwest portion of Osage County.
Mineral Extraction	Applying the BMPs listed in the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA would limit the siting, design, and timing of workover activities; however, they would not reduce the overall number of workover operations in the planning area. These impacts may also occur for activities associated with new leases subject to the Leasing PEA. Impacts on oil and gas development resulting from	Applying standardized RCMs could further restrict oil and gas development, compared to the RCMs applied under the No Action Alternative, if similar measures were not applied on a site-specific basis under that alternative. However, identifying the measures to be applied upfront would provide additional certainty to lessees. They would know the requirements for permits in advance of permit application and would be better able to plan the timing of development and allocation of resources. Additionally, individual	Management under this alternative could be the most restrictive for oil and gas development if site-specific measures applied under the other alternatives did not apply similar restrictions. While this management could increase costs and alter siting, design, and timing of development, it would not decrease the amount of oil and gas development in the planning area.

Table 2-5
Summary of Environmental Consequences of the No Action Alternative, Action Alternative 1, and Action Alternative 2

Resource/Resource Use	No Action Alternative	Action Alternative 1	Action Alternative 2
	APDs and other permit applications outside the scope of the Leasing and Workover PEAs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level. Lessees would continue to face uncertainty regarding the requirements for their operations. The permitting process for activities outside the scope of the Leasing PEA and the Workover PEA would remain extended.	permitting processes would be streamlined because less site-specific analysis and identification of RCMs would be required at the permitting phase.	These measures would provide the most certainty to lessees and would result in the most streamlined permitting process out of all the alternatives.
Recreation and Special Use Areas	The lack of requirements to consistently apply RCMs under the No Action Alternative would result in the continued risk of conflict with recreation activities and opportunities, particularly when leasing and development occurs near special use areas or other important recreation areas.	RCMs under Action Alternative 1 would provide more indirect benefits to recreation than the No Action Alternative if similar measures were not applied on a site-specific basis under that alternative. Such measures include minimizing the use of virgin (i.e., non-recycled) surface water and groundwater needed for drilling and hydraulic fracturing of wells, requiring reclamation of wells no longer in production no later than 90 days after rig removal, and limiting noise that could disturb wildlife, livestock, and private landowners or neighbors.	Although more specific RCMs would be added under Action Alternative 2, none of these measures would be specific to recreation, so any additional beneficial impacts on recreation would be indirect.

CHAPTER 3
AFFECTED ENVIRONMENT

3.1 INTRODUCTION

The purpose of this chapter is to describe the existing biological, physical, and socioeconomic characteristics of the planning area (Osage County, Oklahoma), which includes all Bureau of Indian Affairs (BIA)-administered tribal mineral estate. The descriptions in this chapter include human uses that could be affected by implementing the alternatives described in **Chapter 2**. Each topic area includes a discussion of applicable laws and regulations, followed by a description of current conditions and trends.

The level of information presented in this chapter is commensurate with and sufficient to assess the potential effects discussed in **Chapter 4**, Environmental Consequences, based on the alternatives presented in **Chapter 2**.

Acreages and other numbers used are approximate projections. Readers should not infer that they reflect exact measurements or precise calculations. Many acreages were calculated using geographic information system (GIS) technology, and there may be slight variations in total acres between resources.

Because there is no designated wilderness in the planning area, that topic is not discussed in this chapter or in **Chapter 4**.

3.2 TOPOGRAPHY, GEOLOGY, PALEONTOLOGY, AND SOILS

Topography is the degree of slope, contours of the land, and ranges in elevation. Just as knowledge of area drainage basins, watersheds, and soils is important to planning, so too is the knowledge of slope and contour. This aids site planning, site preparation, and final construction by determining the different gradients and contours of a particular area or site (Osage County 2011).

Geologic resources are defined through descriptions of the geology of the planning area and identification of geologic hazards. Geologic hazards are adverse geologic conditions that are capable of causing damage or loss of property and life. Geologic information is used to evaluate the potential development of mineral resources and to regulate land uses based on slope stability and accessibility, as discussed under topography. Mineral occurrence and management is discussed in detail in **Section 3.16**, Mineral Extraction.

Paleontological resources are any fossilized remains or traces of organisms that are preserved in or on the Earth's crust. They include invertebrate, plant, trace, or vertebrate fossils, which constitute a fragile and nonrenewable record of the history of life. The Bureau of Land Management (BLM) may provide expertise to other federal agencies, such as the BIA, for managing paleontological resources and permitting paleontological research.

Soil resources are described using the characteristics and distribution of soil types in the planning area that may affect the use and management of the land and the quality of surface water, air, forage, and tree growth. Soil characteristics are important to consider when siting construction activities, such as oil and gas well development, road construction, and building placement. They are also important considerations when planning road development, rangeland and timber stand improvements, and surface water quality protection by minimizing erosion and stabilizing the soil surface.

3.2.1 Regulatory Framework

Topography

There are no specific regulations and guidelines for topography critical for National Environmental Policy Act (NEPA) compliance. Topography is listed as a topic for discussion in accordance with the BIA NEPA handbook.

Geology

There are no specific regulations and guidelines for geology or geologic hazards critical for NEPA compliance. Geology is listed as a topic for discussion in accordance with the BIA NEPA handbook. There are specific construction requirements specified in federal building codes to reduce impacts of earthquakes; mandates and authority on mineral development are found in 25 Code of Federal Regulations [CFR], Part 226, Leasing of Osage Reservation Lands for Oil and Gas Mining.

Paleontology

The Paleontological Resource Preservation Act of 2009 codified specific protection for paleontological resources that provide information about the history of life on Earth. It mandated the management and preservation of those resources using scientific principles and expertise. Furthermore, the act created criteria for issuing paleontological collection permits and directed the Secretaries of the Interior and Agriculture to ensure paleontological resources discovered on federal lands are curated properly into the collections of approved institutions.

The Paleontological Resource Preservation Act applies to federal lands only and does not affect private, tribal or allotted lands. It provides the authority to protect paleontological resources on federal lands and includes criminal and civil penalties for fossil theft and vandalism. In addition, NEPA requires that "important historic, cultural and natural aspects of our national heritage" be protected.

Finally, the Indian Affairs Manual, Part 59, Chapter 7, Paleontological Resources, establishes policy on the specific requirements and responsibility of Indian Affairs headquarters and field staff for protecting and managing paleontological resources on Indian lands (BIA 2012b).

Soils

The following statutes, regulations, handbooks, and other policies govern soil resources:

- 25 CFR, Parts 200-227, Energy and Minerals
- Soil Conservation and Domestic Allotment Act of 1935, as amended
- Soil and Water Resources Conservation Act of 1977
- The American Indian Agricultural Resource Management Act, Public Law 103-177
- Indian Self Determination Act, Public Law 93-638
- The Indian Affairs Manual Part 59, Environmental and Cultural Resources Management

3.2.2 Current Conditions

Topography

Osage County's terrain is characterized by gently rolling rocky hills, bisected by the lowlands of the Arkansas River and its major tributaries. The average elevation of the county is about 860 feet and ranges from a maximum of 1,407 feet northeast of Foraker to around 590 feet in the lowlands (BIA 1979). The highest elevation range, 1,116 feet or greater, is shown to be the predominant elevation of the northwest areas of Osage County. This portion of the county stretches along State Highway 18 from north of US Highway 60 and includes the Kaw Wildlife Management Area (WMA), the John Dahl WMA, and the towns of Webb City, Shidler, and Grainola. The range of 985 feet to 1,115 feet is commonly found along the ridgelines of the drainage basins of the major creeks that begin in the northwest portion of the county and flow southeasterly (Osage County 2011).

The degree of slope in Osage County is shown on **Figure 3-1**, and the acres by slope gradient are shown on **Table 3-1**. In general the county is flat, with mostly 0 to 15 degree slopes, but in some of these areas the land slopes in the

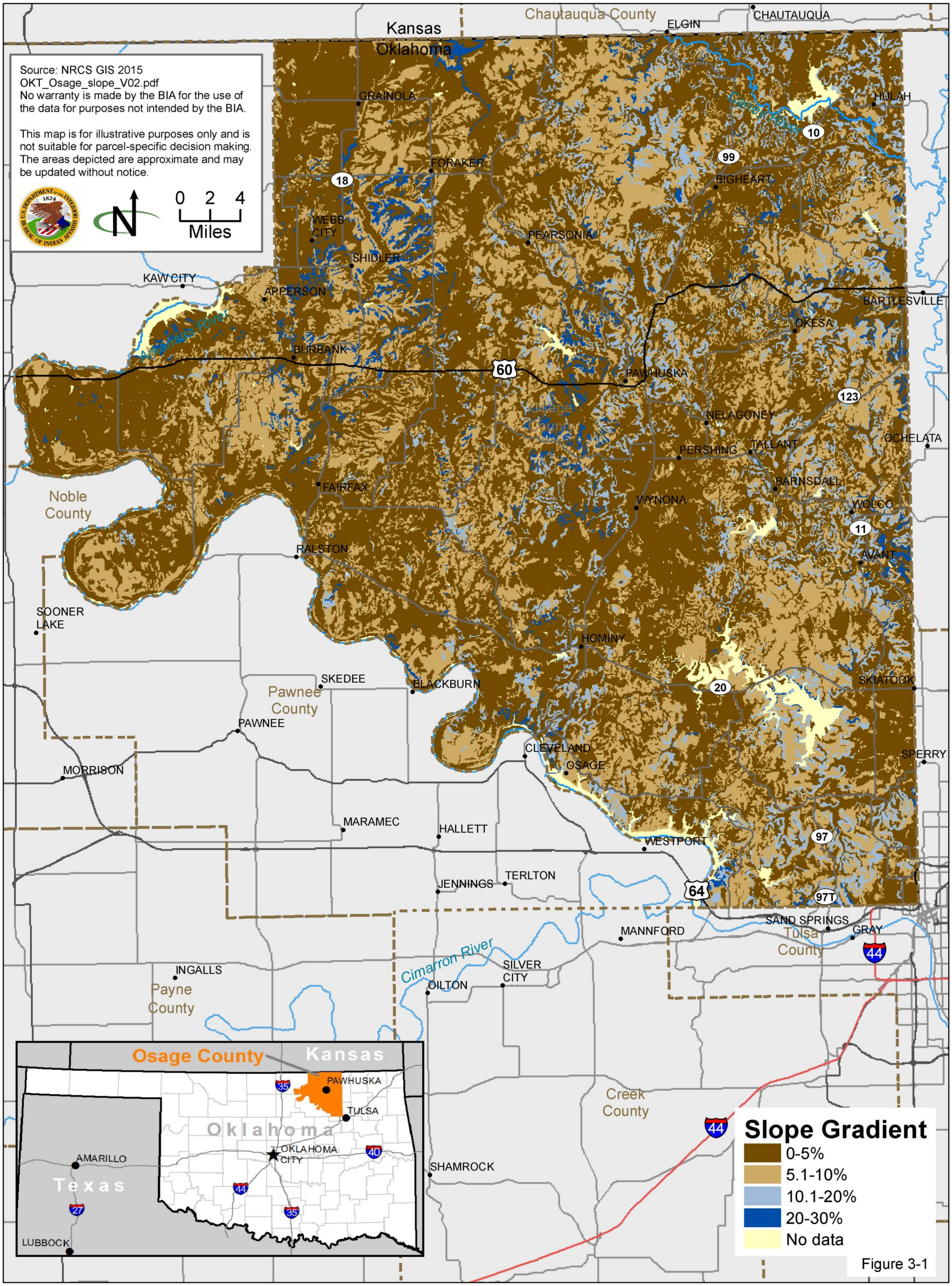

Source: NRCS GIS 2015
OKT_Osage_slope_V02.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
ELGIN
CHAUTAUQUA
GRAINOLA
HULAH
FORAKER
BIGHEART
WEBB CITY
SHIDLER
PEARSONIA
KAW CITY
APPERSON
Arkansas River
BURBANK
PAWHUSKA
OKESA
BARTLESVILLE
NELAGONEY
PERSHING
TALLANT
OCHELATA
BARNSDALL
FAIRFAX
WYNONA
WOLCO
AVANT
Noble County
RALSTON
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
Pawnee County
PAWNEE
SKIATOOK
CLEVELAND
OSAGE
SPERRY
MORRISON
MARAMEC
HALLETT
WESTPORT
JENNINGS
TERLTON
MANNFORD
SAND SPRINGS
GRAY
Tulsa County
Cimarron River
INGALLS
SILVER CITY
OILTON
Payne County
Creek County
SHAMROCK
Osage County
Kansas
PAWHUSKA
TULSA
Oklahoma
OKLAHOMA CITY
AMARILLO
Texas
LUBBOCK
Slope Gradient
0-5%
5.1-10%
10.1-20%
20-30%
No data

Figure 3-1

Table 3-1
Slope Gradient

Percent Slope	Acres
0-5	199,000
5.1-10	441,400
10.1-20	109,500
20.1-30	41,700

Source: NRCS GIS 2015

upper end of the slope gradient range. This can be considered severely sloping for purposes of construction without incorporating specific site planning measures (Osage County 2011).

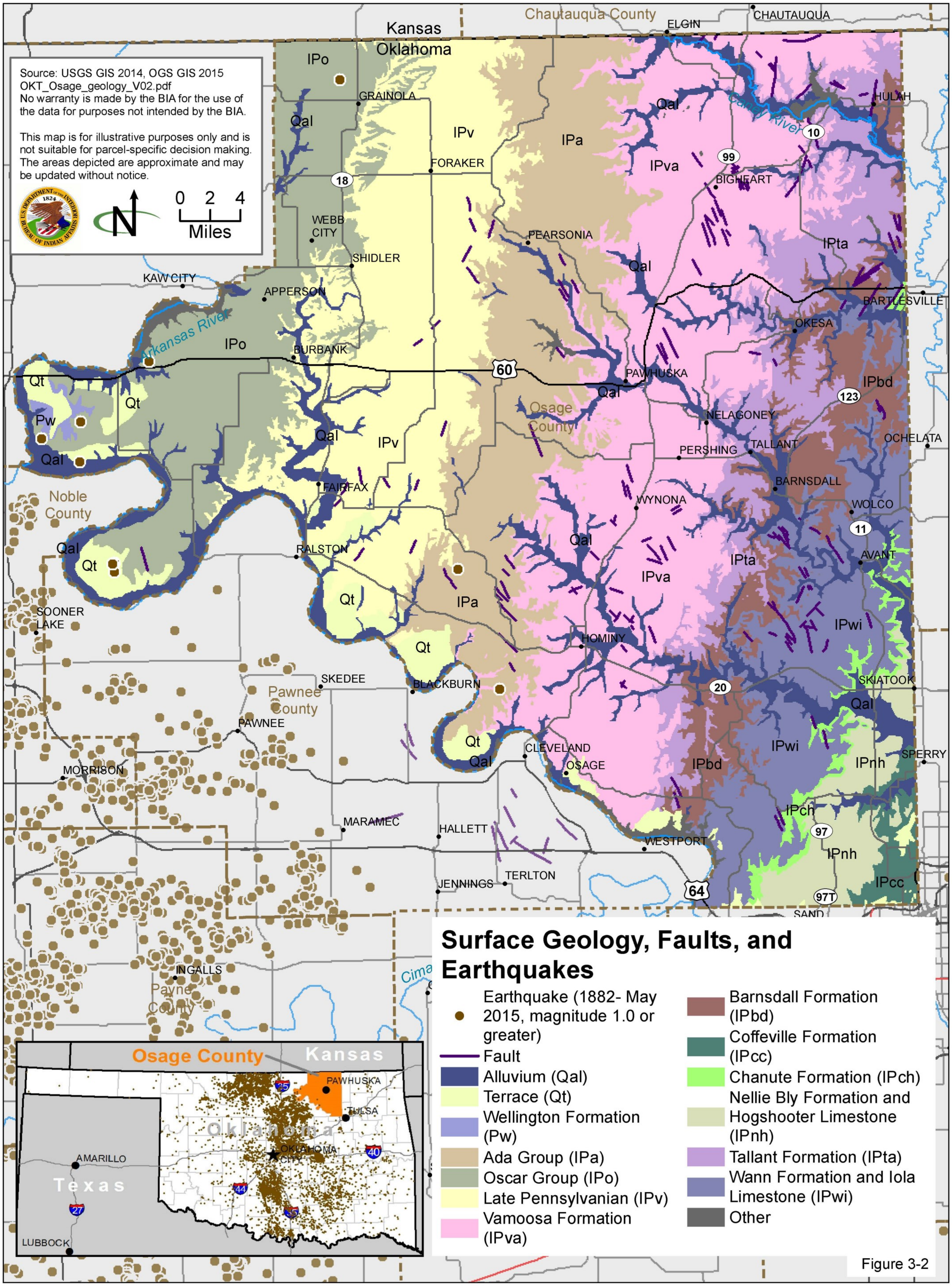
A slope of 5 to 10 percent presents moderate constraints to nonresidential land developments (Osage County 2011). Slopes of 11 to 20 percent can be impracticable for other than lower density residential or certain park and open space activities. Development in these areas requires careful engineering and construction techniques to ensure that the development constraints are properly addressed (Osage County 2011).

Geology

A geomorphic province is part of the Earth's surface, where a suite of rocks with similar geologic character and structure underwent similar geologic history and where present-day character and landforms differ significantly from adjacent provinces (Johnson 2008). Osage County is in the Interior Plain division of the Central Lowlands physiographic/geomorphic province. This area is characterized by low-relief plains, punctuated by east-facing escarpments formed by cuestas, with mixed-grass prairie in the west, transitioning to mixed tall grass savannahs and woodlands in the east (USGS 2014).

The northwestern part of the county is in the Northern Limestone Cuesta Plains subdivision, characterized by thin, Permian limestone-capped, west-dipping cuestas rising above broad shale plains (Johnson 2008). The southeastern portion is in the Eastern Cuesta Plains subdivision, characterized by west-dipping, Pennsylvanian sandstone-formed cuestas that overlook broad shale plains (Johnson 2008). The bedrock formations of this area are stereotypically intermixed with layers of sandstone, shale, and thin limestone outcrops, and the bedrock outcrop formations are mainly of the Upper Pennsylvanian and Lower Permian age structures (BIA 2014).

Surface geology strata (see **Figure 3-2**; **Table 3-2**) consist primarily of Quaternary (2.5-0.005 millions of years ago [Ma]), Permian (298-252 Ma), and Pennsylvanian (323-298 Ma; USGS 2003a). Details of the formation were obtained from the US Geological Survey (USGS) Mineral Resources On-Line Spatial Data database (USGS 2015a). The most westerly formation is


Source: USGS GIS 2014, OGS GIS 2015
OKT_Osage_geology_V02.pdf
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0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
Noble County
Pawnee County
Payne County
Osage County
Arkansas River
Caney River
ELGIN
CHAUTAUQUA
HULAH
GRAINOLA
FORAKER
BIGHEART
WEBB CITY
PEARSONIA
SHIDLER
KAW CITY
APPERSON
BARTLESVILLE
OKESA
BURBANK
PAWHUSKA
NELAGONEY
OCHELATA
PERSHING
TALLANT
FAIRFAX
BARNSDALL
WYNONA
WOLCO
RALSTON
AVANT
SOONER LAKE
HOMINY
SKIATOOK
SKEDEE
BLACKBURN
PAWNEE
CLEVELAND
OSAGE
SPERRY
MORRISON
MARAMEC
HALLETT
WESTPORT
JENNINGS
TERLTON
SAND
INGALLS
IPo
Qal
IPv
IPa
IPva
IPta
IPbd
Qt
Pw
IPwi
IPnh
IPch
IPcc
18
60
99
10
123
11
20
97
64
97T
Surface Geology, Faults, and Earthquakes
Earthquake (1882- May 2015, magnitude 1.0 or greater)
Fault
Alluvium (Qal)
Terrace (Qt)
Wellington Formation (Pw)
Ada Group (IPa)
Oscar Group (IPo)
Late Pennsylvanian (IPv)
Vamoosa Formation (IPva)
Barnsdall Formation (IPbd)
Coffeville Formation (IPcc)
Chanute Formation (IPch)
Nellie Bly Formation and Hogshooter Limestone (IPnh)
Tallant Formation (IPta)
Wann Formation and Iola Limestone (IPwi)
Other
Osage County
Kansas
PAWHUSKA
TULSA
Oklahoma
OKLAHOMA CITY
AMARILLO
Texas
LUBBOCK
35
40
44
27

Figure 3-2

Table 3-2
Major Surface Stratigraphic Units in Osage County, Northeastern Oklahoma

Time-Stratigraphic Unit	Group	Surficial Deposits and Formations	Lithology	Thickness (Feet)
Quaternary		Alluvium	Gravel to clay	0-80
		Terrace	Gravel to clay	0-95
Permian	Summer Group	Wellington Formation	Shale, sandstone	0-850
Pennsylvanian	Oscar Group	Numerous	Shale, limestone, sandstone	0-400
	Vanoss Group	Numerous	Limestone, shale, sandstone	0-500
	Ada Group	Numerous	Shale, limestone, sandstone	0-300
		Vamoosa Formation	Shale, sandstone, limestone	0-500
		Tallant Formation	Shale, sandstone	75-250
		Barnsdall Formation	Sandstone, shake	45-200
		Wann Formation	Shale, sandstone, limestone	50-400
		Iola Limestone	Limestone, sandstone, shale	4-100
		Chanute Formation	Sandstone, shale	10-150
		Dewy Limestone	Limestone, shale	0-60
		Nelly Bly Formation	Shale, sandstone	80-550
		Hogshooter Limestone	Limestone	1-50
		Coffeyville Formation	Shale, sandstone	175-470
		Checkerboard Limestone	Limestone	2-15
		Upper Holdenville Formation	Shale, sandstone, limestone	40-250
Mississippian		Pitkin Limestone	Limestone	—
		Fayetteville Shale	Shale	—
		Batesville Formation	Sandstone	—
		Hindsville Limestone	Limestone	—
		Moorefield Formation	Shale	—
		Koekuk Limestone	Limestone	—
		Reeds spring Formation	Limestone	0-100
		St. Joe Formation	Limestone	0-50
Mississippian/Devonian		Chattanooga Shale	Shale	0-30
Ordovician	Simpson Group	Bromide Formation	Shale	0-30
		Tulip Creek Formation	Limestone, shale, sandstone	—
		McLish Formation		—
		Oil Creek Formation		—
		Joins Formation		—
		West Spring Creek Formation	Dolomite	200-1,500
		Kindblade Formation	Dolomite	
		Cool Creek Formation	Dolomite	
		McKenzie Hill Formation	Dolomite	
Upper Cambrian	Arbuckle Group	Butterfly Formation	Dolomite	
		Signal Mountain Formation	Dolomite	
		Royer Dolomite	Dolomite	
		Fort Sill Limestone	Dolomite	

Source: USGS 2014

Quaternary Alluvium (loose gravel, sand, or clay deposited by streams) along the Arkansas River and around Kaw Lake (Osage County 2011). This formation is overlain with a large area of the Oscar Group (shale with many layers of limestone with sandstone) and patches of terrace deposits (alluvial deposits on one or more terrace levels of unconsolidated gravels, sand, silt, and clay).

To the east of the Oscar Group is the Vanoss Group (alternating layers of limestone and shale) and then the Ada Group (orange-brown fine-grained sandstone and red-brown to gray shale). The Ada Group is bounded on the east by a wide band of the Vamoosa Formation (alternating layers of shale and fine- to coarse-grained sandstone, with some limestone). East of the Vamoosa Group is a narrow band of the Tallant Formation (alternating layers of shale and sandstone), followed by a similar narrow band of the Barnsdall Formation (fine- to medium-grained sandstone, overlain by shale). This in turn is followed by Wann limestone (shale and fine- to medium-grained sandstone, with many thin layers of fossiliferous limestone) and Iola limestone (limestone, calcareous sandstone, and shale and underlying Wann).

The southeast areas of the county are the Nellie Bly Formation (shale with a few layers of fine- to medium-grained sandstone), Hogshooter limestone (crinoidal limestone underlying Nellie Bly), and the Coffeyville Formation (shale interbedded with fine- to medium-grained sandstone). **Table 3-2** gives additional details of the stratigraphy in the planning area.

Mineral Resources

Oil and gas production in the county comes mainly from formations at depths of between 200 and 3,000 feet. The Burbank and Bartlesville Sands, Mississippi Chat, and Arbuckle Group are among the formations that oil and gas have been produced from. The Burbank and Bartlesville Sands are Pennsylvanian or younger aged sandstone bodies that are up to 15 miles long and several miles wide, and up to 200 feet in thickness. Both of these sands occur in the Cherokee Group, which includes several other sands, limestones, and coal beds (Thorman and Hibpshman 1979).

The Bartlesville sand occurs at 1,400 feet in depth, and the Burbank sand occurs at 3,100 feet (Jordan 1957). The Mississippi Chat is a Pennsylvanian or younger aged basal unit, consisting mainly of conglomerate derived from underlying Mississippi lime, with an irregular channel of siliceous deposits that vary rapidly in thickness from 0 to 100 feet, and from 3,000 to 6,000 feet below the surface (Thorman and Hibpshman 1979; IPPA 2015). The Arbuckle Group ranges in age from the Late Cambrian to Early Ordovician and is composed of interbedded limestone, dolomite, and sandstone units, up to 1,200 feet thick.

Additionally, shale and limestone are quarried at some surface outcrops of these rocks, and sand and gravel are recovered from alluvial deposits along the Arkansas River and the major tributary streams.

Geologic Hazards

Faults and Earthquakes

Faults are discontinuous features in a volume of rock, typically expressed as a fracture or break, with a surficial expression fault line. Faults are rarely individual occurrences; they are more typically formed in a fault zone and result when a body of rock breaks under stress, which most causes an earthquake. Fault lines are concentrated on the central, south-central, and eastern areas of Osage County.

Earthquakes are ground-shaking events that occur at various magnitudes as a result of movement within the Earth's crust that releases seismic waves. Earthquakes can vary from slight tremors to building-collapsing events, as shown on the Modified Mercalli Intensity Scale (**Table 3-3**); fault lines and recorded earthquakes in and adjacent to the planning area are shown on **Figure 3-2**.

Earthquakes are either induced through human activities or occur naturally. Since the mid-1960s, oil and gas development, specifically the injection of fluids into the subsurface, has been known to induce earthquakes (Weingarten et al. 2015). The hazard from these earthquakes was traditionally considered small due to their infrequency and small magnitude, but several damaging earthquakes have occurred since 2011 (Weingarten et al. 2015).

Earthquake activity has increased in the central United States, rising from an average of 24 earthquakes per year with a magnitude of 3 or greater from 1973 to 2008 to an average of 193 magnitude 3 or greater earthquakes per year from 2009 to 2014. In 2014 there were 688 earthquakes (Rubinstein and Mahani 2015). Many of these are believed to have been induced by wastewater or saltwater disposal wells (Rubinstein and Mahani 2015; Weingarten et al. 2015).

According to the Oklahoma Geological Society, Oklahoma earthquakes totaled 1,701 from 1977 to 2005; only 5 took place in Osage County (Osage County 2011). However, the seismicity rate in 2013 was 70 times greater than the background seismicity rate observed in Oklahoma before 2008. The current seismicity rate is approximately 600 times greater than the background rate. According to the Oklahoma Geological Survey, it is very unlikely that this increase is due to natural processes. The Oklahoma Geological Survey (OGS) considers it very likely that "the majority of recent earthquakes, particularly those in central and north-central Oklahoma, are triggered by the injection of produced water in disposal wells." Oil and gas plays in these areas are characterized by large amounts of produced water (OGS 2015).

Table 3-3
Modified Mercalli Intensity Scale

Value	Summary Damage Description Used on Maps	Description of Shaking Severity	Full Description, Shortened from *Elementary Seismology*
I	Not mapped	Not mapped	Not felt.
II	Not mapped	Not mapped	Felt by people seated or those on the upper floors of buildings.
III	Not mapped	Not mapped	Felt by almost all indoors. Hanging objects swing. Vibration is like that of a passing light truck. It may not be recognized as an earthquake.
IV	Not mapped	Not mapped	Vibration feels like a passing heavy truck. Stopped cars rock; hanging objects swing; windows, dishes, and doors rattle and glasses clink. In the upper range of IV, wooden walls and frames creak.
V	Light	Pictures move	Felt outdoors. Sleepers are wakened. Liquids are disturbed, some spilled. Small unstable objects are displaced or upset. Doors swing; pictures move; pendulum clocks stop.
VI	Moderate	Objects fall	Felt by all. People walk unsteadily. Many become frightened. Windows crack; dishes, glassware, knickknacks, and books fall off shelves; pictures fall off walls; furniture is moved or overturned. Weak plaster, adobe buildings, and some poorly built masonry buildings crack. Trees and bushes shake visibly.
VII	Strong	Nonstructural damage	Difficult to stand or walk and is noticed by drivers. Furniture is broken. Poorly built masonry buildings are damaged. Weak chimneys break at the roof line. Plaster, bricks, stones, tiles, cornices, unbraced parapets, and porches fall. Some cracks appear in better masonry buildings. Waves are generated on ponds.
VIII	Very strong	Moderate damage	Drivers' ability to steer is affected. Extensive damage to unreinforced masonry buildings, including partial collapse, and some masonry walls fall. Chimneys and monuments are twisted and fall. Wood-frame houses move on foundations if not bolted; loose partition walls are thrown out. Tree branches break.
IX	Violent	Heavy damage	General panic. Damage to masonry buildings ranges from collapse to serious damage, unless buildings are of modern design. Wood-frame structures rack and, if not bolted, shift off foundations. Underground pipes break.
X	Very violent	Extreme damage	Poorly built structures are destroyed with their foundations. Even some well-built wooden structures and bridges are heavily damaged and need to be replaced. Water is thrown on water body banks.
XI	Not mapped because these intensities are typically limited to areas with ground failure.		Rails are bent greatly. Underground pipelines are completely out of service.
XII	Not mapped because these intensities are typically limited to areas with ground failure.		Damage is nearly total. Large rock masses are displaced. Lines of sight and level are distorted. Objects are thrown into the air.

Source: Richter 1958

Hydrogen Sulfide

Oil and gas exploration and development can release hydrogen sulfide (H_2S) gas from geologic formations, which can be a public health and safety hazard. This is a colorless gas with the characteristic foul odor of rotten eggs. It is heavier than air, corrosive, flammable, explosive, and very poisonous. At low concentrations it can irritate the eyes and act as a depressant; at high concentrations it can irritate the upper respiratory tract and, during long exposure, lead to pulmonary edema (USGS 2010). A 30-minute exposure to 500 parts per million (ppm) results in headache, dizziness, excitement, staggering gait, and diarrhea, followed sometimes by bronchitis or bronchopneumonia (USGS 2010).

Overpressure Zones

Overpressure zones are areas where subsurface pressure is abnormally high and exceeds hydrostatic pressure at a given depth, usually in buried fluid-filled sediments. This could result in the rapid escape of the over-pressured fluids, leading to a well blowout, which can harm individuals on the drilling rig (Schlumberger 2015).

Zones of Lost Circulation

Lost circulation is the reduced or total absence of returning fluid flow during drilling, generally classified as seepage (less than 3 cubic meters per hour [m^3/hr]), partial loss returns (greater than 3 m^3/hr), and total loss, where no fluid returns (Schlumberger 2015). The loss of fluid generally translates into financial loss to the drilling company, well damage, and potential risk to the drilling rig and personnel.

Paleontology

During the Early and Middle Paleozoic, a shallow sea covered the planning area and supported small marine animals, such as brachiopods, trilobites, mollusks, and crinoids. Late in the Paleozoic (Carboniferous/Pennsylvanian), vast swampy deltas were deposited by rivers supporting amphibians and early reptiles and developing a rich growth of vegetation that would later become coal seams. Periodically, the sea would alternately return and retreat, resulting in the cyclic deposition pattern of shales, limestones, and sandstones. Rare fossils of insects, amphibians, and reptiles and vertebrate footprints have been collected from Late Paleozoic rocks in Oklahoma (The Paleontology Portal 2015).

During the Mesozoic, Oklahoma lay above sea level, with the western and southeastern portions being covered again by the sea during the Late Mesozoic. Fossils from these marine deposits include oysters, ammonites, sand dollars, and shark teeth.

During the Early Cenozoic (Tertiary), the Rocky Mountains were being pushed up to the west, causing a period of broad gentle uplift in Oklahoma and surrounding areas. Rivers draining off the rising mountains carried extensive sand and gravel deposits and filled wide shallow valleys. These sediments and rocks contain a rich vertebrate fossil record, including a large assortment of fossil mammals and petrified wood. Quaternary fossils in the planning area are clams and snails and the teeth and bones of horses, camels, bison, and mammoths (The Paleontology Portal 2015).

Potential fossil yield classification maps have not been completed for the planning area. The BIA has not done a paleontological investigation in the planning area because of the limited area subject to BIA surface management and the types of activities that this management typically permits. There is a geological potential for fossils, especially for Pennsylvanian epoch fossils, but there has been relatively little formal investigation.

Soils

Soils are grouped on the basis of soil characteristics, including permeability, percolation, ponding, drainage conditions, shrink-swell potential, depth to cemented pan, depth to hard/soft bedrock, soil texture, flooding frequency, filtering capacity, topography, seepage, subsistence, and organic content. These characteristics also influence their adaptation to non-agricultural uses for roads, residences, and small commercial structures and septic tank absorption. Soils are considered healthy when they are able to support region-specific vegetative communities (i.e., appropriate drainage, porosity, and salinity) and are not eroding at rates above what is considered natural for that specific soil type.

Map units are identified during soil surveys at the county level, which can be used for management involving site-specific disturbance. Soil map units may be designated based on the soil's series, slope, aspect, or texture. Soil series are two or more geographically associated soils that have similar formation, chemistry, or physical properties. Examples of soil series properties are runoff capabilities, erosion hazards, associated native vegetation, wildlife habitat, and suitability for community development.

In 2012, the US Department of Agriculture, Natural Resources Conservation Service (NRCS) conducted a complete and detailed soil survey of Osage County. There are 71 soil map units in the planning area, but only 8 that cover 3 percent or more of the planning area, which together total 66 percent (NRCS GIS 2015). These 8 dominant soil map units, along with a brief description of their characteristics, are listed in **Table 3-4** and shown in **Figure 3-3**.

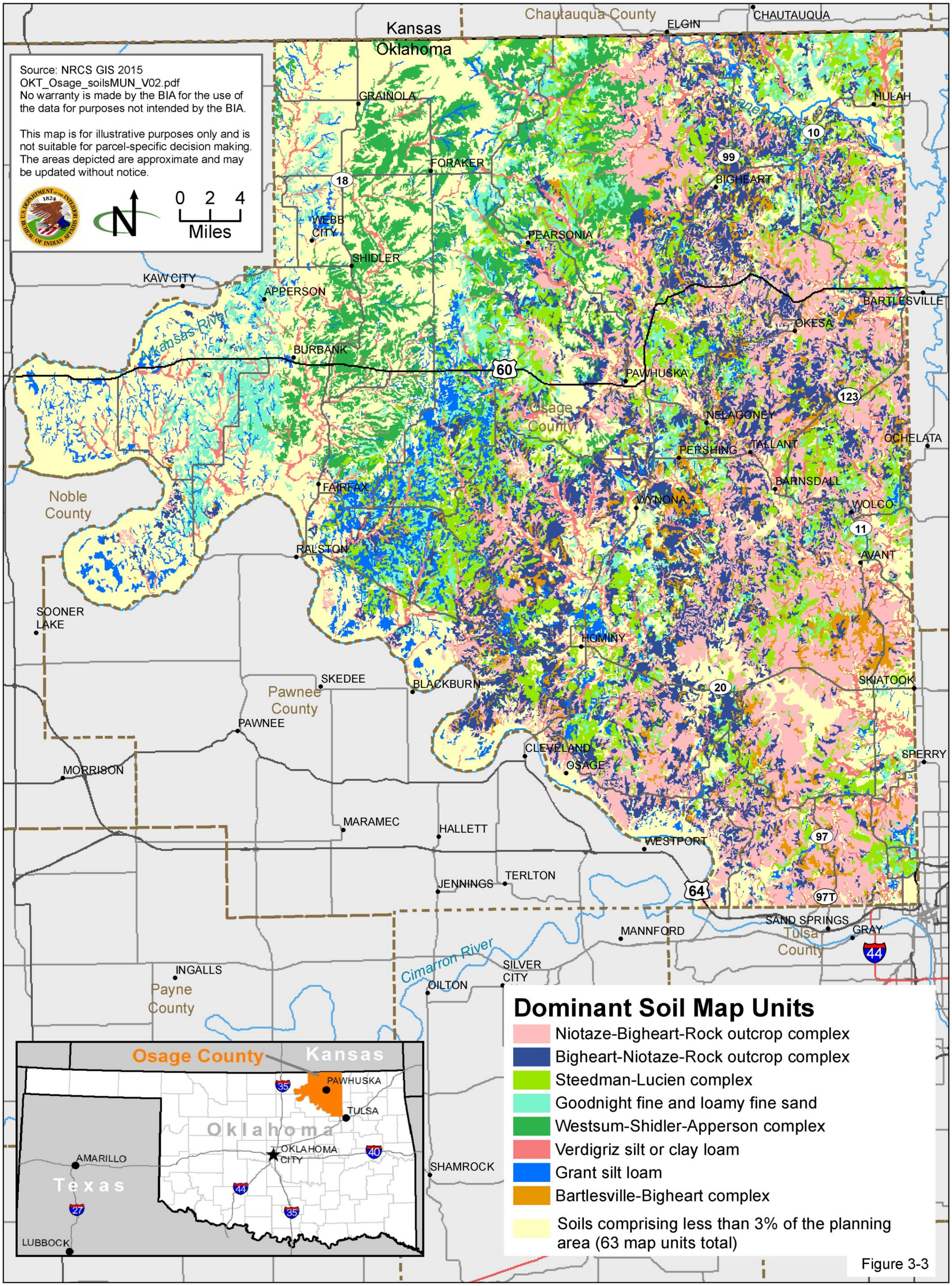
The characteristics and distribution of soil types in the planning area affect the use and management of the land and the quality of surface water, air, forage, and tree growth. Soil characteristics are important to consider when siting construction locations, such as those for oil and gas well development, roads, and buildings.

Sensitive soils are those with characteristics that make them more susceptible to impacts or that make them more difficult than healthy soils to restore or reclaim after disturbance. Sensitive soils in the planning area are susceptible to increased erosion rates. Steep slopes are discussed under *Topography*, above.

Table 3-4
Dominant Soil Map Units

Map Unit Name	Description	Acres	Percent of Planning Area
Niotaze-Bigheart-Rock outcrop complex, 3 to 45 percent slope	Niotaze—Loamy colluvium derived from sandstone over clayey residuum weathered from shale; depth to bedrock: 20-40 inches (densic) or 31-79 inches (paralithic); somewhat poorly drained Bigheart—Residuum weathered from sandstone; depth to bedrock: 10-20 inches; well drained	229,900	15.9
Bigheart-Niotaze-Rock outcrop complex, 1 to 8 percent slopes	Niotaze—Loamy colluvium derived from sandstone over clayey residuum weathered from shale; depth to bedrock: 20-40 inches (densic) or 31-79 inches (paralithic); somewhat poorly drained Bigheart—Residuum weathered from sandstone; depth to bedrock:10-20 inches; well drained	178,900	12.3
Steedman-Lucien complex, 3 to 25 percent slopes	Steedman—Clayey residuum weathered from sandstone and shale; depth to bedrock: 20-40 inches; moderately well drained Lucien—Loamy residuum weathered from sandstone and shale; depth to bedrock: 10-20 inches; well drained	146,600	10.1
Goodnight loamy fine sand, fine sand, and loamy fine sand, 3 to 15 percent slopes	Reworked stabilized dunes adjacent to floodplains of major streams in the Central Rolling Red Prairie; depth to bedrock: greater than 80 inches; excessively drained	99,300	6.9
Westsum-Shidler-Apperson complex, 3 to 12 percent slopes	Westsum—Calcareous clayey residuum weathered from shale; depth to bedrock: greater than 60 inches; well drained Shidler—Loamy residuum weathered from cherty limestone; depth to bedrock: 4-20 inches; well drained Apperson—Calcareous clayey residuum weathered from limestone; depth to bedrock: 40-60 inches; somewhat poorly drained	96,800	6.7
Verdigriz silt or clay loam, 0 to 1 percent slopes, frequently or occasionally flooded	Very deep soils that formed in silty alluvium on floodplains in the Cherokee Prairies; depth to redox concentrations where present: 20 to more than 60 inches; well drained	88,700	6.1
Grant silt loam, 1 to 5 percent slopes, (some eroded)	Deep, moderately permeable soils that formed in material weathered predominantly from siltstone or silty shale of Permian age; depth to paralithic contact: 40-60 inches; well drained	77,600	5.4
Bartlesville-Bigheart complex, 1 to 5 percent slopes, very rocky	Bartlesville—Loamy residuum weathered from sandstone; depth to bedrock (paralithic): 20-29 inches; well drained Bigheart—Residuum weathered from sandstone; depth to bedrock: 10-20 inches; well drained	43,800	3.0

Source: NRCS GIS 2015



Chautauqua County
ELGIN
CHAUTAUQUA
Kansas
Oklahoma
Source: NRCS GIS 2015
OKT_Osage_soilsMUN_V02.pdf
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0 2 4
Miles
GRAINOLA
HULAH
FORAKER
BIGHEART
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PEARSONIA
SHIDLER
KAW CITY
APPERSON
BARTLESVILLE
OKESA
Arkansas River
BURBANK
60
PAWHUSKA
123
Osage County
NELAGONEY
OCHELATA
PERSHING
TALLANT
BARNSDALL
FAIRFAX
Noble County
WYNONA
WOLCO
11
RALSTON
AVANT
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
SKIATOOK
Pawnee County
20
PAWNEE
CLEVELAND
OSAGE
SPERRY
MORRISON
MARAMEC
HALLETT
WESTPORT
97
TERLTON
JENNINGS
64
97T
SAND SPRINGS
MANNFORD
GRAY
Tulsa County
44
Cimarron River
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OILTON
Payne County
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AMARILLO
Texas
LUBBOCK
SHAMROCK
Dominant Soil Map Units
Niotaze-Bigheart-Rock outcrop complex
Bigheart-Niotaze-Rock outcrop complex
Steedman-Lucien complex
Goodnight fine and loamy fine sand
Westsum-Shidler-Apperson complex
Verdigriz silt or clay loam
Grant silt loam
Bartlesville-Bigheart complex
Soils comprising less than 3% of the planning area (63 map units total)

Figure 3-3

Accelerated erosion is usually in response to a land use practice that causes excessive runoff from even normal intensity storms. This type of erosion persists and worsens until the land use practice is corrected or mitigated. Any land use activity that leads to bare soil or increased impervious areas can cause erosion to accelerate. Soils that are susceptible to erosion may require the addition of protective measures to prevent excessive erosion.

Table 3-5 shows the acres of soils susceptible to natural erosion in the planning area. Soils assigned to Group 1 are most susceptible to wind erosion, and those assigned to Group 8 are least susceptible. Additionally, **Table 3-6** shows the relative potential erosion hazard for the map unit when used as a site for forest roads and trails. The erosion hazard is expressed as the rating class for the dominant component in the map unit, based on composition percentage of each map unit component. Map units with moderate or severe ratings would need additional management to prevent excessive erosion.

Soils in the planning area have been impacted by oil and gas leasing for the past 100 years. Impacts are as follows (USGS 2003b):

- Surface disturbance and soil compaction related to the construction of oil and gas operations and ancillary facilities
- Salt scarring
- Tree kills
- Soil salinization
- Brine and petroleum contamination from improper disposal or accidental release of large volumes of saline water produced in association with oil and gas production

Before federal regulations were instituted in the 1970s, produced waters were often discharged into streams, creeks, and unlined evaporation ponds, causing salt scars and surface and groundwater pollution (USGS 2003b). These waters are highly saline (total dissolved solids may exceed 350,000 milligrams per liter dissolved solids), may contain toxic metals, organic, and inorganic components, and radium-226/228, and other naturally occurring radioactive materials.

Currently, contaminated water generally comes from accidental hydrocarbon and produced water releases and from incorrectly sealed abandoned wells (USGS 2003b). Areas with salt scarring or petroleum (oil) contamination are unable to support vegetation, leaving the soils susceptible to erosion. To gauge the potential success of restoration, soil salt content, nutrients, organic matter, petroleum hydrocarbons, and bacterial activity at individual sites would need to be measured.

Table 3-5
Wind Erodibility Group

Group	Acres
1: Very fine sand, fine sand, sand, or coarse sand	0
2: Loamy very fine sand, loamy fine sand, loamy sand, and loamy coarse sand; very fine sandy loam and silt loam with 5 percent or less clay and 25 percent or less very fine sand, and sapric soil materials, except folists	34,500
3: Very fine sandy loam (but does not meet wind erodibility group criterion 2), fine sandy loam, sandy loam, and coarse sandy loam; noncalcareous silt loam that has greater than or equal to 20 to less than 50 percent very fine sand and greater than or equal to 5 percent to less than 12 percent clay	308,500
4: Clay, silty clay, noncalcareous clay loam that has more than 35 percent clay and noncalcareous silty clay loam that has more than 35 percent clay; none of these have sesquic, parasesquic, ferritic, ferruginous, or kaolinitic mineralogy (high iron oxide content)	24,900
5: Noncalcareous loam that has less than 20 percent clay; noncalcareous silt loam with greater than or equal to 5 percent to less than 20 percent clay (but does not meet wind erodibility group criterion 3); noncalcareous sandy clay loam; noncalcareous sandy clay; and hemic soil materials	133,500
6: Noncalcareous loam and silt loam that have greater than or equal to 20 percent clay; noncalcareous clay loam and noncalcareous silty clay loam that have less than or equal to 35 percent clay; silt loam that has parasesquic, ferritic, or kaolinitic mineralogy	586,800
7: Noncalcareous silt; noncalcareous silty clay, noncalcareous silty clay loam, and noncalcareous clay that have sesquic, parasesquic, ferritic, ferruginous, or kaolinitic mineralogy and are oxisols or ultisols; and fibric soil materials	339,400
8: Soils not susceptible to wind erosion due to rock and pararock fragments at the surface or wetness and folists	43,800

Source: NRCS GIS 2015

Table 3-6
Erosion Hazard Ratings for Roads

Rating	Acres
Not rated	40,600
Slight	499,500
Moderate	776,100
Severe	158,300

Source: NRCS GIS 2015

3.2.3 Trends

Topography

Topography and knowledge of topography are expected to remain the same, with buildings and ancillary facilities being built on a site-specific basis, with the implementation of additional construction techniques or careful engineering as needed.

Geology

An increased understanding of area geology and geologic hazards can be expected as more knowledge is gained through oil and gas exploration and drilling and through geologic mapping.

Paleontology

Continued mineral estate development could lead to more discoveries but also to potential adverse impacts on the resource. The increase of use or activities in sensitive areas would require additional measures to manage these resources according to BIA policy and laws. The scientific, educational, and recreational value of any discovered or known paleontological resource should be determined on-site by careful examination and evaluation by a paleontological resource specialist.

Soils

Soils in the planning area are affected by the development of fluid mineral resources. Minerals extraction generally involves disturbing the surface and impacting soil resources; adverse impacts can be long term. Disturbance is associated with such activities as pipeline installation, power line construction, seismic exploration, and exploratory drilling. The development of rights-of-way (ROWs) can include a number of surface-disturbing activities, such as road building, trenching, and construction site clearing.

All of these activities have the potential to create both short-term and long-term impacts on soils. The cumulative extent of surface disturbance or vegetative manipulation that can be supported by soils in the planning area has not been determined. Interim reclamation, or projects aimed at returning the environment to a more natural state through regrading, reseeding, and reestablishing vegetation after the necessary disturbance of an individual project. Best management practices through the life of an individual project would reduce cumulative impacts.

3.3 Water Resources

3.3.1 Regulatory Framework

The following federal laws, statutes, mandates, and authorities govern water resources:

- Appropriations Act of 1952, McCarran Amendment

- Federal Water Pollution Control Act (commonly referred to as the Clean Water Act [CWA]), as amended (33 United States Code [USC], Sections 1251-1387)
- Safe Drinking Water Act of 1974 (42 USC, Section 201)
- Economy Act of 1932, as amended
- Watershed Protection and Flood Prevention Act of 1954, as amended
- Water Resources Development Act of 1974
- Water Resources Planning Act of 1965, as amended
- Water Resources Research Act of 1954, as amended
- Soil and Water Resources Conservation Act of 1977 (Pub. L. 95-87, 91 Stat. 1407, November 8, 1977, 16 USC, Section 2000 et seq.)
- Executive Order (EO) 11514, as amended by EO 11991, Protection and Enhancement of Environmental Quality, March 5, 1970
- EO 11988, as amended by EO 12148, Floodplain Management, May 24, 1977
- EO 11990, Protection of Wetlands, May 24, 1977
- EO 12088, Federal Compliance with Pollution Control Standards, October 13, 1978
- EO 12322, Water Resources Projects, September, 17, 1981
- President's Letter of May 26, 1974 (created the Interagency Committee on Water Resources and established interagency participation in river basin planning)
- The Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management (*Federal Register*, October 18, 2000)

3.3.2 Current Conditions

The primary water sources used in the planning area are surface water withdrawn from Skiatook Lake and groundwater withdrawn from alluvial aquifers and the Vamoosa-Ada aquifer. Surface water is also withdrawn from other lakes, ponds, creeks, and streams in the planning area. There are no large industries in the planning area using water from public suppliers; therefore, the volume of water withdrawn by public suppliers, such as cities, towns, rural water districts, and small communities, is likely to vary in response to population changes (USGS 2014).

In 2010, approximately 96 percent of the water withdrawn by public suppliers in the planning area was from surface-water sources. Skiatook Lake is the primary source of water for public suppliers in the planning area and for cities in, or partly in, adjoining counties. Planning area residents living outside of towns or service areas of rural water districts rely on private wells. Industrial self-supplied use of surface water and groundwater in the planning area, primarily for oil and gas activities, has been a relatively small component of total water use. Surface water in the planning area is also used for livestock and irrigation. Livestock is the second highest water use in the planning area, behind public water suppliers (USGS 2014).

Oil and gas extraction involves extracting saline groundwater. Much of this groundwater is reinjected into the petroleum-producing zones to enhance petroleum extraction, in the process known as water flooding. The petroleum-producing zones are stratigraphically below the bedrock aquifers in this area (USGS 2014).

Use of hydraulic fracturing to extract the remaining oil and gas from existing fields and previously undeveloped shale units may have increased saline groundwater reinjection in the planning area's heavily developed Burbank Oil Field (Murray 2013). The Burbank Oil Field is one of several petroleum and natural gas producing fields in the planning area. The volume of saline groundwater reinjected into the oil field was considerably larger than the volume of freshwater estimated to have been withdrawn for all other purposes in the planning area between 1950 and 2012.

Additional volumes of produced saline groundwater probably are reinjected in other producing fields in the planning area, but data are not available from those fields. Freshwater also may be used for hydraulic fracturing in the planning area, but no data for such water use are available (USGS 2014).

Groundwater

There are three major aquifers in the planning area (see **Figure 3-4**). The first is composed of alluvial and terrace aquifers (hereinafter referred to as alluvial) made up of unconsolidated sands, silts, clays, and gravels deposited along streams and rivers in the Quaternary. The second is the Vamoosa-Ada aquifer, consisting of a sequence of sandstones, siltstones, shales, conglomerates, and limestones deposited in marine environments in the Pennsylvanian. The third major aquifer in the planning area is really a series of minor bedrock aquifers. They were deposited during the Pennsylvanian in the eastern part of Osage County and during the Pennsylvanian through Permian in the western part of Osage County, where the Vamoosa-Ada aquifer is absent (USGS 2014).

The supply of potable groundwater in the alluvial aquifers and the Vamoosa-Ada aquifer is adequate for current domestic and other purposes; however, in areas where these aquifers are absent, groundwater must be pumped from minor bedrock aquifers that generally produce smaller volumes of water (Bingham and Bergman 1980).

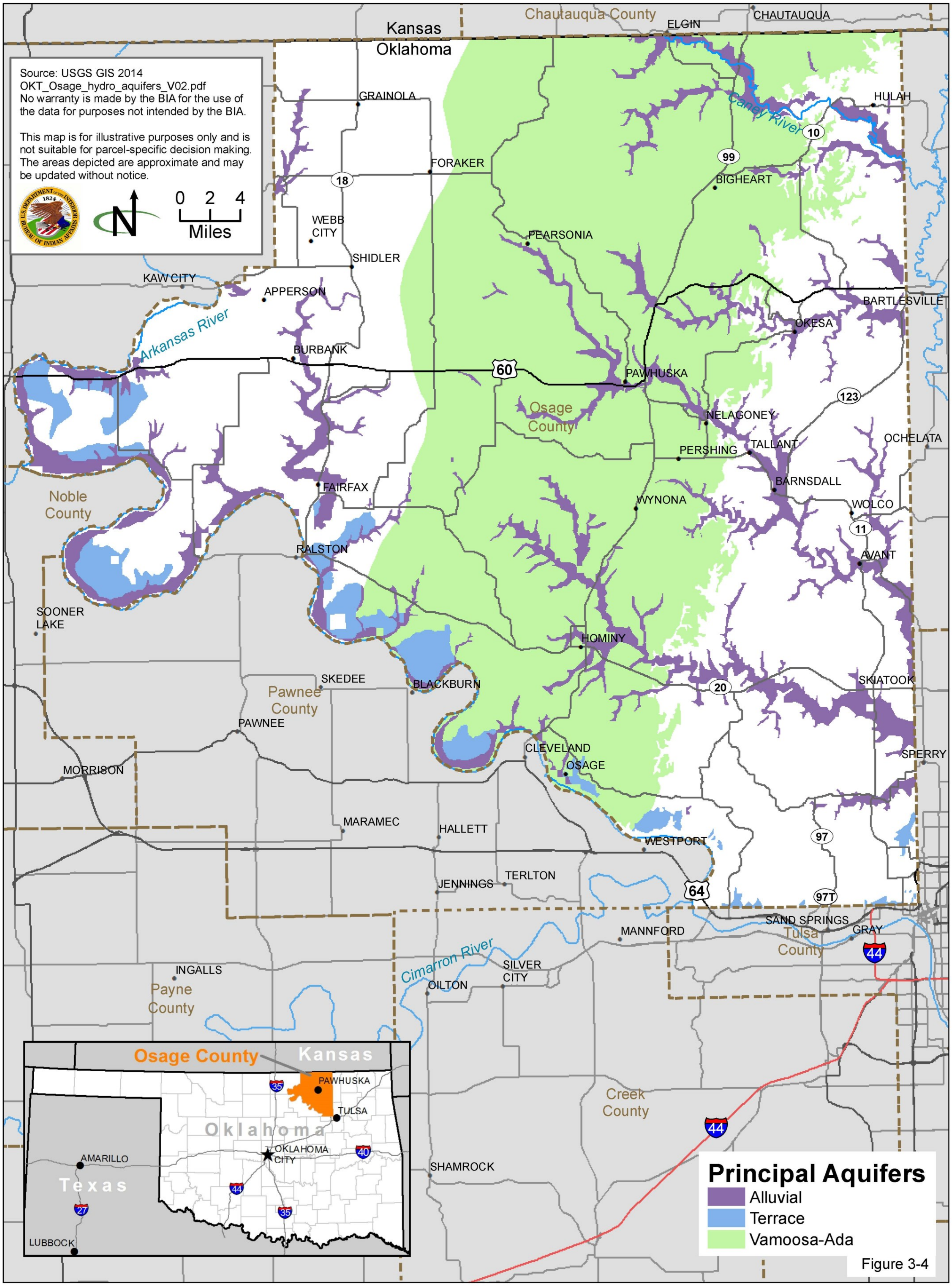

Source: USGS GIS 2014
OKT_Osage_hydro_aquifers_V02.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
ELGIN
CHAUTAUQUA
HULAH
Caney River
GRAINOLA
FORAKER
BIGHEART
WEBB CITY
SHIDLER
PEARSONIA
KAW CITY
APPERSON
Arkansas River
BURBANK
BARTLESVILLE
OKESA
PAWHUSKA
Osage County
NELAGONEY
OCHELATA
PERSHING
TALLANT
Noble County
FAIRFAX
BARNSDALL
WYNONA
WOLCO
RALSTON
AVANT
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
Pawnee County
SKIATOOK
PAWNEE
CLEVELAND
OSAGE
SPERRY
MORRISON
MARAMEC
HALLETT
WESTPORT
JENNINGS
TERLTON
MANNFORD
SAND SPRINGS
GRAY
Tulsa County
INGALLS
Payne County
Cimarron River
SILVER CITY
OILTON
Creek County
SHAMROCK
Osage County
Kansas
PAWHUSKA
TULSA
Oklahoma
OKLAHOMA CITY
AMARILLO
Texas
LUBBOCK
Principal Aquifers
Alluvial
Terrace
Vamoosa-Ada

Figure 3-4

Alluvial aquifers adjoining rivers and streams in Osage County consist of unconsolidated lens-shaped beds of sand, silt, clay, and gravel. Alluvium underlies river valleys and adjoins active stream channels, whereas terrace aquifers are at higher elevations and were deposited when the riverbed was at a higher elevation. Alluvial aquifers underlie approximately 186,800 acres of the planning area and range in thickness from 0 to 80 feet (Bingham and Bergman 1980; Abbott 2000; USGS GIS 2014). Terrace aquifers near the Arkansas River, which are grouped with alluvial aquifers in this section, range in thickness from 0 to about 95 feet (Mashburn et al. 2003).

The Vamoosa-Ada aquifer underlies approximately 667,100 acres of the planning area (USGS GIS 2014) and consists of stacked sequences of fine-grained to very fine-grained sandstone, siltstone, shale, and conglomerates that are interbedded with very thin limestones (D'Lugosz et al. 1986).

In parts of the planning area, where the alluvial or Vamoosa-Ada aquifers are absent, wells produce water from permeable rocks that occur intermittently in the subsurface. These minor bedrock aquifers are associated with nine sedimentary rock units of Pennsylvanian through Permian (USGS 2014). Wells completed in these minor aquifers typically produce less than 25 gallons per minute and underlie approximately 540,800 acres of the planning area (Bingham and Bergman 1980; Abbott 2000).

The USGS analyzed groundwater quality in the planning area in 2014 (USGS 2014). The entire planning area is underlain by brines containing large concentrations of sodium and chloride and total dissolved solids (D'Lugosz et al. 1986); therefore, all freshwater aquifers in the planning area are subject to contamination by brines from natural seepage or oil and gas activity (USGS 2014).

Chloride, a component of total dissolved solids, is a conservative element in hydrologic systems. Chloride can indicate sources and movement of groundwater, such as upward discharge of saline groundwater to springs and streams or the effects of disposal or leakage of brines brought to the surface during petroleum and natural gas extraction.

Chloride concentrations were significantly greater in water samples collected from wells completed in the Vamoosa-Ada aquifer than in water samples collected from wells in alluvial aquifers in the planning area. Chloride concentrations in the few water samples collected from wells completed in minor aquifers were not significantly different from those in water samples collected from wells completed in alluvial and the Vamoosa-Ada aquifers in the planning area. Water sampled from wells completed in alluvial, the Vamoosa-Ada, and minor bedrock aquifers generally contained smaller concentrations of dissolved chloride than water samples collected at Hominy Creek (USGS 2014).

Local effects may cause the substantial variations in dissolved chloride concentration in groundwater in the planning area (USGS 2014). These effects can be caused by seepage of brines into shallow groundwater or by leaks and spills from petroleum and natural gas extraction conducted near the land surface. No general geographic patterns of dissolved chloride concentration in groundwater samples collected in the planning area are apparent.

Surface Water

The planning area generally receives approximately 45 inches of annual precipitation in the southeastern portion and approximately 36 inches in the western and northeastern portions. May and September are typically the wettest months of the year. Snowfall ranges from 1 to over 10 inches per year (Oklahoma Climatological Survey 2013).

The USGS delineated watersheds in the United States using a national standard hierarchical system. This system classifies surface hydrologic features into hydrologic units: region (first field), subregion (second field), accounting unit (third field), and cataloging unit (fourth field). Each hydrologic unit is identified by a unique hydrologic unit code: region (2-digit), subregion (4-digit), accounting unit (6-digit), and cataloging unit (8-digit).

A cataloging unit is a geographic area representing part or all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature (USGS 2015b). Cataloging units sometimes are called watersheds. A cataloging unit is the most widely used hydrological unit in water resource planning, management, and policy (Daniels et al. undated). **Table 3-7** shows the cataloging units in the planning area.

Table 3-7
Hydrologic Cataloging Units

Cataloging Unit Name	Total Acres	Acres in Planning Area
Bird	727,904	574,400
Black Bear-Red Rock	1,366,773	432,900
Caney	1,340,509	365,000
Kaw Lake	609,945	76,800
Polecat-Snake	846,226	25,400

Source: NHD GIS 2015

The planning area is drained by the Caney River in the northeast, Bird Creek in the southeast, and Salt Creek in the west. The Arkansas River borders the western and southwestern portion of the planning area for 123 miles (USGS 2014).

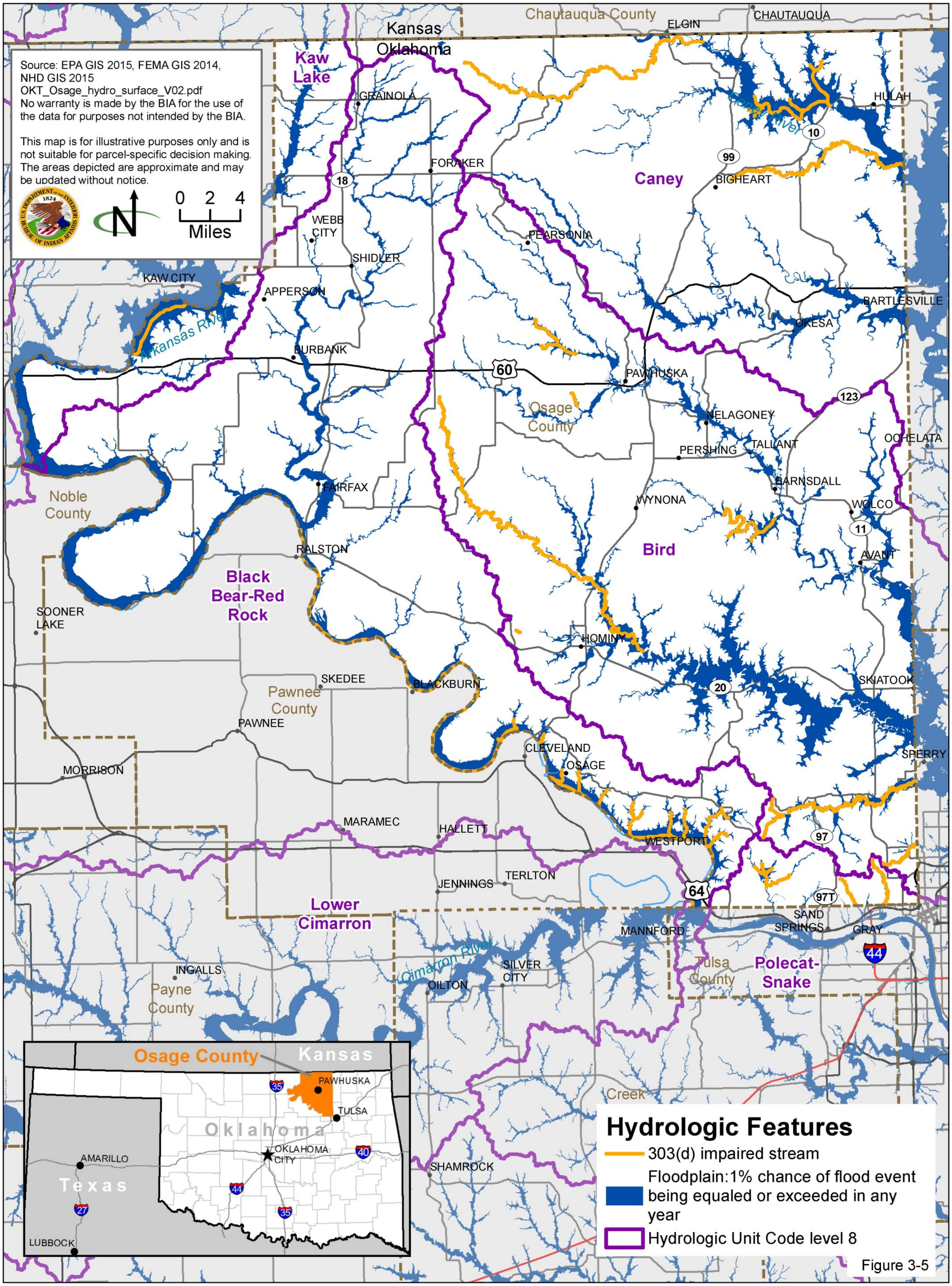
There are 69 lakes in the planning area, ranging from 2-acre ponds to the 10,000-acre Skiatook Lake and portions of the larger Keystone and Kaw Lakes along the planning area boundary. Hulah Lake (2,640 acres) near Bowring is the major lake in the Caney River Basin, in the northeastern portion of the planning area. The major reservoirs in the Bird Creek Basin are Bluestem Lake (860 acres) near Pawhuska, Birch Lake (1,040 acres) near Barnsdall, and Skiatook Lake (10,400 acres) near Skiatook (OWRB GIS 2015; USGS 2002). Approximately 2,180 miles of rivers and creeks traverse the planning area (OWRB GIS 2015). **Figure 3-5** shows streams, rivers, and lakes in the planning area.

Water quality standards consist of the designation of beneficial uses, water quality criteria to protect the designated uses, and anti-degradation policies. Under Section 303(d) of the CWA, states, territories, and authorized tribes are required to develop lists of impaired waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop total maximum daily loads for these waters. This is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards (EPA 2015a). There are 18 water bodies covering approximately 212 miles in the planning area that are on the US Environmental Protection Agency [EPA]'s 303(d) list of impaired waters (see **Table 3-8** and **Figure 3-5**).

As shown in **Table 3-8**, petroleum and natural gas activities are considered a probable source contributing to impairment of 4 out of the 18 impaired water bodies in the planning area: Delaware Creek, Hominy Creek, Bigheart Creek, and Harlow Creek. No total maximum daily load has been established for the pollutants that could be related to petroleum and natural gas activities on these water bodies (EPA 2015b).

Chloride is one of the pollutants causing impairment in Delaware Creek and Hominy Creek (EPA 2015b). In the planning area, chloride in surface water can come from natural upward seepage of brines underlying fresh groundwater and from brines pumped to the surface and reinjected or otherwise disposed of as a byproduct of petroleum extraction. Chloride concentration measured in surface water in 1999 at sites distributed throughout much of the planning area generally were greatest in the southern and eastern sections. This is also where the most petroleum wells had been drilled. Chloride levels are particularly high in the Little Hominy Creek watershed in the Bird Creek basin (USGS 2014).

A floodplain is a geographic area of relatively level land that is occasionally inundated by surface water from rivers or streams. A 100-year flood has a one percent chance of being equaled or exceeded in magnitude in any given year; a floodplain would be covered by water in the event of a 100-year flood. Areas in the 100-year floodplain are considered special flood hazard areas, and special insurance and construction requirements apply.


Source: EPA GIS 2015, FEMA GIS 2014, NHD GIS 2015
OKT_Osage_hydro_surface_V02.pdf
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This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Hydrologic Features
303(d) impaired stream
Floodplain:1% chance of flood event being equaled or exceeded in any year
Hydrologic Unit Code level 8
Kaw Lake
Caney
Bird
Black Bear-Red Rock
Lower Cimarron
Polecat-Snake
Chautauqua County
Osage County
Noble County
Pawnee County
Payne County
Tulsa County
Creek
Kansas
Oklahoma
Arkansas River
Cimarron River
ELGIN
CHAUTAUQUA
HULAH
GRAINOLA
FORAKER
BIGHEART
WEBB CITY
SHIDLER
PEARSONIA
KAW CITY
APPERSON
BURBANK
BARTLESVILLE
OKESA
PAWHUSKA
NELAGONEY
OCHELATA
PERSHING
TALLANT
BARNSDALL
FAIRFAX
WYNONA
WOLCO
AVANT
RALSTON
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
SKIATOOK
PAWNEE
CLEVELAND
OSAGE
SPERRY
MORRISON
MARAMEC
HALLETT
WESTPORT
JENNINGS
TERLTON
SAND SPRINGS
GRAY
MANNFORD
INGALLS
SILVER CITY
OILTON
SHAMROCK
10
99
18
60
123
11
20
97
97T
64
44
Osage County
Kansas
Oklahoma
Texas
PAWHUSKA
TULSA
OKLAHOMA CITY
AMARILLO
LUBBOCK
35
40
44
27
Figure 3-5

Table 3-8
Water Bodies on the 303(d) List of Impaired Waters

Water Body	Water Body ID	Miles Impaired in Planning Area	Petroleum/Natural Gas Activities a Probable Contributor?
Delaware Creek	OK121300010150_00	21.84	Yes
Bluestem Lake	OK121300030300_00	6.35	Unknown
Hominy Creek	OK121300040280_00	39.42	Yes
Keystone Lake, Arkansas River Arm	OK621200010050_00	24.21	Unknown
Keystone Lake	OK621200010020_00	3.62	Unknown
Arkansas River	OK621200010200_00	25.33	No
Kaw Lake, Lower	OK621210000020_00	5.68	Unknown
Kaw Lake, Upper	OK621210000040_00	0.15	Unknown
Bigheart Creek	OK120420010140_00	2.40	Yes
Harlow Creek	OK120420010170_00	4.29	Yes
Shell Lake	OK120420010250_00	5.47	Unknown
Flat Rock Creek	OK121300010120_00	3.89	Unknown
Birch Lake	OK121300030040_00	9.44	Unknown
Pawhuska Lake	OK121300030230_00	1.02	Unknown
Hominy Lake	OK121300040350_00	0.35	Unknown
Mission Creek	OK121400020190_00	18.63	No
Hulah Lake	OK121400030020_00	14.59	Unknown
Buck Creek	OK121400030170_00	25.36	No

Source: EPA GIS 2015; EPA 2015b

The Federal Emergency Management Agency (FEMA) has different requirements for different types of areas, or flood zones, in the 100-year floodplain. The planning area contains areas in three different flood zones, as follows:

- Zone A is subject to inundation by a 100-year flood but has not had detailed hydraulic analyses completed
- Zone AE is subject to inundation by a 100-year flood and has been the subject of more detailed analysis on flood elevations
- Zone AO is subject to inundation by 100-year shallow flooding (usually sheet flow on sloping terrain) and has been the subject of detailed analysis on average flood depths

The number of acres in each of these flood zones in the planning area is shown in **Table 3-9**; **Figure 3-5** shows the locations of these zones.

Table 3-9
FEMA Flood Zones

Flood Zone	Acres in Planning Area
A	107,100
AE	41,300
AO	100

Source: FEMA GIS 2013

3.3.3 Trends

Public water supplies, livestock, and oil and gas activities are expected to remain the primary water uses in the planning area. As described in **Section 3.16.3**, Mineral Extraction, *Trends*, and **Section 3.10.1**, Population, oil and gas activity and population in the planning area are expected to increase in the next 20 years. As oil and gas activities and population increase, demand for water will likely increase. Injecting saline produced water is also expected to increase as hydraulic fracturing and conventional oil and gas activities in the planning area continue.

3.4 AIR QUALITY AND CLIMATE

3.4.1 Air Quality

Air quality may be affected by BIA lease approvals, workover approvals, development permits, and restrictions on oil and gas activities. Therefore, the BIA must consider and analyze the potential effects of BIA and BIA-authorized activities on air resources as part of the planning and decision-making process.

3.4.2 Climate

Climate is defined as the generally prevailing weather conditions of a particular region throughout the year, averaged over a series of years. Climate is both a driving force and a limiting factor for biological, ecological, and hydrological processes.

Climate change is a statistically significant and long-term change in climate patterns. The terms climate change and global warming are often used interchangeably, although they are not the same. Climate change is any deviation from the average climate, whether warming or cooling, and can result from both natural and human-made sources. Natural contributors are fluctuations in solar radiation, volcanic eruptions, and plate tectonics; human contributors are the burning of fossil fuels and solid waste, livestock grazing and other activities associated with agriculture, as well as the contributors discussed below. Global warming refers to the apparent warming of climate observed since the early twentieth century. It is primarily attributed to human activities, such as fossil fuel combustion, industrial processes, and land use changes.

Greenhouse gases (GHGs) are chemical compounds in the Earth's atmosphere. These compounds allow incoming, short-wave, solar radiation to reach the surface, but GHGs absorb long-wave infrared radiation reflected by the Earth's surface, trapping heat. The 2013 Intergovernmental Panel on Climate Change Fifth Assessment Report states that the atmospheric concentrations of well-mixed, long-lived GHGs have increased to levels unprecedented in the last 800,000 years. Further, human influence has been detected in the following:

- Warming of the atmosphere and the oceans
- Changes in the global water cycle
- Reductions in snow and ice
- Rising of mean global sea levels
- Changes in some climate extremes

There is a 95 to 100 percent probability that human influence has been the dominant cause of the observed warming since the mid-twentieth century (Intergovernmental Panel on Climate Change 2013).

GHGs are carbon dioxide, methane, nitrous oxide, water vapor, and several trace gases. Some GHGs, such as carbon dioxide, occur naturally and are emitted into the atmosphere through both natural processes and human activities; others are created and emitted solely through human activities.

The GHGs that enter the atmosphere due to human activities are the following:

- Carbon dioxide from burning fossil fuels, solid waste, and trees and wood products
- Methane emitted during the production and transport of coal, natural gas, and oil and by livestock grazing, deforestation, soil emissions, and agriculture
- Nitrous oxide from agriculture and industry
- Fossil fuels and solid waste combustion
- Fluorinated gases, which result from a variety of industrial processes

Although GHG levels have varied for millennia (along with corresponding variations in climate), industrialization and burning fossil carbon sources have caused GHG concentrations to increase measurably at a global scale.

3.4.3 Regulatory Framework

Air Quality

The federal Clean Air Act (42 USC, Sections 7401-7642) established the principal framework for national, state, and local efforts to protect air quality. The EPA sets regulations and standards to implement the requirements of the Clean Air Act. While the EPA retains authority for certain air quality rules, including most pertaining to emission standards for mobile sources, it may authorize states and, in some cases, tribal governments to implement portions of the Clean Air Act.

Under the 1990 amendment to the Clean Air Act, tribal governments are to be treated as states. Tribes are authorized to develop and implement parts of the Clean Air Act that they deem appropriate, but unlike states, they are not required to implement all Clean Air Act requirements. The EPA generally implements the law in Indian country when a tribe does not have the desire or capability to administer Clean Air Act programs. The EPA's Office of Air and Radiation works closely with tribal governments to provide support in the development and management of tribal air quality programs (EPA 2013a). The Osage Nation Environment and Natural Resources Department has staff who may obtain EPA-approved inspectors credentials for specific environmental programs. Department staff conduct environmental monitoring, sampling, and other activities and coordinates with the EPA and other federal agencies on matters of common interest.

Ambient Air Quality Standards

Under the Clean Air Act, the EPA has set time-averaged National Ambient Air Quality Standards (NAAQS; **Table 3-10**) for six air pollutants considered to be key indicators of air quality: carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, and two categories of particulate matter (particulate matter less than 10 microns in diameter [PM_{10}] and particulate matter less than 2.5 microns in diameter [$PM_{2.5}$]).

The two-tiered standards may be primary or secondary. Primary standards set limits to protect public health, including the health of sensitive populations, such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Averaging periods vary by pollutant, based on potential health and welfare effects of each pollutant.

Tribes and states can set their own standards, but they must be at least as stringent as the national standards. For actions on lands within the boundaries of Indian reservations, national standards apply when they differ from the state standards.

In addition to criteria pollutants, the Clean Air Act regulates toxic air pollutants, or hazardous air pollutants, that are known to cause or are suspected to cause cancer or other serious health effects or adverse environmental impacts. The EPA has issued rules covering 80 categories of major industrial sources, as well as categories of smaller sources. Controls are usually required at the source to limit the release of these toxics into the atmosphere.

Table 3-10
National Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards		
		Primary	Secondary	Form
Ozone	8-hour	0.075 ppm[1]	Same as primary	Annual 4th-highest daily maximum 8-hour concentration, averaged over three years
Carbon monoxide	8-hour	9 ppm	—	Not to be exceeded more than once a year
	1-hour	35 ppm	—	
Nitrogen dioxide	Annual (arithmetic mean)	0.053 ppm	Same as primary	Annual mean
	1-hour	100 ppb	—	98th percentile, averaged over three years
Sulfur dioxide	3-hour	—	0.5 ppm	Not to be exceeded more than once a year
	1-hour	75 ppb[2]	—	99th percentile of 1-hour daily maximum concentrations, averaged over three years
PM_{10}	24-hour	150 μg/m³	Same as primary	Not to be exceeded more than once a year, on average, over three years
$PM_{2.5}$	Annual (arithmetic mean)	12 μg/m³	15 μg/m³	Annual mean, averaged over three years
	24-hour	35 μg/m³	Same as primary	98th percentile, averaged over three years
Lead[3]	Rolling three-month average	0.15 μg/m³	Same as primary	Not to be exceeded

Source: EPA 2014a

[1]**ppm**—parts per million. Final rule signed March 12, 2008. The 1997 standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over three years) and related implementation rules remain in place. In 1997, the EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once a year) in all areas, although some areas have obligations under that standard (anti-backsliding). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 12 ppm is less than or equal to 1.

[2]**ppb**—parts per billion. Final rule signed June 2, 2010. The 1971 annual and 24-hour sulfur dioxide standards (0.03 ppm annual and 0.14 ppm 24-hour) were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard. One exception is in areas designated as nonattainment for the 1971 standards; in such cases the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

[3]**μg/m³**—micrograms per cubic meter. Final rule signed October 15, 2008. The 1978 lead standard (1.5 μg/m³) remains in effect until one year after an area is designated for the 2008 standard. The one exception is in areas designated as nonattainment for the 1978 standard; in such cases the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

Clean Air Act General Conformity

Section 176(c) of the Clean Air Act requires that federal actions conform to the appropriate state implementation plan. The EPA has promulgated rules establishing conformity analysis procedures for transportation-related actions and for other general federal agency actions (40 CFR, Parts 6, 51, and 93).

The EPA general conformity rule requires a formal conformity determination document for federal agency actions that are undertaken, approved, or funded in federal nonattainment or maintenance areas. This rule applies when the total net change in direct and indirect emissions of nonattainment pollutants (or their precursors) exceeds specified thresholds.

Prevention of Significant Deterioration

In addition to the NAAQS, the Prevention of Significant Deterioration regulations set forth a permit process that applies to new major sources or major modifications of existing sources for pollutants. It is applicable where the emission source is inside an attainment or unclassifiable area, as defined by the NAAQS. Furthermore, the Prevention of Significant Deterioration Program requires the use of best available control technologies and provides for an air quality impact analysis and public involvement. The purpose of the program is to protect public health and welfare. It also preserves, protects, and enhances the air quality of national parks and wilderness areas, national monuments, seashores, and other areas of recreation, scenic, or historic value.

In August 2015, the EPA proposed a Federal Implementation Plan rule that would apply to new true minor sources and minor modifications at existing true minor sources in the production segment of the oil and natural gas sector that are locating in or expanding into Indian country. In the same action, the EPA also proposed several amendments to the Federal Indian Country Minor New Source Review Rule and one amendment to the Federal Indian Country Major New Source Review Rule. These rules are meant to streamline the permitting process for oil and gas development in Indian country, while ensuring air quality protection. The public comment period for these proposed rules ended on October 17, 2015.

Prevention of Significant Deterioration regulations prevent areas that are in attainment of the NAAQS from being polluted up to the level of the standards. The Clean Air Act directs the EPA to classify airsheds as class I, class II, or class III. Class I airsheds are national parks and wilderness areas of a certain size that were in existence before 1977 or additional areas that have since been designated by federal regulation. Class I airsheds should be given special protection. Class II airsheds would receive less protection than class I areas. Class III airsheds require the least stringent air quality protection; air quality in these areas would be permitted to degrade up to the NAAQS (National Park Service 2006).

There are two class 1 airsheds in Oklahoma, but neither is in the planning area (National Park Service 2011). There are no tribal class 1 airsheds in the planning area (National Park Service 2011). Class II airsheds are the remaining areas outside nonattainment and maintenance areas. No areas have been designated as class III.

Hazardous Air Pollutants

Toxic air pollutants, also known as hazardous air pollutants, are those that are known to cause or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects or adverse environmental effects. No ambient air quality standards exist for hazardous air pollutants; instead, emissions of these pollutants are under a variety of regulations that target the specific source class and industrial sectors for stationary, mobile, and product use and formulations.

Sources of hazardous air pollutants from oil and gas operations are well-site production emissions (benzene, toluene, ethyl benzene, xylene, n-hexane, and formaldehyde) and compressor station and gas plant combustion emissions (formaldehyde). Oil and gas exploration and development can also release H_2S gas from geologic formations, which can be a public health and safety hazard. While H_2S has been removed from the Clean Air Act Section 112(b) list of Hazardous Air Pollutants, it is subject to accidental release provisions under Section 112(r) of the act.

Under Section III of the Clean Air Act, the EPA has enacted emissions standards for specific categories of stationary sources. These standards are referred to as New Source Performance Standards (40 CFR, Part 60). They could be applicable to oil and gas operations in the planning area.

Climate

In 2007, the US Supreme Court ruled in *Massachusetts v. EPA* that the EPA has the authority to regulate GHGs, such as methane and carbon dioxide, as air pollutants under the Clean Air Act. The ruling did not, however, require the EPA to create any emission control standards or ambient air quality standards for GHGs. At present, there are no ambient air quality standards for GHGs. There are, however, applicable reporting requirements under the EPA's Greenhouse Gas Reporting Program. These GHG emission reporting requirements, finalized in 2010 under 40 CFR, Part 98, require facility operators to develop and report annual methane and carbon dioxide emissions from equipment leaks and venting. Operators also must report emissions of carbon dioxide, methane, and nitrous oxide from flaring, combustion emissions from onshore production stationary and portable equipment, and combustion emissions from stationary equipment.

As of January 14, 2015, the White House and the EPA are seeking to use authority granted under Section 111(b) of the Clean Air Act to directly regulate methane emissions from the oil and gas industry. By 2025, the industry would need to reduce methane emissions by 40 to 45 percent from the 2012 levels. These reductions will apply to new, not existing, oil and gas sources (White

House 2015). This mandate could one day be expanded to include existing methane sources, through Section 111(d) of the Clean Air Act.

Additionally, methane and volatile organic compounds contribute to the creation of ozone, a criteria pollutant regulated by the NAAQS (**Table 3-10**) Reducing methane emissions could reduce ozone in the future.

3.4.4 Current Conditions

Air Quality

The planning area encompasses Osage County in Oklahoma. The area of analysis for directly emitted pollutants (pollutants other than ozone) is generally limited to a few miles downwind of a source. The area of analysis for ozone is larger; this is because ozone is formed by photochemical reactions of other pollutants in the atmosphere, primarily volatile organic compounds and nitrogen oxides. Ozone may form later and at a greater distance from the sources of precursor emissions.

The Clean Air Act requires each state to identify areas that have ambient air quality in violation of federal standards using monitoring data collected through state monitoring networks, as follows:

- Areas that violate air quality standards are designated as nonattainment for the relevant criteria air pollutants.
- Areas that comply with air quality standards are designated as attainment for the relevant criteria air pollutants.
- Areas that have been redesignated from nonattainment to attainment are considered maintenance areas.
- Areas of uncertain status are generally designated as unclassifiable but are treated as attainment areas for regulatory purposes.

Osage County is currently in attainment for all NAAQS (EPA 2015c). As a result, general conformity regulations do not apply and an applicability analysis is not necessary. However, note that Osage County is part of the Tulsa Metropolitan Statistical Area, which is represented by the Indian Nations Council of Governments (INCOG; this is the Metropolitan Planning Organization for the area). The Tulsa area is vulnerable to being designated as nonattainment for ozone in the next few years. Because of this, INCOG has applied to and been accepted into the EPA Ozone Advance Program. This is a collaboration between the EPA, states, and local governments to enact expeditious emission reductions to help near nonattainment areas to remain in attainment of the NAAQS.

Table 3-11 shows the locations of air monitoring stations in the planning area, the pollutants monitored at each station, and three years of monitoring data for

Table 3-11
Air Quality Monitoring Values in the Planning Area[1]

Pollutant	Averaging Time	2010	2011	2012	3-Year Average[1]	NAAQS	Percent of NAAQS[1]
Site ID 401139020 (not in a city; in Osage County)							
Ozone	8-Hour Averaging End Hour	0.068	0.079	0.07	0.72 ppm	0.075 ppm	96
PM_{10}	2nd highest maximum for 24-hour block average[2]	39	49	—	44	150 µg/m³	29
104 Gilcrease Road, Tulsa (Osage County)							
SO_2	99th percentile for 1-hour	45	45	58	49	75 ppb	66

Source: EPA 2014b

Note: Exceptional events data are excluded.
[1]Monitored concentrations are the maximum second highest for 24-hour PM_{10}; the fourth highest daily maximum for 8-hour O_3; 98th percentile for 24-hour $PM_{2.5}$ and 1-hour NO_2; 99th percentile for 1-hour SO_2; highest for lead and 1-hour carbon monoxide and 8-hour carbon monoxide; and maximum arithmetic mean for annual $PM_{2.5}$. Average values for $PM_{2.5}$ are monitored for each year to determine three-year average.
[2] 24-hour block average data used because no 24-hour data available.

each station. Data were not available at the monitoring sites for 2013, so data provided are from 2010-2012. Exceedance of the NAAQS is based on an average of data from 2010, 2011, and 2012.

An air quality monitor in Osage County reported an exceedance of the NAAQS for ozone in 2011. High temperatures and drought may have contributed to ozone exceedances between 2010 and 2012.

Climate

The planning area is classified as part of the Great Plains region. The climate here tends to be characterized by long, hot summers and severe winters (National Climate Assessment 2014). The average temperature in Osage County is about 59 degrees Fahrenheit, with an average high temperature around 93 degrees and an average low temperature around 23 degrees. The annual mean temperature increased by about 1 degree Fahrenheit between 1970 and 2007, as measured at the National Weather Service field station in Pawhuska (Andrews and Smith 2014).

Annual rainfall in Osage County ranges from about 36 inches in the west and northeast and 45 inches in the southeast, with May and September typically receiving the most precipitation (Andrews and Smith 2014). The region tends to be susceptible to droughts (National Climate Assessment 2014).

Table 3-12 shows monthly climate normal data for three representative cities in the planning area, from 1981 to 2010. Climate normals are three-decade averages of climatological variables produced every ten years by the National Oceanic and Atmospheric Administration, National Climatic Data Center.

Table 3-12
Average Temperatures and Precipitation in the Planning Area (1981-2010)

Location	Average Maximum Temperature (°F)			Average Minimum Temperature (°F)			Average Precipitation (Inches)		
	Jan.	July	Annual	Jan.	July	Annual	Jan.	July	Annual
Pawhuska	47.9	92.3	71.3	24.6	70.3	47.8	1.68	4.56	3.91
Ralston	47.6	93.1	71.5	22.5	69.3	46.1	1.31	3.39	3.28
Ponca City	45.7	92.7	70.1	24.0	70.6	47.4	1.00	3.33	2.90

Source: National Oceanic and Atmospheric Administration 2015

3.4.5 Trends

Air Quality

The planning area is in attainment or unclassified for all pollutants, though the NAAQS for ozone was exceeded in the planning area in 2011. Warm weather and drought over the past few years could have contributed to the exceedances in the NAAQS for ozone. However, note that Osage County is part of the Tulsa Metropolitan Statistical Area, which is represented by the Indian Nations Council of Governments (INCOG; this is the Metropolitan Planning Organization for the area). As described under **Section 3.4.4**, The Tulsa area is vulnerable to being designated as nonattainment for ozone in the next few years.

Climate

Atmospheric concentrations of naturally emitted GHGs have varied over time, and the Earth's climate has fluctuated accordingly. Since the beginning of the industrial revolution, human activities have increased GHG concentrations and introduced human-made compounds that act as GHGs in the atmosphere.

In its latest report, the Intergovernmental Panel on Climate Change stated that the atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years (Intergovernmental Panel on Climate Change 2013). From preindustrial times until today, global average concentrations in the atmosphere have increased by around 40 percent for carbon dioxide, 150 percent for methane, and 20 percent for nitrous oxide (Intergovernmental Panel on Climate Change 2013).

Forecast

Air Quality

Air pollutants, especially ozone, will continue to be a concern in the planning area. New sources of ozone precursor emissions, particularly from the oil and gas sector and electrical generating plants, continue to be proposed in the planning area. At the same time, federal, state, local, and tribal jurisdictions continue to seek ways to reduce emissions from these industries through voluntary and regulatory mechanisms. Climate scientists have predicted drought conditions and high temperatures, which could contribute to increased ozone exceedances in the future.

A driver to reduce ozone concentrations is to avoid designation as nonattainment for the ozone NAAQS. The EPA revised the ozone standard in 2008 to be more stringent; it issued a proposed rule in 2010 to further revise the 8-hour primary standard from 0.075 ppm to a lower level in the range of 0.060 to 0.070 ppm. Air monitoring concentration levels (see **Table 3-11**) for the past three years exceed the lower level of this proposed range. These levels also frequently exceed the original 0.075 ppm standard. The EPA is reviewing the ozone standard and must promulgate a new standard by the end of 2015, in accordance with court proceedings.

Climate

Climate changes over the past 100 years are well documented, and climate change is expected to continue. Fossil fuel combustion and other human-caused GHG-producing activities are ongoing, although public awareness and future regulations may reduce annual GHG emissions. Total GHG emissions in the United States decreased from 2011 to 2012, largely due to reductions in GHG emissions from power plants, which are the largest contributors of GHG emissions, followed by oil and gas activities (EPA 2015d). Data from 2013 and 2014 are not yet available. Regulations such as the January 14, 2015, methane reduction discussed under *Regulatory Framework* are likely to contribute to similar reductions. However, due to the long atmospheric lifetime of most GHGs, climate change impacts will continue to increase for many years after GHG emissions decrease (EPA 2013b). Climate change may increase air pollution levels if temperatures increase and droughts are extended.

Over the past 100 years, annual temperature and precipitation have increased, and climate models predict that they will continue to increase through the twenty-first century. Extreme weather, such as severe drought and intense rainfall, are also expected to increase in frequency (National Conference of State Legislatures 2008). Global mean surface temperature predictions from 2046 to 2065 range between an increase of 1.0°C (1.8°F) and 2.0°C (3.6°F). For 2081 through 2100, the projected global mean surface temperature increase is between 1.0°C (1.8°F) and 3.7°C (6.7°F; Intergovernmental Panel on Climate Change 2013).

In the Great Plains, climate change projections indicate that droughts, heat waves, and extreme rainfall will occur with greater frequency and intensity. This will likely result in challenges related to water quantity and agriculture (National Climate Assessment 2014). Currently, the southern portion of the Great Plains region has an average of seven days a year where maximum temperatures exceed 100 °F. Mid-century projections show the number of such days will quadruple. Projections also show an increase in the length of dry spells in Oklahoma (National Climate Assessment 2014).

3.5 FISH AND WILDLIFE

3.5.1 Regulatory Framework

Migratory Bird Treaty Act of 1918, as amended

The Migratory Bird Treaty Act (MBTA; 16 USC, Sections 703-712) makes it unlawful to, among other things, pursue, hunt, take, capture, kill, or possess any migratory bird or part, nest, or egg of such bird listed in four separate wildlife protection treaties between the United States, Great Britain, Mexico, Japan, and Russia. The MBTA covers 1,007 species, as specified in 50 CFR, Subpart 10.13.

3.5.2 Current Conditions

Fisheries

Lands within the planning area contain ponds, lakes, and other waterways that provide habitat for a diverse assortment of game and non-game fish species. Many of the ponds and lakes are stocked with game fish, some of the most common species of which are bass (*Micropterus* spp.), crappie (*Pomoxis* spp.), and catfish (*Ictalurus* spp.). Some lakes in the planning area, such as Keystone, Skiatook, Hulah, and Kaw Lakes, have been combined with WMAs and waterfowl refuges. Approximately 2,080 miles of rivers and creeks and 25,230 acres of lakes are found in the planning area (OWRB GIS 2015).

Wildlife

The Cross Timbers and Flint Hills Ecoregions dominate most of the planning area and provide habitat for an array of wildlife species.

Five bat species are known to occur in Osage County; these are the big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*L. cinereus),* silver-haired bat (*Lasionycteris noctivagans*), and tri-colored bat (*Permyotis subflavus*). These species roost in a variety of habitats, such as caves, rock crevices, tree hollows and cracks, tree foliage, and buildings (Oklahoma Department of Wildlife Conservation 2013a).

White-nose syndrome is a disease affecting hibernating bats and is named for a white fungus that appears on the muzzle and other parts of infected bats. A newly discovered fungus, *Pseudogymnoascus* (formerly *Geomyces*) *destructans*, has been demonstrated to cause white-nose syndrome (Coleman 2014). The disease is responsible for extensive mortality of bats in eastern North America; while no incidents have been recorded in the planning area, white-nose syndrome has been confirmed in western Missouri and northwestern Arkansas.

Other mammals found in the planning area are moles, shrews, opossums, rabbits, armadillos, squirrels, beavers, gophers, mice, raccoons, red foxes, coyotes, bobcats, and woodchucks. Payne et al. (2001) conducted an inventory of the Tallgrass Prairie Preserve in Osage County between June 1991 and May 1992. They reviewed previous literature to determine historical accounts of mammals in the preserve. Based on the collected information, Payne et al. found 43 extant species of mammals in the preserve.

Big game species, such as white-tailed deer (*Odocoileus virginianus*), are common in the planning area. Deer harvest counts for Osage County in 2013 were 3,755, more than any other county in Oklahoma for that year (Oklahoma Department of Wildlife Conservation 2013b). Distribution and abundance of big game species vary by habitat type and ecoregion. White-tail deer are typically found at the edges of woodlands and forested areas (American Society of Mammalogists 2015). Mule deer prefer open, arid, sparsely wooded areas. In mountainous areas, they will migrate to lower elevations for winters (American Society of Mammalogists 2015).

Migratory Birds

Lands in the planning area are used for nesting and foraging grounds by large numbers of migratory birds, including songbirds, waterfowl, shorebirds, and raptors. Some species overwinter in the planning area, while others breed or are resident there.

The one important bird area in the planning area is the 38,700-acre Tallgrass Prairie Preserve in northern Osage County. It contains large tracts of grasslands that provide nesting, breeding, and migratory stopover habitat for a variety of bird species. Between 1950 and 2015, 242 species of birds have been observed in the Tallgrass Prairie Preserve (eBird 2015). Species commonly associated with the preserve are Bell's vireo (*Vireo bellii*), greater prairie-chicken (*Tympanuchus cupido*), Henslow's sparrow (*Ammodramus henslowii*), northern bobwhite (*Colinus virginianus*), painted bunting (*Passerina ciris*), and the red-headed woodpecker (*Melanerpes erythrocephalus*).

The USGS Wildlife Research Center in Patuxent, Maryland, collects migratory bird survey data. There are three breeding bird survey routes in Osage County. Bird species that have been recorded at one or more of these routes are presented in **Table 3-13**. Species identified as Birds of Conservation Concern are also noted.

Table 3-13
Birds Recorded in Breeding Bird Survey Routes in Osage County

Scientific Name	Common Name	Bird of Conservation Concern
Empidonax virescens	Acadian flycatcher	X
Corvus brachyrhynchos	American crow	
Spinus tristis	American goldfinch	
Falco sparverius	American kestrel	X
Turdus migratorius	American robin	
Peucaea aestivalis	Bachman's sparrow	X
Icterus galbula	Baltimore oriole	

Table 3-13
Birds Recorded in Breeding Bird Survey Routes in Osage County

Scientific Name	Common Name	Bird of Conservation Concern
Hirundo rustica	Barn swallow	
Strix varia	Barred owl	
Vireo bellii	Bell's vireo	X
Megaceryle alcyon	Belted kingfisher	
Thryomanes bewickii	Bewick's wren	X
Coragyps atratus	Black vulture	
Mniotilta varia	Black-and-white warbler	
Coccyzus erythropthalmus	Black-billed cuckoo	X
Passerina caerulea	Blue grosbeak	
Cyanocitta cristata	Blue jay	
Polioptila caerulea	Blue-gray gnatcatcher	
Buteo platypterus	Broad-winged hawk	
Toxostoma rufum	Brown thrasher	X
Molothrus ater	Brown-headed cowbird	
Branta canadensis	Canada goose	
Poecile carolinensis	Carolina chickadee	
Thryothorus ludovicianus	Carolina wren	
Bubulcus ibis	Cattle egret	
Chaetura pelagica	Chimney swift	
Spizella passerina	Chipping sparrow	
Caprimulgus carolinensis	Chuck-will's-widow	X
Petrochelidon pyrrhonota	Cliff swallow	
Quiscalus quiscula	Common grackle	
Chordeiles minor	Common nighthawk	
Geothlypis trichas	Common yellowthroat	X
Accipiter cooperii	Cooper's hawk	
Spiza americana	Dickcissel	X
Picoides pubescens	Downy woodpecker	
Sialia sialis	Eastern bluebird	
Tyrannus tyrannus	Eastern kingbird	
Sturnella magna	Eastern meadowlark	
Sayornis phoebe	Eastern phoebe	
Caprimulgus vociferus	Eastern whip-poor-will	X
Contopus virens	Eastern wood-pewee	
Streptopelia decaocto	Eurasian collared-dove	
Sturnus vulgaris	European starling	
Spizella pusilla	Field sparrow	X
Corvus ossifragus	Fish crow	
Ammodramus savannarum	Grasshopper sparrow	X

Table 3-13
Birds Recorded in Breeding Bird Survey Routes in Osage County

Scientific Name	Common Name	Bird of Conservation Concern
Dumetella carolinensis	Gray catbird	
Ardea herodias	Great blue heron	
Myiarchus crinitus	Great crested flycatcher	
Ardea alba	Great egret	
Bubo virginianus	Great horned owl	
Tympanuchus cupido	Greater prairie-chicken	
Geococcyx californianus	Greater roadrunner	
Quiscalus mexicanus	Great-tailed grackle	
Butorides virescens	Green heron	
Picoides villosus	Hairy woodpecker	
Ammodramus henslowii	Henslow's sparrow	X
Eremophila alpestris	Horned lark	X
Carpodacus mexicanus	House finch	
Passer domesticus	House sparrow	
Troglodytes aedon	House wren	
Passerina cyanea	Indigo bunting	
Charadrius vociferus	Killdeer	
Chondestes grammacus	Lark sparrow	
Egretta caerulea	Little blue heron	X
Lanius ludovicianus	Loggerhead shrike	X
Anas platyrhynchos	Mallard	
Ictinia mississippiensis	Mississippi kite	X
Zenaida macroura	Mourning dove	
Colinus virginianus	Northern bobwhite	
Cardinalis cardinalis	Northern cardinal	
Colaptes auratus	(Yellow-shafted flicker) Northern flicker	X
Circus cyaneus	Northern harrier	
Mimus polyglottos	Northern mockingbird	
Setophaga americana	Northern parula	
Stelgidopteryx serripennis	Northern rough-winged swallow	
Icterus spurius	Orchard oriole	X
Passerina ciris	Painted bunting	X
Dryocopus pileatus	Pileated woodpecker	
Protonotaria citrea	Prothonotary warbler	X
Progne subis	Purple martin	
Melanerpes carolinus	Red-bellied woodpecker	
Vireo olivaceus	Red-eyed vireo	
Melanerpes erythrocephalus	Red-headed woodpecker	X

Table 3-13
Birds Recorded in Breeding Bird Survey Routes in Osage County

Scientific Name	Common Name	Bird of Conservation Concern
Buteo lineatus	Red-shouldered hawk	
Buteo jamaicensis	Red-tailed hawk	
Agelaius phoeniceus	Red-winged blackbird	
Phasianus colchicus	Ring-necked pheasant	
Columba livia	Rock pigeon	
Archilochus colubris	Ruby-throated hummingbird	
Tyrannus forficatus	Scissor-tailed flycatcher	X
Asio flammeus	Short-eared owl	X
Actitis macularius	Spotted sandpiper	
Piranga rubra	Summer tanager	X
Buteo swainsoni	Swainson's hawk	X
Baeolophus bicolor	Tufted titmouse	
Cathartes aura	Turkey vulture	
N/A	Unidentified buteo hawk	
Bartramia longicauda	Upland sandpiper	X
Vireo gilvus	Warbling vireo	
Tyrannus verticalis	Western kingbird	
Sturnella neglecta	Western meadowlark	
Sitta carolinensis	White-breasted nuthatch	
Vireo griseus	White-eyed vireo	
Meleagris gallopavo	Wild turkey	
Hylocichla mustelina	Wood thrush	X
Setophaga petechia	Yellow warbler	X
Coccyzus americanus	Yellow-billed cuckoo	X
Icteria virens	Yellow-breasted chat	
Nyctanassa violacea	Yellow-crowned night-heron	
Vireo flavifrons	Yellow-throated vireo	
Dendroica dominica	Yellow-throated warbler	

Source: USFWS 2008; Pardieck et al. 2015

3.5.3 Trends

Much of the tallgrass prairie has declined greatly in acreage due to agriculture conversion throughout the region, although large intact tallgrass prairie landscapes still remain in Osage County (Oklahoma Department of Wildlife Conservation 2005a). Invasive species continue to threaten native habitat for wildlife by changing community structure in a way that is harmful to native wildlife species.

Trends for bird species in the region are unknown, although many species, such as Bell's vireo, northern bobwhite, red-headed woodpecker, and upland sandpiper, appear to be in decline (Oklahoma Department of Wildlife Conservation 2011). Climate conditions play an important role in wildlife production and habitat quality and quantity. Persistent droughts have contributed to range-wide bobwhite quail population declines since the 1960s (Oklahoma Department of Wildlife Conservation 2015a). For other upland game species, such as wild turkey, long-term population trends have generally increased since the second half of the twentieth century, in part due to restocking and restoration.

Riparian disturbances caused by changing land use practices has historically threatened streams in the planning area by increasing the amount of stream bank erosion. Increased erosion can change the stream channel by, for example, widening streams and making them shallower, which can degrade suitable fish habitat.

3.6 VEGETATION, WETLANDS, AND NOXIOUS WEEDS

3.6.1 Regulatory Framework

Clean Water Act

The CWA, as amended in 1977, established the basic framework for regulating discharges of pollutants into the Waters of the United States, including wetlands. The US Army Corps of Engineers (USACE) regulates the discharge of dredged and fill material into Waters of the United States, including wetlands, in accordance with Section 404 of the CWA. Additionally, EO 11990, Protection of Wetlands, requires federal agencies to avoid, to the extent possible, adverse impacts on wetlands.

The USACE describes wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

The USACE provides guidelines for determining the areas under Section 404 jurisdiction (Environmental Laboratory 1987). These guidelines require that at least one positive indicator for each of three criteria (hydrophytic vegetation, hydric soils, and wetland hydrology) exist for an area to be designated as a wetland. The numerous and varied indicators for each of the criteria are described in detail in the guidelines. If these areas meet the criteria, certain activities, such as placing fill in these areas, would be subject to USACE regulation. The planning area is under the USACE Tulsa District.

Federal Noxious Weed Act

The Federal Noxious Weed Act of 1974 provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or public health.

The act prohibits importing or moving any noxious weeds identified by the regulations and allows for inspection and quarantine to prevent their spread.

Executive Order 13112, Invasive Species

Signed in 1999, EO 13112 directs federal agencies to prevent the introduction of invasive species, to provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.

Oklahoma Agricultural Code—Noxious Weeds

Title 2 of the Oklahoma Agricultural Code advises that controlling noxious weeds is the responsibility of every landowner or occupant. According to the Noxious Weed Laws and Rules of Oklahoma (OSDA 2000), every landowner and any public, private, or corporate entity that maintains ROWs in Oklahoma is responsible for removing any thistle infestation on their land. Noxious weeds in Oklahoma were listed by passage of Oklahoma House Bill 2277 (NRCS 2012a).

Programmatic Biological Assessment

The BIA has prepared a draft programmatic biological assessment (PBA; BIA [in preparation]) to evaluate habitat and endangered species with respect to oil and gas activities in Osage County. (For a discussion of special status wildlife species, including those addressed by the PBA, see **Section 3.7**.) The PBA addresses noxious weeds, including the potential for their establishment and spread, when assessing impacts on sensitive species habitat from oil and gas activities. The BIA developed this PBA for the proposed ongoing exploration, development, extraction, transport, and distribution of crude oil, natural gas, and petroleum products in Osage County.

3.6.2 Current Conditions

Vegetation in Oklahoma is influenced by larger regional patterns of climate, particularly the precipitation gradient. Precipitation is 55 inches in southeast Oklahoma, enough to support dense oak-pine forests. Shortgrass prairie grasslands are the predominant vegetation in the far western portion of the state, which receives only 13 inches of precipitation annually (Hoagland 2008). Vegetation in the planning area reflects its intermediate location along this precipitation gradient. It is also influenced by geology and soils, as well as disturbances from fires and grazing.

According to the Oklahoma Biological Survey, the planning area contains three potential vegetation types: post oak-blackjack forest, tallgrass prairie, and bottomland forest along the Arkansas River (Hoagland 2008).

Table 3-14 summarizes acreages of each potential vegetation type in the planning area. The potential vegetation types reflect the distribution of vegetation in the absence of human intervention and thus do not depict urban or agricultural areas.

Table 3-14
Potential Vegetation Types

Vegetation Type	Acres
Post oak-blackjack forest	772,700
Tallgrass prairie	656,700
Bottomland forest	41,400
Total[1]	1,470,800

Source: Oklahoma Biological Survey GIS 1943
[1]Due to a data discrepancy, potential vegetation type total acres do not precisely match the planning area total acres.

Approximately 74,000 acres (5 percent) of the planning area is developed or barren. Developed areas consist of small cities and towns and the northwest edge of the Tulsa metropolitan area, near the southeast corner of the planning area (Andrews and Smith 2014). Developed and barren areas are not included in the potential vegetation types in **Table 3-14**.

Post Oak-Blackjack Forest

Post oak-blackjack forest, also locally known as the cross timbers, is characterized by a mix of forest, woodland, and grassland vegetation. Common woody species are post oak (*Quercus stellata*), blackjack oak (*Q. marilandica*), black oak (*Q. velutina*), blackhaw (*Viburnum prunifolium*), black hickory (*Carya texana*), gum bumelia (*Sideroxylon lanuginosum*), Mexican plum (*Prunus mexicana*), redbud (*Cercis* spp.), roughleaf dogwood (*Cornus drummondii*), and sumac (*Rhus* spp.).

The understory is made up of little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), and other species, depending on the site (Hoagland 2008; Duck and Fletcher 1943), though understory and regeneration are limited where cattle graze in this vegetation type (ONENRD 2006). Between 1910 and 1980, post oak-blackjack forests in the planning area approximately doubled in size due to fire suppression (ONRNRD 2006).

Post oak-blackjack forest is commercially managed, in part to produce harvestable wood products under the Osage Nation Forest Management Plan (ONENRD 2006). Commercial management was limited before the forest management plan. Forest stands in the planning area may be over-mature and in need of thinning. They lack sufficient regeneration due in part to the cattle grazing, fire suppression, and lack of forest management that were in place before the forest management plan was developed. Management goals are to provide a source of income from sustained commercial harvest and sale of timber and wood products, to improve habitat for game and non-game wildlife, and to protect and enhance the aesthetic and cultural value of the resource.

Prescribed fire is a primary management tool in upland forest vegetation in the planning area; it is used on approximately 4,500 acres annually to reduce fuel loading and the likelihood of catastrophic fire (ONENRD 2006).

Tallgrass Prairie

Tallgrass prairies contain primarily grasses, such as little bluestem, big bluestem, Indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*). Other herbaceous plants found in the tallgrass prairie are lead plant (*Amorpha canescens*), Indian plantain (*Arnoglossum plantagineum*), prairie clover (*Dalea purpurea*), heath aster (*Aster ericoides*), pallid coneflower (*Echinacea pallida*), ashy sunflower (*Helianthus mollis*), and Missouri goldenrod (*Solidago missouriensis*). Tallgrass prairie has declined greatly in acreage due to agricultural conversion throughout the region; however, large expanses of this vegetation type still occur in Osage and adjacent counties (Hoagland 2008; Duck and Fletcher 1943; ONENRD 2006).

The largest protected remnant of tallgrass prairie left on Earth is in the planning area (TNC 2015). The 38,100-acre Tallgrass Prairie Preserve has been managed since 1989 by The Nature Conservancy (TNC), which conducts research, prescribed burning, and bison grazing management in the preserve to maintain and improve ecological diversity. The preserve is a single parcel (with several inholdings), so habitat fragmentation within it is low.

Prescribed fire is also used to improve rangelands in the planning area; it is used on approximately 39,000 acres annually to reduce woody species encroachment and the likelihood of catastrophic fire (ONENRD 2006).

Bottomland Forest

Bottomland forest extends from eastern to western Oklahoma, along major rivers, as mapped by Duck and Fletcher (1943). As a result, there is tremendous variation in species composition of bottomland forests. Typical stream growth in central Oklahoma within the tallgrass prairie vegetation type consists of American elm (*Ulmus americana*), chinquapin oak (*Quercus muhlenbergii*), post oak, blackjack oak, hackberry (*Celtis laevigata* and *C. occidentalis*), chittamwood (*Bumelia lanuginosa*), cottonwood (*Populus deltoides*), chickasaw plum (*Prunus angustifolia*), fragrant sumac (*Rhus trilobata*), smooth sumac (*R. glabra*), and roughleaf dogwood (Hoagland 2008; Duck and Fletcher 1943).

This vegetation type is commercially managed in part to produce harvestable wood products under the Osage Nation Forest Management Plan (ONENRD 2006), as described under *Post Oak-Blackjack Forest*, above.

Riparian Vegetation

In Oklahoma, forested riparian areas are often referred to as bottomland hardwood forests (OSU 1998), as described above (Hoagland 2008). The Oklahoma landscape, crossed by large rivers, formerly contained millions of acres of riparian land before Euro-American settlement (OSU 1998). Estimates suggest that less than 15 percent of the original riparian forest remains in the 28 easternmost counties (Brabander et al. 1985). While this estimate does not include Osage County, it does include Washington, Tulsa, and Creek Counties, which border Osage County on the east, southeast, and south.

Between 1910 and 1980, bottomland hardwood (riparian) forests in the planning area shrank by approximately half due primarily to agricultural conversion (ONENRD 2006). These areas provide an extensive list of benefits to humans and the natural environment. Riparian areas act as a natural buffer between upland activities and sensitive water resources. They store water, mitigate the effects of flooding, reduce erosion, and provide shelter and forage for wildlife (OSU 1998).

Wetlands

Freshwater wetlands are classified as riverine (rivers, streams, and creeks), lacustrine (lakes and reservoirs), and palustrine (forested, scrub-shrub, and emergent wetlands and ponds; Cowardin et al. 1979). According to the National Wetland Inventory remote sensing data, approximately 33,100 acres of freshwater wetlands occur in the planning area. **Table 3-15** summarizes the area of each type of freshwater wetlands mapped by the National Wetland Inventory in the planning area.

Table 3-15
National Wetland Inventory Wetlands

Wetland Type	Acres
Freshwater emergent wetland (palustrine)	3,300
Freshwater forested/shrub wetland (palustrine)	10,800
Freshwater pond (palustrine)	5,700
Lake (lacustrine)	16,400
Riverine	7,100
Total	**43,300**

Source: NWI GIS 2015a

Riverine

The riverine system includes nontidal freshwater wetland and deep-water habitats contained within a channel (Cowardin et al. 1979). Those wetlands that are in a channel but are dominated by trees, shrubs, or persistent emergent vegetation are described in the palustrine system, below. Riverine wetlands in the planning area are closely associated with major rivers and larger streams in the planning area, including the Arkansas and Caney Rivers and the Salt and Hominy Creeks (NWI GIS 2015a).

Lacustrine

The lacustrine system includes wetlands and deep-water habitats situated in a topographic depression or a dammed river channel. Lacustrine systems lack trees, shrubs, and persistent emergent vegetation and generally have a total surface area of at least 20 acres (Cowardin et al. 1979). Lacustrine wetlands in the planning area are Keystone and Kaw Lakes and Hulah and Skiatook Reservoirs (NWI GIS 2015a). Several other smaller reservoirs falling under the lacustrine system are also in the planning area.

Palustrine

The palustrine system includes all nontidal freshwater wetlands dominated by trees, shrubs, persistent emergent vegetation, and emergent mosses or lichens. It also includes wetlands lacking such vegetation but with total surface area of less than 20 acres. The palustrine system was developed to group the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie. It also includes the small, shallow, permanent or intermittent water bodies often called ponds.

Palustrine wetlands may be situated shoreward of lakes, river channels, or estuaries, on river floodplains, in isolated catchments, or on slopes. They may also occur as islands in lakes or rivers (Cowardin et al. 1979). Palustrine wetlands in the planning area are freshwater forested or shrub wetlands, which are associated with larger river and stream systems, including the Arkansas River.

Freshwater emergent wetlands are also associated with these river and stream systems, as well as along margins of lacustrine wetlands, like reservoirs and lakes. Hundreds of small freshwater ponds are scattered across the planning area for agriculture or livestock grazing; these are also included in the palustrine system. Many of these ponds have freshwater emergent wetlands along portions of their margins (NWI GIS 2015a).

A comprehensive planning area-wide delineation of wetlands following USACE guidelines (Environmental Laboratory 1987) has not been conducted in the planning area.

Noxious Weeds and Nonnative, Invasive Plants

The Oklahoma state noxious weed list includes three weeds: musk thistle (*Carduus nutans*), Canada thistle (*Cirsium arvense*), and Scotch thistle (*Onopordum acanthium*; NRCS 2012a). These thistles grow mostly unimpeded in the state due to a lack of natural disease and insects to control their growth (OSU 2012).

In addition to noxious weeds, there are also nonnative invasive plants that are not listed but that can also be problematic. Both noxious and nonnative invasive plants have the potential to impact the ecological integrity of a region, thus both noxious and nonnative invasive plants are discussed in this section.

Noxious Weeds

Musk thistle was first documented in Oklahoma in Payne County in 1944 (OSU 2012), southwest of but relatively near the planning area. Musk thistle has now been documented in almost every county in the state, including Osage, and was declared a noxious weed in Oklahoma in 1994. Integrated control using herbicides and musk thistle weevils (*Rhinocyllus conicus*) can provide satisfactory control (OSU 2012).

The perennial Canada thistle is widely distributed in northern states. Some plants were collected in the Oklahoma panhandle counties over 50 years ago, but currently no infestations are known to exist in the state (OSU 2012). However, this species remains on the Oklahoma state noxious weed list due to the high potential for invasion and rapid spread in the state.

Scotch thistle invaded Oklahoma from the west and is known to exist in several primarily western Oklahoma counties. The occurrence nearest to the planning area was reported in 2001 in Garfield County (OSU 2012), west of the planning area. Scotch thistle is difficult to control with herbicides, and no biological control options are currently available.

Nonnative, Invasive Plants

The Oklahoma Invasive Plant Council (OkIPC) maintains a list of problem and watch list species that pose a potential threat of invasion in the state (OkIPC 2014), based on a 2009 invasive plant audit for Oklahoma conducted by TNC (Pruett 2009). These nonnative invasive species are in addition to the three state-listed noxious weeds described above (NRCS 2012a). OkIPC lists 32 problem species and 21 watch list species in the state (**Table 3-16**).

Not all of the nonnative invasive species listed in **Table 3-16** necessarily occur in the planning area. However, OkIPC (2014) indicates that the following species all occur in the planning area: Japanese brome, cheatgrass, sericea lespedeza, Johnsongrass, beefsteak plant, poison hemlock, field bindweed, Mexican fireweed, sulphur cinquefoil, and common mullein. In addition, the 1979 environmental assessment for oil and gas leasing in the planning area (BIA 1979) found that Japanese brome and other annual weedy grass species (referred to as chess and threeawn (*Aristida* spp.) in the environmental assessment) can become common or dominant in tallgrass prairie habitat in response to persistent severe overgrazing. Threeawn is not listed by OkIPC as a problem or watch list species.

Many of these species were formerly recommended forage species that are now recognized as invasive (OkIPC 2014); as such they are now widespread through the planning area and state due to ranching and grazing. Though not included on the OkIPC list, Bermudagrass (*Cynodon dactylon*) is a nonnative invasive perennial grass in the planning area that was widely planted in the 1940s to control old-field erosion (ONENRD 2006) and provide forage for livestock.

Table 3-16
OkIPC Problem and Watch List Species

Scientific Name	Common Names
Problem Species	
Albizia julibrissin	Mimosa, silk tree
Alternanthera philoxeroides[1]	Alligator weed
Bothriochloa bladhii	Caucasian bluestem
B. ishaemum	Yellow bluestem, King Ranch bluestem
Bromus japonicus	Japanese brome
B. racemosus	Meadow brome
B. tectorum	Cheatgrass
Carduus nutans[2]	Musk thistle, nodding plumeless thistle
Cirsium arvense[2]	Canada thistle
C. vulgare	Bull thistle
Conium maculatum	Poison hemlock
Convolvulus arvense	Field bindweed
Hydrilla verticillata[2]	Hydrilla
Kochia scoparia	Mexican fireweed
Lespedeza cuneata	Sericea lespedeza
Ligustrum sinense	Chinese privet
Lonicera japonica	Japanese honeysuckle
Lythrum salicaria[2]	Purple loosestrife
Microstegium vimineum	Nepalese browntop
Myriophyllum aquaticum[2]	Parrot's feather
M. spicatum[1]	Eurasian watermilfoil
Perilla frutescens	Beefsteak plant
Potentilla recta	Sulphur cinquefoil
Pueraria montana	Kudzu
Rosa multiflora	Multiflora rose
Saccharum ravennae	Revennagrass
Salsola tragus	Russian thistle, tumbleweed
Sorghum halepense	Johnsongrass
Tamarix chinensis	Chinese salt cedar
T. parviflora	Small-flowered tamarisk
T. ramosissima	Salt cedar, tamarisk
Verbascum thapsus	Common mullein
Oklahoma Watch List	
Ailanthus altissima	Tree of heaven
Arundo donax	Giant reed
Broussonetia papyrifera	Paper mulberry
Cyperus rotundus	Nut grass
Eichhornia crassipes[1]	Water hyacinth
Elaeagnus angustifolia	Russian olive
E. pungens	Thorny olive
E. umbellate	Autumn olive
Egeria densa[1]	Brazilian water weed
Erodium cicutarium	Red stem stork's bill
Ligustrum japonicum	Japanese privet

Table 3-16
OkIPC Problem and Watch List Species

Scientific Name	Common Names
Lolium arundinaceum	Tall fescue
L. pretense	Meadow ryegrass
L. temulentum	Darnel ryegrass
Lonicera mackii	Bush honeysuckle
Lygodium japonicum	Japanese climbing fern
Melia azedarach	Chinaberry tree
Mililotus officinalis	Yellow sweet clover
Paulownia tomentosa	Princess tree
Pyrus calleryana	Callery pear
Ulmus pumila	Siberian elm

Source: OkIPC 2014

[1]On watch list by law in Oklahoma
[2]Currently banned by law in Oklahoma

Culturally Important Plants

Many native plants in the planning area are culturally important to the Osage. Traditional and sacred plants are used for ceremonies and on an everyday basis by tribal members. Woody plants are used for firewood, poles and fire ash sticks, and handles for tools and provide leaves for smoking and medicinal teas (ONENRD 2006). Culturally important plants are native to the planning area and evolved under historical fire regimes; thus, prescribed fire is used to mimic historical fire regimes and to reduce the risk of catastrophic wildfire for the benefit of culturally important plants (ONENRD 2006).

3.6.3 Trends

Upland Vegetation

Tallgrass prairie has declined greatly in acreage due to agricultural conversion throughout the region; however, large expanses of this vegetation type still occur in the planning area in Osage County and in adjacent counties (Hoagland 2008). The Osage grasslands were historically used largely for pasture (Duck and Fletcher 1943). The associated conversion to exotic pasture grasses (yellow bluestem, Bermuda grass, and weeping lovegrass [*Eragrostis curvula*]; Hoagland 2000) is an ongoing threat in tallgrass prairie and other vegetation types in the planning area. Management of the Tallgrass Prairie Preserve will continue to improve ecological integrity of this stronghold of native tallgrass prairie in the planning area.

Upland hardwood forests are commercially managed in part to produce harvestable wood products under the Osage Nation Forest Management Plan (ONENRD 2006), as described in **Section 3.6.2**. Where upland vegetation is managed under the forest management plan, the quality of the habitat can be expected to improve due to reduced fuel loads, decreased chances for catastrophic wildfire, and improved regeneration. The Osage Nation Environmental and Natural Resource Department coordinates with the BIA, the Forest Service, and the State of Oklahoma to monitor the health of tribal forests and woodlands, including monitoring for outbreaks of disease and damaging insect pest populations (ONENRD 2006).

Riparian Vegetation

Projections for the future of riparian vegetation in Oklahoma show continued loss of riparian areas (OSU 1998). Threats to riparian areas continue from many sectors. Riparian forests or bottomlands are fertile and often are valued as prime farmland because they grow on deep, rich alluvial soils. Many riparian areas have been cleared for pastureland or for row crops or other agricultural activities. Many of these activities use fertilizers and pesticides, increasing the potential for both groundwater and surface water pollution. Urban encroachment, channelization, and other water resource development projects also continue to alter riparian areas (OSU 1998).

Bottomland hardwood forests are also commercially managed, as discussed in *Upland Vegetation*, above, and forest health could be expected to improve in properly managed stands. Outbreaks of disease and damaging insect pest populations are monitored in woodlands and forests in the planning area, which would reduce the chances for damaging pest or disease outbreaks in riparian woodlands.

Wetland Vegetation

Wetlands in the planning area are generally under the jurisdiction of the USACE regulatory division. It is responsible for protecting aquatic resources, including wetlands in the planning area, while allowing reasonable development through informed permit decisions. Development projects, agricultural conversion, and water resource projects will likely continue in the planning area and will have the potential to impact wetlands under the jurisdiction of the USACE. Unavoidable impacts on the aquatic environment will be offset by issuing permits that will include mitigation requirements, such as restoring, enhancing, creating, and preserving aquatic functions and values (USACE 2014).

Noxious Weeds and Nonnative Invasive Species

Noxious weed and invasive plant programs through the NRCS, Oklahoma State University, OkIPC, Oklahoma Biological Survey, and others will continue to increase awareness of invasive plants in the planning area. Recognition of the sources of invasives and their economic and ecological impacts, along with early detection and prevention programs, can help prevent additional infestations in the planning area. Control and management strategies will continue to manage and prevent further expansion of current infestations in the planning area.

Culturally Important Plants

Culturally important plants are native species that are found in the vegetation communities described above. If native upland, riparian, and wetland vegetation continues to decline in the planning area, culturally important plants may also be at risk of decline.

Other Considerations

Oil and gas activities will continue to occur throughout the planning area. As part of the draft biological assessment, the BIA proposes conservation and mitigation measures to reduce or mitigate impacts of oil and gas activities on American burying beetle (ABB) habitat (see **Section 3.7**). This habitat is widespread in the planning area and generally includes upland forests, shrublands, grasslands, and certain types of wetland and riparian areas. Measures developed by the BIA generally include reducing soil compaction, wildfire risk, and soil erosion, restoring habitat, and monitoring vegetation and noxious weeds (BIA [in preparation]). Such measures will ensure that impacts on vegetation from oil and gas activities are minimized.

3.7 SPECIAL STATUS SPECIES

3.7.1 Regulatory Framework

Endangered Species Act of 1973

The Endangered Species Act (ESA) of 1973 (16 USC, Section 1531 et seq.), as amended, provides for the conservation of federally listed plant and animal species and their habitats. The ESA directs federal agencies to conserve listed species and imposes an affirmative duty on these agencies to ensure that their actions are not likely to jeopardize the continued existence of a listed species or adversely modify its designated critical habitat.

Critical habitat is defined in the ESA as “the specific areas within the geographical area occupied by the species … on which are found those physical or biological features (I) essential to the conservation of the species, and (II) which may require special management considerations or protection; and … specific areas outside the geographical area occupied by the species … upon a determination by the Secretary [of the Interior] that such areas are essential for the conservation of the species” (16 USC, Section 1532[5][A]).

Under the ESA, Section 7 formal consultation is required when a federal action may affect, and is likely to adversely affect, a listed species or designated critical habitat. During this process, the federal action agency submits a biological assessment to the US Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service, which includes the following:

- A list of potentially and actually occurring listed species and designated critical habitat that may be affected by the project
- A description of the proposed project
- An evaluation of the potential effects of the project on such species and habitat

During formal consultation, the USFWS and the federal action agency exchange information and gather any necessary additional information. Section 7 formal consultation concludes with the USFWS issuing a biological opinion, detailing its conclusion of jeopardy or no jeopardy to a species and adverse modification/no adverse modification to a critical habitat. All reasonable and prudent measures and any incidental take statements are contained in the biological opinion. Section 7 consultation for the proposed project began on November 17, 2014, with submission to the USFWS of a biological assessment and requested addenda.

Programmatic Biological Assessment

The BIA has prepared a draft PBA to evaluate existing habitat and endangered species with respect to oil and gas activities in Osage County (BIA [in preparation]). The BIA developed this PBA for the proposed ongoing exploration, development, extraction, transport, and distribution of crude oil, natural gas, and petroleum products in Osage County.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 USC, Sections 668-668d) applies primarily to taking, hunting, and trading activities that involve bald or golden eagles. The act prohibits the taking[1] of any individuals of these two species, as well as any part, nest, or egg.

Migratory Bird Treaty Act of 1918, as amended

The MBTA (16 USC, Sections 703-712) makes it unlawful to, among other things, pursue, hunt, take, capture, kill, or possess any migratory bird or part, nest, or egg of such bird listed in four separate wildlife protection treaties between the United States, Great Britain, Mexico, Japan, and Russia. The MBTA covers 1,007 species, as specified in 50 CFR, Subpart 10.13.

3.7.2 Current Conditions

Osage County is characterized by rolling uplands bisected by drainages, with narrow floodplains in the south and level to rolling uplands in the north (BIA 2013). Elevation ranges from 750 feet to 1,000 feet above mean sea level. The highest elevation in Osage County is near the town of Wynona, southeast of Pawnee; the lowest elevations are found along the Caney and Arkansas Rivers.

Predominant vegetation cover is rangeland and native pastureland. Native grass meadows, prairie, and oak savannah also are found in Osage County (BIA 2013), along with bottomland forest along the Arkansas River (Hoagland 2000). TNC's Tallgrass Prairie Preserve (approximately 40,000 acres) in Osage County is part of the 3.8 million-acre Flint Hills, the largest remaining intact tallgrass prairie in

[1]The term "take" as used in the act includes "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb."

North America. The preserve is a center for rangeland research, focusing on conservation and restoration of prairie ecosystems.

American Burying Beetle (*Nicrophorus americanus*), Endangered

The ABB is a federally endangered species in 31 counties in Oklahoma, including Osage (USFWS 2012a). The USFWS published the recovery plan for ABB in 1991. This beetle is shiny black, and its most diagnostic feature is the large orange-red markings on the raised portion of the pronotum. The species is up to 1.5 inches long. The ABB has been frequently found in upland grasslands or near the edge of grassland/forest. Sandy/clay loam soils and food (carrion) availability are also important. The species appears to prefer loose soil in which carrion can be easily buried. It is a habitat generalist, and all vegetation types are considered ABB habitat within its range, excluding developed areas, tilled lands, mowed grasslands, saturated soils, or unvegetated areas (USFWS 2014a).

This large, strikingly colored beetle is nocturnal and belongs to a small group of beetles known to bury small dead animals. It is threatened by disease, pesticides, habitat loss, competition for food, isolation and loss of genetic diversity, decrease in prey abundance, agriculture and grazing, and invasive species (USFWS 1991, 2014a). The ABB was once found in 35 eastern states but now occupies only the periphery of its former range. It has been documented in Rhode Island, South Dakota, Nebraska, Oklahoma, Arkansas, and Kansas, with reintroductions attempted in Massachusetts and Ohio (GPNC 2012; USFWS 2012b).

The ABB is present in the planning area and would be impacted by planned oil and gas drilling. Most of Osage County is in the range of this species, and the northeastern part of the county is considered a Conservation Priority Area for ABB (USFWS 2014a; see **Figure 3-6**).

Whooping Crane (*Grus americana*), Endangered

The whooping crane is a federal endangered species that has been observed in Osage, Pawnee, and Payne Counties, Oklahoma. It is the tallest North American bird and is named for its whooping sound. Along with the sandhill crane, it is one of only two crane species found in North America (USFWS 2012c).

An adult whooping crane is white with a red crown and a long, dark, pointed bill. Immature whooping cranes are cinnamon brown. While in flight, their long necks are kept straight and their long dark legs trail behind. Adult whooping cranes' black wing tips are visible during flight.

The muskeg of the taiga in Wood Buffalo National Park, Alberta, Canada, and the surrounding area was the last remnant of the former nesting habitat of the whooping crane summer range. However, with the recent Whooping Crane Eastern Partnership Reintroduction Project, whooping cranes nested naturally for the first time in 100 years in the Necedah National Wildlife Refuge in central

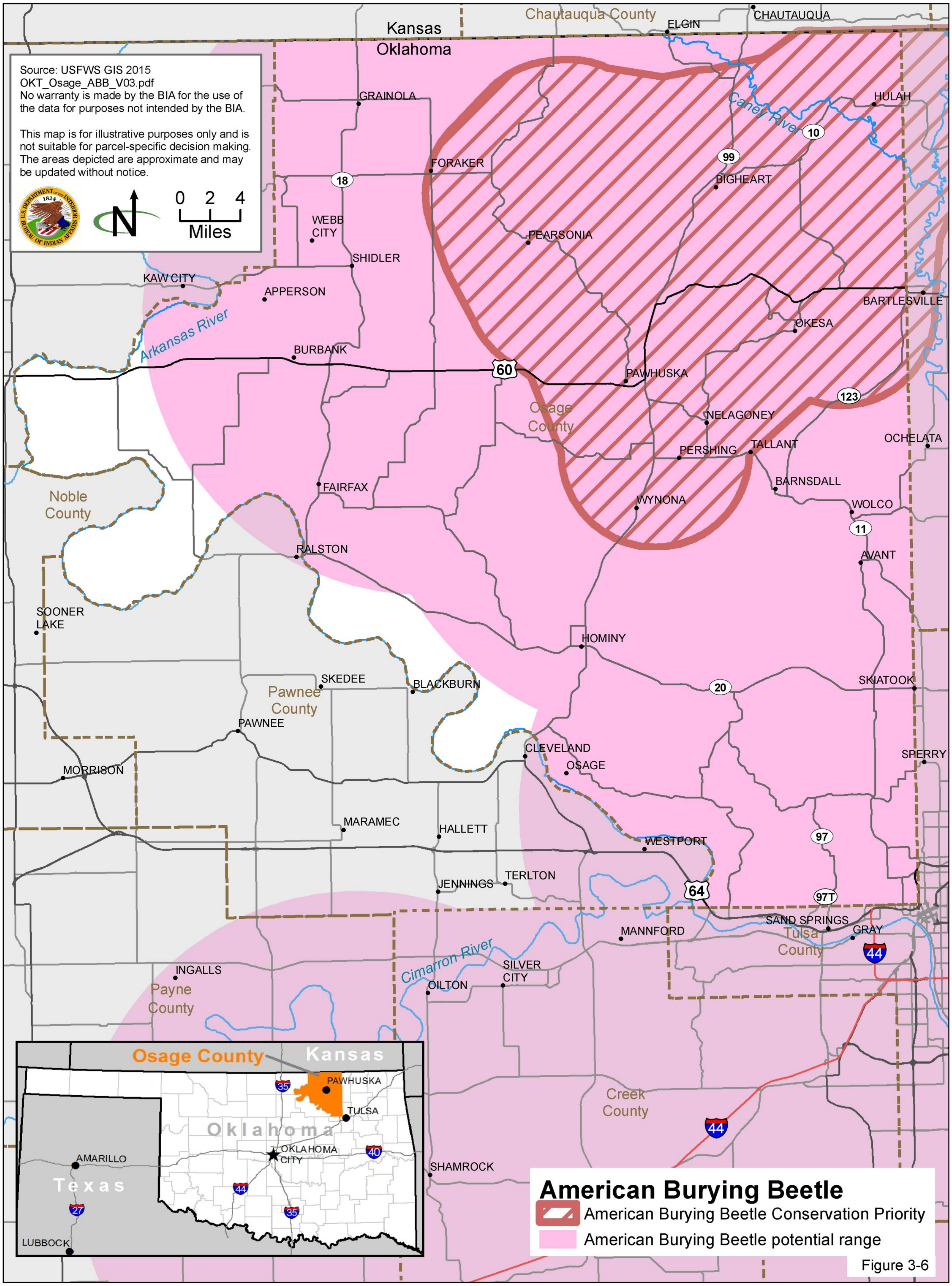

Source: USFWS GIS 2015
OKT_Osage_ABB_V03.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
ELGIN
CHAUTAUQUA
GRAINOLA
HULAH
Caney River
10
99
FORAKER
18
BIGHEART
WEBB CITY
PEARSONIA
SHIDLER
KAW CITY
APPERSON
BARTLESVILLE
Arkansas River
OKESA
BURBANK
60
PAWHUSKA
123
Osage County
NELAGONEY
OCHELATA
PERSHING
TALLANT
FAIRFAX
BARNSDALL
Noble County
WYNONA
WOLCO
11
RALSTON
AVANT
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
Pawnee County
SKIATOOK
20
PAWNEE
CLEVELAND
OSAGE
SPERRY
MORRISON
MARAMEC
HALLETT
97
WESTPORT
TERLTON
JENNINGS
64
97T
SAND SPRINGS
MANNFORD
Tulsa County
GRAY
44
INGALLS
Payne County
Cimarron River
SILVER CITY
OILTON
Osage County
Kansas
PAWHUSKA
35
TULSA
Oklahoma
OKLAHOMA CITY
40
AMARILLO
Texas
44
27
35
LUBBOCK
Creek County
44
SHAMROCK
American Burying Beetle
American Burying Beetle Conservation Priority
American Burying Beetle potential range

Figure 3-6

Wisconsin. They nest on the ground, usually on a raised area in a marsh. The female lays one or two blotchy, olive green eggs, usually in late-April to mid-May. The incubation period is 29 to 31 days. Both parents brood the young, although the female is more likely to directly tend to them. Usually no more than one young bird survives in a season.

Breeding populations winter along the Gulf Coast of Texas, near Corpus Christi on the Aransas National Wildlife Refuge and along Sunset Lake in Portland (Texas), Matagorda Island, Isla San Jose, and portions of the Lamar Peninsula and Welder Point, on the east side of San Antonio Bay. The Salt Plains National Wildlife Refuge in Oklahoma is a major migratory stopover for the crane population, hosting over 75 percent of the species annually. The whooping crane is endangered mainly as a result of habitat loss, although they are also still illegally shot.

The whooping crane's lifespan is estimated to be 22 to 24 years in the wild. After being pushed to the brink of extinction by unregulated hunting and loss of habitat to just 21 wild and two captive whooping cranes by 1941, conservation efforts have led to a limited recovery. As of 2011, there are an estimated 437 birds in the wild and more than 165 in captivity (BIA [in preparation]).

The nearest critical habitat for the whooping crane is the Salt Plains National Wildlife Preserve, approximately 60 miles west of Osage County. Although the bird has been observed migrating through Osage County, it is unlikely to be impacted by drilling.

Red Knot* (Calidris canutus rufa)*, Threatened

Calidris canutus rufa is a subspecies of red knot, a sandpiper-like shorebird with a round body, long legs, a small head, and tiny eyes. The beak tapers and is not much longer than its head. Males and females vary slightly in size and color. It migrates over long distances, breeding in Arctic tundra and wintering on sandy beaches and barren flats in the Americas (NatureServe 2015).

Although the breeding plumage of *C. c. rufa* is the dullest of all red knot subspecies, the face, chest, and belly remain a striking reddish brown. The head is a dark gray, the eye stripe, back, and rump are rust colored, while the rear belly is white. The wing feathers are gray, with a pale edging and oblong rust-colored centers. When not breeding, the species has a white eye stripe; the head, back, and tail are a plain gray, while the face, chest, and belly are a dingy white. The upper chest has dark streaking that may extend down the flanks. In juveniles there is no distinction between male and female, which both have a dark gray head with a white eye stripe. The back and tail are gray with distinct white outlines on the feathers, giving each feather a predominant shape. The chest and belly are white with light streaking (Harrington 2001; Niles et al. 2008).

Red knot populations have been in drastic decline from overharvesting horseshoe crabs, whose eggs are a primary food source during migration. Although this species has been observed in migration in Osage County, it does not nest in the vicinity (NatureServe 2015).

Interior Least Tern (**Sternula antillarum athalassos*****), Endangered***

The interior least tern is a federal endangered species known from Osage, Pawnee, and Payne Counties, Oklahoma. It is one of three subspecies of the least tern (*S. albifrons*), segregated on the basis of separate breeding ranges. The breeding season lasts from May through August. The terns gather at staging areas with high concentrations of fish, their primary prey, to rest and eat before the long flight to southern wintering grounds. Low wet sand or gravel bars at the mouths of tributary streams and floodplain wetlands are important staging areas. Interior least terns often return to the same breeding site, or one nearby, year after year.

Least terns nest in colonies, where nests can be as close as 10 feet but are often 30 feet or more apart. The nest is a shallow depression in an open, sandy area, a gravelly patch, or an exposed flat. Small twigs, pieces of wood, small stones, or other debris usually are found near the nest (Crawford 2012; KDWPT 2011; MDC 2011; USFWS 2011). Nesting habitat of the interior least tern is bare or sparsely vegetated sand, shell and gravel beaches, sandbars, islands, and salt flats associated with rivers and reservoirs. The birds prefer open habitat and tend to avoid thick vegetation and narrow beaches.

The interior least tern is migratory, breeding along inland river systems in the United States and wintering along the Central American coast and the northern coast of South America, from Venezuela to northeastern Brazil. Today, the interior least tern continues to breed on sandy flats in most of the major river systems, but its distribution is generally restricted to the less altered and more natural or little disturbed river segments. It has been observed in migration in Osage County.

Piping Plover (**Charadrius melodus*****), Threatened***

The piping plover is a federal threatened species known from Osage, Pawnee, and Payne Counties, Oklahoma. It is a small, sand-colored, sparrow-sized shorebird that nests and feeds along coastal sand and gravel beaches in North America. The adult has yellow-orange legs, a black band across the forehead from eye to eye, and a black ring around the neck. This chest band is usually thicker in males during the breeding season, and it is the only reliable way to tell the sexes apart. The piping plover is difficult to see when standing still as it blends well with open, sandy beach habitats. It typically runs in short starts and stops (USFWS 2012d).

Its breeding habitat is beaches or sand flats on the Atlantic coast, the shores of the Great Lakes, and the Midwest of Canada and the United States. It nests on sandy or gravel beaches or shoals and forages for food on beaches, usually by sight, moving across the beaches in short bursts. Generally, piping plovers will forage for food around the high tide wrack zone and along the water's edge. It eats mainly insects, marine worms, and crustaceans (USFWS 2014b).

Piping plovers migrate north in the summer and winter to the south on the Gulf of Mexico, the southern Atlantic coast of the United States, and the Caribbean. They begin migrating north beginning in mid-March. Their breeding grounds extend from southern Newfoundland south to the northern parts of South Carolina. Males begin claiming territories and pairing up in late March. They also perform elaborate courtship ceremonies, including stone tossing and courtship flights, featuring repeated dives. Piping plovers begin mating and nesting on the beach in mid-April.

Migration south begins in August for some adults and fledglings, and by mid-September most piping plovers have headed south for the winter. Although this species has been observed migrating in Osage County, it does not nest in the vicinity.

Northern Long-Eared Bat (**Myotis septentrionalis*****), Threatened***

A small insectivorous bat, the northern long-eared bat hibernates in winter and has a single young in May or June. They forage primarily over springs and waterways and roost in small colonies in mines, caves, or trees. This bat has a wide but scattered distribution in the eastern and north-central United States and southern Canada. It has suffered severe recent declines in abundance associated with the fungal white-nose syndrome in eastern North America. The disease is expected to spread across the species' range. The northern long-eared bat was listed as threatened on May 4, 2015. It is also threatened by wind-energy development, habitat modification, destruction and disturbance (e.g., hibernation site vandalism and roost tree removal), climate change, and contaminants, particularly for populations reduced by white-nose syndrome (NatureServe 2015). Osage County is on the edge of the range for this species, and because it does not roost in grassland areas, it is unlikely to be impacted by oil and gas activities.[2]

Neosho Mucket Mussel (**Lampsilis rafinesqueana*****), Endangered***

The Neosho mucket is a federal endangered species known to exist in Osage County. It is a medium to large mussel in the Lampsilinae subfamily. The shell of the Neosho mucket is relatively oblong, and the umbones are low and project only slightly or not at all above the dorsal curvature of the shell (Shiver 2002). The Neosho mucket is associated with shallow riffles and runs with gravel substrate and moderate to swift currents. Channel stability is an important factor determining the location of Neosho muckets. They need substrate loose enough to allow burrowing, and typically they are deeply imbedded in the

[2]Kevin Stubbs, USFWS biologist, phone conversation with Katie Patterson, EMPSi environmental planner, February 17, 2015.

substrate in a variety of habitats in large streams and small rivers. The Neosho mucket spawns in late April and May and broods larvae from May through August (Shiver 2002; KDWPT 2012).

The preferred habitat of this species is along rivers; because of this, the likelihood of a threat from oil and gas drilling in Osage County is low, if appropriate measures are implemented to protect habitat from disturbance related to oil and gas activities (BIA [in preparation]).

Rattlesnake Master Borer Moth (**Papaipema eryngii*****), Candidate***

A member of the genus *Papaipema*, the rattlesnake master borer moth has simple antennae and is generally characterized by a long thoracic tuft that often slants forward and ends abruptly at the far end. *P. eryngii* is a large chocolate-colored moth with bold white disk markings on the wings. Nearly all the larvae in the genus are purplish brown and have a pattern of longitudinal white stripes. They can be placed into one of four groups, based on stripe configurations. *P. eryngii* is a member of the group with zero stripes. The adult of the species is readily distinguished using male genitalia or external spots (Forbes 1954).

P. eryngii larvae rely on the rattlesnake master, which is the sole host plant for this species; a population of 100 to 1,000 rattlesnake master plants are needed for *P. eryngii* to persist. *P. silphii* and rarely *P. baptisiae* will also feed on rattlesnake master in June. Mating and egg laying are strictly nocturnal. Females deposit 200 or more eggs in the duff on or near host plants. Larvae emerge from overwintered eggs in late May and immediately begin to bore into the rattlesnake master host. Larvae enter stems near the ground and slowly eat their way into the root of the plant. Feeding continues through early August, at which time mature larvae cease all activity and lay dormant for approximately one week. Larvae pupate in late August, either in the root or in the soil, and emerge as adults roughly 18 to 21 days later. (BIA [in preparation]).

Sprague's Pipit (**Anthus spragueii*****), Candidate***

A pale, slender, sparrow-sized bird with white outer tail feathers and a heavily streaked back, Sprague's pipit is known for its jingling call and high flight. It feeds on insects and grains and nests in depressions in the ground, concealed in clumps of grass or other dense vegetation. Nests are difficult to find, and females do not flush from the nest until they are almost stepped on. Its breeding habitat is short-grass plains, mixed grass prairie, alkaline meadows, and wet meadows. The breeding season extends from late April through early September. Sprague's pipits may raise two broods of young a year. Clutch size is usually four or five eggs. On the ground, the bird is extremely secretive and flies away in a long, undulating flight when approached. It walks instead of hops and usually lands only on the ground. It breeds mainly on the northern Great Plains but has bred as far south as Osage County. It winters from Texas to Arizona and in Mexico. It forms flocks with horned larks and longspurs for migration.

The USFWS found its listing under the ESA to be warranted but precluded by higher priority species; thus, it is considered a candidate species. It is found in grasslands, including upland mixed-grass prairie, alkaline meadows, and wet meadow zones around alkali and freshwater lakes. Its population has declined as a result of loss, degradation, and fragmentation of habitat due to cultivation, wetland drainage, overgrazing, and nonnative vegetation (NatureServe 2015; USFWS 2010).

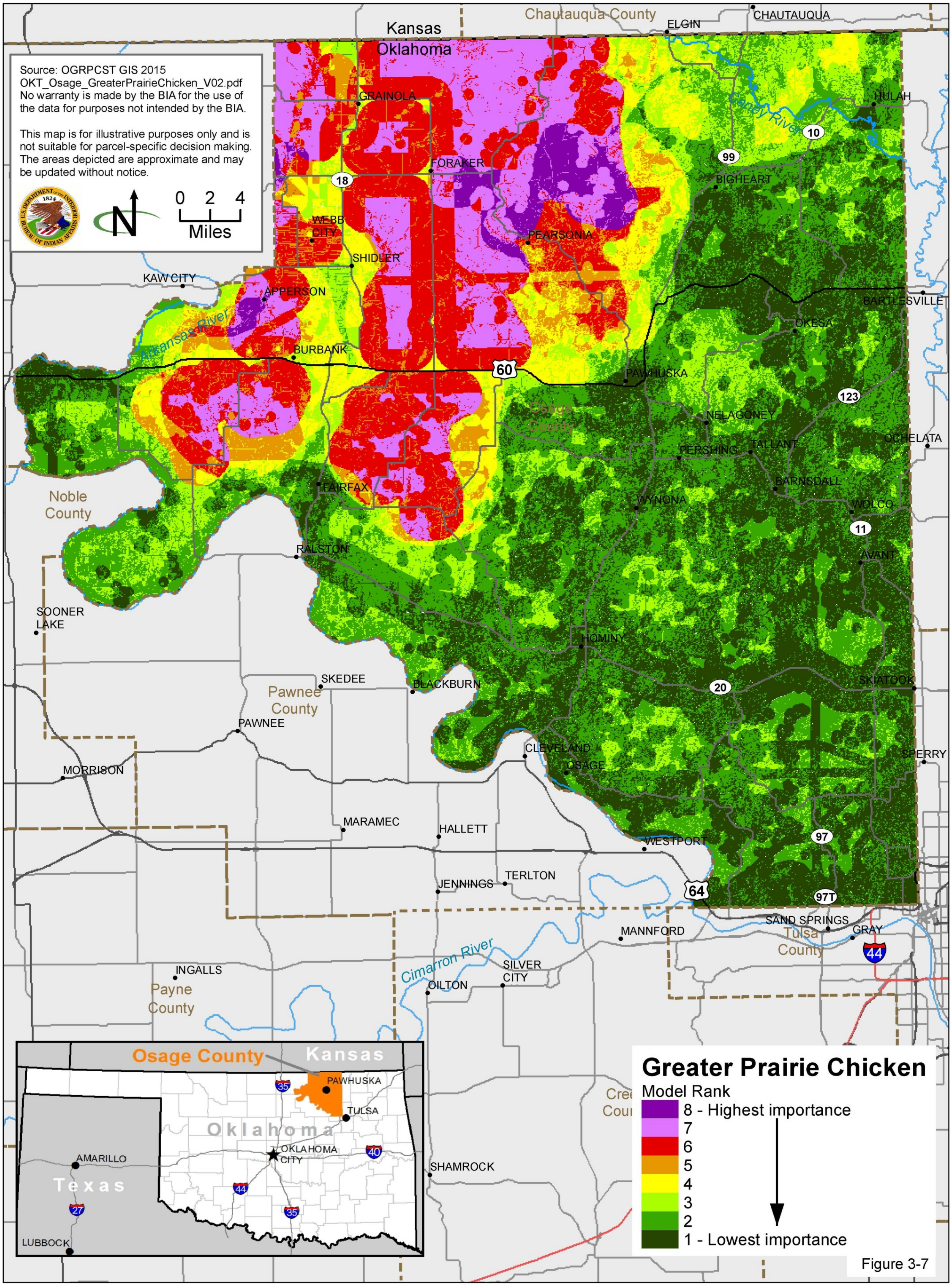
Greater Prairie Chicken (*Tympanuchus cupido*), Bird of Conservation Concern

The greater prairie-chicken is a chunky hen-like bird, barred with dark brown, cinnamon, and pale buff. It is slightly larger, darker, and more barred than the closely related lesser prairie chicken, a federal threatened species. Its preferred habitat is grasslands with herbaceous cover; it may also be found in cultivated lands and pastures. Males gather in leks for communal courtship, as do lesser prairie chicken, and females nest in the vicinity, in a scrape on the ground lined with vegetation. Both sexes show site fidelity and most do not migrate; ranges vary from 25 to 500 acres.

The diet consists primarily of insects, especially grasshoppers in summer. At other times of year it eats fruit, leaves, flowers, shoots, and grain. Formerly widespread in the grasslands of Canada and the western United States, the greater prairie chicken is now found locally in much reduced numbers in the Great Plains south to Texas. The species' decline is mainly the result of loss and fragmentation of tallgrass prairie, as a result of roads, infrastructure development, and incursion of trees, such as red cedar. The largest remaining populations are in Kansas, Nebraska, Oklahoma, and South Dakota. Northwestern Osage County is a stronghold for the species and contains 32,700 acres of highest importance habitat (see **Figure 3-7**). The closely related lesser prairie chicken is also diminished in range, and the subspecies *Tympanuchus cupido cupido* (heath hen) of the eastern seaboard has been extinct since the 1930s (NatureServe 2015).

Ferruginous Hawk (*Buteo regalis*), Bird of Conservation Concern

With a rusty back and shoulders, pale head, and white tail, the ferruginous hawk winters in Texas and Oklahoma in grassland and desert shrub areas. It prefers open country, primarily prairies, plains, and badlands, sagebrush, saltbush-greasewood shrubland, the periphery of pinyon-juniper and other woodlands, and desert. It nests in tall trees or willows along streams or on steep slopes, on cliff ledges and hillsides, on power line towers, on sloped ground on the plains, or on mounds in open desert, avoiding agriculture and human activity. Ferruginous hawks may maintain several nests in a territory and alternate their use. Clutch size varies with the availability of prey, especially ground squirrels (*Spermophilus* spp.) and jackrabbits (*Lepus* spp.). Home range size varies widely, from 3 to 30 square miles in some areas. Uncommon but widespread in suitable



Source: OGRPCST GIS 2015
OKT_Osage_GreaterPrairieChicken_V02.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
ELGIN
CHAUTAUQUA
HULAH
Caney River
GRAINOLA
FORAKER
BIGHEART
WEBB CITY
PEARSONIA
SHIDLER
KAW CITY
APPERSON
BARTLESVILLE
OKESA
Arkansas River
BURBANK
PAWHUSKA
Osage County
NELAGONEY
OCHELATA
PERSHING
TALLANT
BARNSDALL
FAIRFAX
Noble County
WYNONA
WOLCO
RALSTON
AVANT
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
Pawnee County
SKIATOOK
PAWNEE
CLEVELAND
OSAGE
SPERRY
MORRISON
MARAMEC
HALLETT
WESTPORT
JENNINGS
TERLTON
SAND SPRINGS
MANNFORD
GRAY
Tulsa County
Cimarron River
SILVER CITY
INGALLS
OILTON
Payne County
Osage County
Kansas
PAWHUSKA
TULSA
Oklahoma
OKLAHOMA CITY
AMARILLO
Texas
LUBBOCK
SHAMROCK
Greater Prairie Chicken
Model Rank
8 - Highest importance
7
6
5
4
3
2
1 - Lowest importance

Figure 3-7

habitat in the western United States and Canada, the ferruginous hawk has declined in local areas. It is highly sensitive to human disturbance and is subject to continuing habitat loss from agricultural development and forest incursion into grasslands (NatureServe 2015).

3.7.3 Trends

Tallgrass prairie acreage has declined greatly due to agricultural conversion throughout the region, and riparian vegetation is threatened by use as farmland or pastureland and urban encroachment (Oklahoma Department of Wildlife Conservation 2005b). Habitat for greater prairie chicken, ferruginous hawk, and other prairie-dwelling birds is being increasingly fragmented by roads, development, and drilling infrastructure.

For the ABB, trends of death and injury and the loss and fragmentation of habitat in Osage County are expected to continue. Oil and gas companies are expected to continue to construct, operate, and reclaim well pads, pipelines, and accompanying facilities, including access roads, electric distribution lines and substations, and off-site impoundments. Oil and gas activities in Osage County are likely to result in take of ABBs or impacts on their habitat. Activities occurring during the ABB active season could reduce the species' foraging and reproduction efficiency for the duration of the active season. Species used by ABB for food and reproduction and their habitat within project areas would be impacted. This likely would reduce the available food sources, decrease reproductive potential, and decrease ABB use of the area. Any permanent facilities, such as access roads, would remove ABB breeding, feeding, or sheltering habitat.

3.8 Agriculture

Agriculture in Osage County is primarily the production of cattle, corn, wheat, soybeans, sorghum, and other grains, oilseeds, and dry beans and peas. There are a total of 1,325 farms in Osage County covering 1,216,673 acres, with 65 of those farms covering 1,716 acres of orchards.

3.8.1 Regulatory Framework

Farmland Protection Policy Act

The Farmland Protection Policy Act states that federal agencies must "minimize the extent to which federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses…." The NRCS is responsible for protecting significant agricultural lands from irreversible conversions that result in the loss of an essential food or environmental resource. Prime farmland has the best physical and chemical characteristics for the production of food, feed, forage, fiber, and oilseed crops. This land either is used for food or fiber crops or is available for those crops, and not urban, built-up land, or a water area. The soil qualities, growing season, and moisture supply are those needed for a well-managed soil to economically produce a sustained, high yield of crops (NRCS 2012b).

American Indian Agricultural Resource Management Act

The American Indian Agricultural Resource Management Act declares that "Indian agricultural lands are renewable and manageable natural resources which are vital to the economic, social, and cultural welfare of many Indian tribes and their members; and development and management of Indian agricultural lands in accordance with integrated resource management plans will ensure proper management of Indian agricultural lands and will produce increased economic returns, enhance Indian self-determination, promote employment opportunities, and improve the social and economic well-being of Indian and surrounding communities" (25 USC, Section 3701).

2030 Osage County Comprehensive Plan

The 2030 Osage County Comprehensive Plan includes ranching and agriculture goals and policies to protect and preserve agricultural lands in the county. These are as follows:

Ranching and Agriculture Area Goals:

1. Preserve and protect land used for agriculture and ranching and control growth in a manner that supports these elements of the County as set out in the 2030 Plan
2. Protect agricultural and ranching areas from premature or unplanned development until a full range of public facilities, services, and utilities is available, as well as discourage wasteful scattering of non-agricultural development within prime agricultural areas
3. Concentrate the development of medium and high intensity land uses within or in close proximity to existing cities and towns and in the south and southeast areas of the County
4. Maintain and preserve prime agricultural land for its highest and best use as agricultural and ranching
5. Emphasize matters of compatibility of agriculture and ranching with oil and gas production
6. Achieve an orderly transition between agriculture and ranching uses with urban development and, in particular, industrial development, concentrating such industrial development within or adjacent to existing cities and towns, and in the south and southeast areas of the County
7. Support and plan for ranching and agriculture uses to continue to be basic economic activities of the County

8. Encourage and support the Tourism Committee in the development of agri-tainment and agri-tourism as future basic elements of the economic growth and development of the County

Ranching and Agricultural Area Policies are as follows:

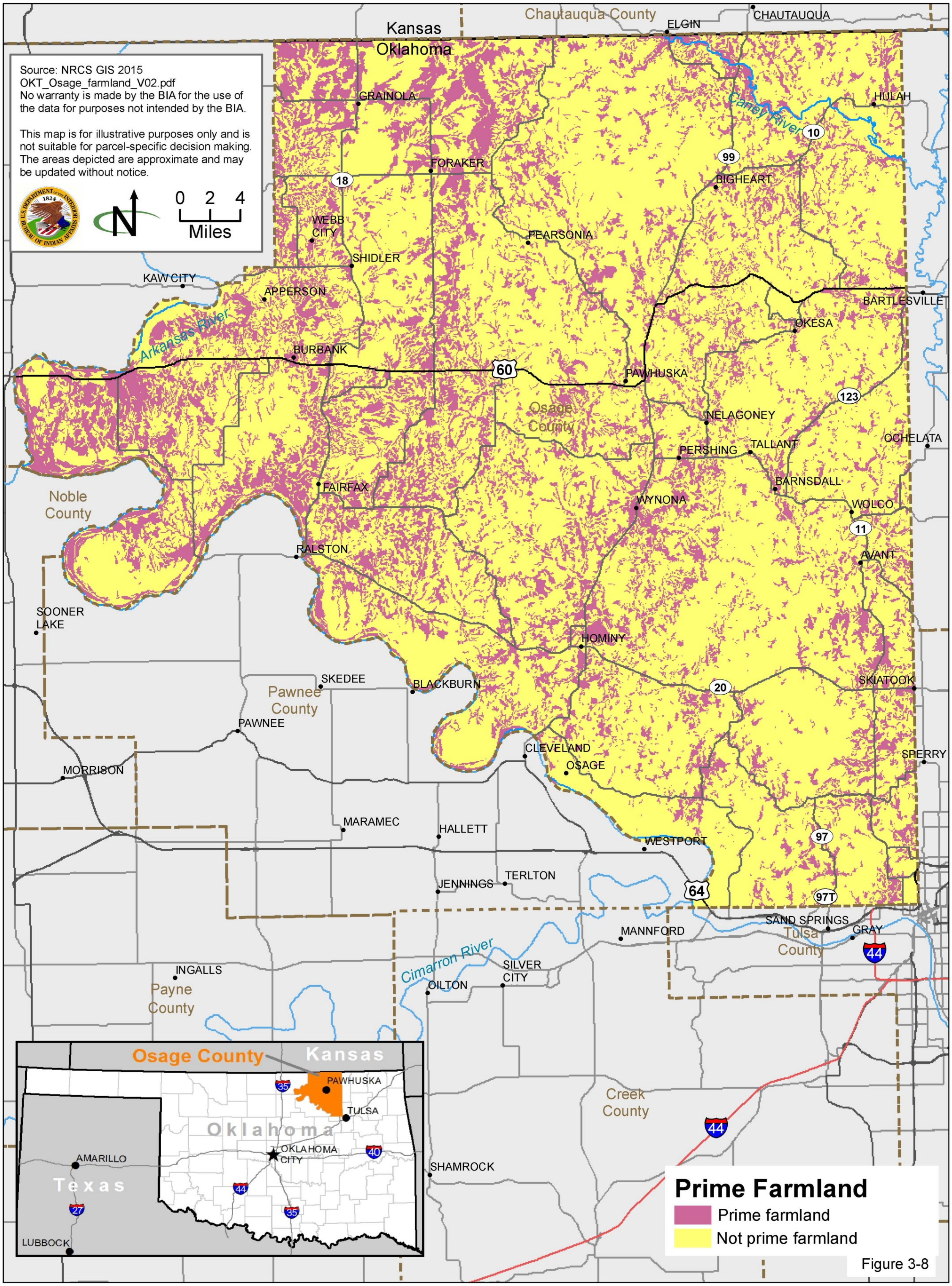
1. Implement and develop, as needed, those planning and land use policies and regulations that support, protect and encourage agriculture and ranching as a basic economic industry
2. Seek financial and technical assistance in the development of the necessary agricultural and rural infrastructure from various federal and state agencies to support the agricultural economy and preservation of agricultural lands
3. Consider the impact upon and preservation of agricultural and ranching activities prior to the extension of urban services into agriculture areas
4. Protect soil and water quality in ranching and agriculture areas from erosion, uncontrolled runoff, pollution and other problems sometimes associated with the initial stages of the development process or poor agricultural cultivation practices

3.8.2 Current Conditions

Ranching is the main enterprise in Osage County. According to the 2012 agricultural census, livestock sales accounted for $127 million, or 96 percent of the total agricultural market (USDA 2012). Osage County ranks ninth out of the 77 counties in Oklahoma in total value of agricultural products sold (USDA 2007). The average operating farm unit is approximately 83.5 acres. About 75 percent of the land on farms or ranches is open range, 12 percent is wooded range, 7 percent is cropland, and 6 percent is tame pasture.

Small grains, mainly wheat, alfalfa, grain sorghums, and soybeans are the principal crops (BIA 2014). Corn and sorghums, cut for silage and used by local dairies, and orchard crops are grown on a minor acreage. A large acreage of native grasses and tame pastures are cut for hay, which is mostly used by local farmers and ranchers. The other crops are shipped to local and distant markets. Approximately 75 percent of the annual production on rangeland grows in April, May, and June, coinciding with spring rains and moderate temperatures. A secondary growth period generally occurs in September and October, coinciding with fall rains and cooling temperatures (NRCS 2012b).

The farmland classification of soils found Osage County is prime farmland and not prime farmland, as shown in **Table 3-17**. **Figure 3-8** demonstrates how Prime Farmland is found along the rivers and major creek systems in areas that correspond to a great extent with the 100-year floodplain.



Chautauqua County
CHAUTAUQUA
ELGIN
Kansas
Oklahoma
Source: NRCS GIS 2015
OKT_Osage_farmland_V02.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
GRAINOLA
HULAH
Caney River
10
99
FORAKER
18
BIGHEART
WEBB CITY
PEARSONIA
SHIDLER
KAW CITY
APPERSON
BARTLESVILLE
Arkansas River
OKESA
BURBANK
60
PAWHUSKA
123
Osage County
NELAGONEY
OCHELATA
PERSHING
TALLANT
BARNSDALL
FAIRFAX
Noble County
WYNONA
WOLCO
11
RALSTON
AVANT
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
SKIATOOK
Pawnee County
20
PAWNEE
CLEVELAND
SPERRY
OSAGE
MORRISON
MARAMEC
HALLETT
WESTPORT
97
TERLTON
JENNINGS
64
97T
SAND SPRINGS
MANNFORD
Tulsa County
GRAY
44
Cimarron River
SILVER CITY
INGALLS
OILTON
Payne County
Osage County
Kansas
PAWHUSKA
35
TULSA
Oklahoma
OKLAHOMA CITY
40
AMARILLO
Texas
44
27
35
LUBBOCK
Creek County
44
SHAMROCK
Prime Farmland
Prime farmland
Not prime farmland

Figure 3-8

Table 3-17
Farmlands

Classification	Acres
Prime farmland	382,400
Not prime farmland	1,092,000

Source: NRCS GIS 2015

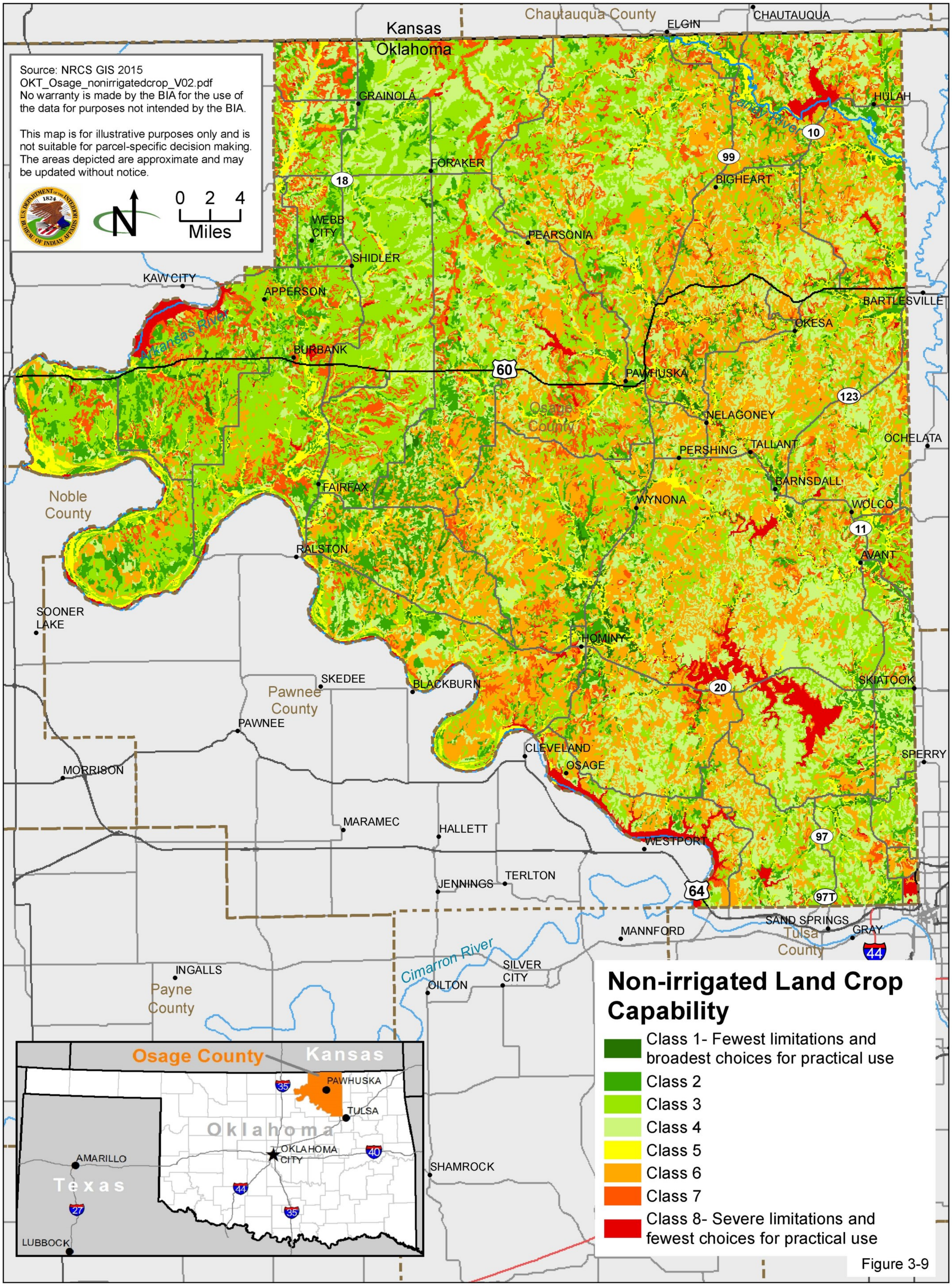
Additionally, the potential in the planning area for non-irrigated crop production capability is shown on **Table 3-18** and **Figure 3-9**. These are classified as follows:

1. Few limitations that restrict their use
2. Moderate limitations that reduce the choice of plants or that require moderate conservation practices
3. Severe limitations that reduce the choice of plants or that require special conservation practices, or both
4. Very severe limitations that reduce the choice of plants or that require careful management, or both
5. Soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat
6. Soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat
7. Soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat
8. Soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreation, wildlife habitat, watershed, or aesthetic purposes

Table 3-18
Non-Irrigated Crop Capability

Category	Acres
1	14,500
2	154,100
3	390,500
4	327,800
5	89,300
6	342,400
7	111,300
8	44,600

Source: NRCS GIS 2015


Source: NRCS GIS 2015
OKT_Osage_nonirrigatedcrop_V02.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
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0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
ELGIN
CHAUTAUQUA
HULAH
Caney River
GRAINOLA
FORAKER
BIGHEART
PEARSONIA
WEBB CITY
SHIDLER
KAW CITY
APPERSON
Arkansas River
BURBANK
BARTLESVILLE
OKESA
PAWHUSKA
Osage County
NELAGONEY
OCHELATA
PERSHING
TALLANT
BARNSDALL
FAIRFAX
Noble County
WYNONA
WOLCO
RALSTON
AVANT
SOONER LAKE
HOMINY
SKEDEE
BLACKBURN
Pawnee County
SKIATOOK
PAWNEE
CLEVELAND
OSAGE
SPERRY
MORRISON
MARAMEC
HALLETT
WESTPORT
JENNINGS
TERLTON
SAND SPRINGS
MANNFORD
GRAY
Tulsa County
Cimarron River
INGALLS
SILVER CITY
OILTON
Payne County
SHAMROCK
Osage County
Kansas
PAWHUSKA
TULSA
Oklahoma
OKLAHOMA CITY
AMARILLO
Texas
LUBBOCK
Non-irrigated Land Crop Capability
Class 1- Fewest limitations and broadest choices for practical use
Class 2
Class 3
Class 4
Class 5
Class 6
Class 7
Class 8- Severe limitations and fewest choices for practical use
Figure 3-9

3.8.3 Trends

The planning area is projected to have high levels of new oil and gas activity. Soils with farmland characteristics are generally avoided when siting oil and gas or other development features; however, farmlands disturbed by topsoil excavation and soils compaction would change these soils. Stockpiling the soil horizons separately and spreading them across the site in their original order during reclamation could prevent this change. If prime or unique farmland is present, then an appropriate level of analysis would be necessary to determine if the proposed action may have an adverse effect. Also, appropriate mitigation measures would be identified to minimize any unnecessary and irreversible conversion of farmland to nonagricultural uses.

3.9 Historical, Cultural, and Archaeological Resources

Cultural resources are locations of human activity, occupation, or use. They include expressions of human culture and history in the physical environment, such as archaeological sites, historic buildings and structures, and historic trails. Cultural resources can also be natural features, plants, animals, or places that are considered to be traditionally important or sacred to a culture, subculture, or community. The significance of these places is derived from the role the resource plays in a community's cultural identity, as defined by its beliefs, practices, history, and social institutions.

This section also addresses Indian trust assets, which are legal interests held by the federal government for federally recognized Indian tribes or nations or for individual Indians. Indian trust assets cannot be sold, leased, or otherwise encumbered without approval of the federal government. Tribal uses and interests in the planning area include both the exercise of economic and resource rights and those uses and resources that are tied to traditional cultural practices. Under the federal government's trust responsibilities to tribes, the BIA has an obligation to exercise statutory and other legal authorities to protect tribal resources and rights. The BIA also has a duty to carry out the mandates of federal law with respect to American Indians.

3.9.1 Regulatory Framework

National Historic Preservation Act of 1966, as Amended

The principal federal law addressing cultural resources is Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, (54 USC, Section 300101 et seq.) and its implementing regulations, Protection of Historic Properties (36 CFR, Part 800). Under the NHPA, the compliance procedure for cultural resources, known as the Section 106 process, outlines the steps for identifying and evaluating historic properties, for assessing the effects of federal actions on historic properties, and for consulting to avoid, reduce, or minimize adverse effects.

Historic properties are cultural resources that meet specific criteria (36 CFR, Subpart 60.4) for eligibility for listing on the National Register of Historic Places (NRHP). After a cultural resource has been determined eligible for listing, it is afforded procedural protections through the Section 106 process whether or not it is formally nominated or listed. The Section 106 process does not require historic properties to be preserved but does ensure that the decisions of federal agencies concerning the treatment of these places result from meaningful consideration of cultural and historic values and the options available to protect them.

The NHPA requires federal agencies to consult with Indian tribes that attach religious and cultural significance to historic properties that may be affected by undertakings as defined in the Section 106 process. The 1992 amendment to the NHPA also allows tribes to assume all or some of the duties of the State Historic Preservation Officer (SHPO) under Section 101(d)(2). The National Parks Service has certified the Osage Nation to have a Tribal Historic Preservation Officer (THPO), who has assumed most of the SHPO's duties on tribal lands.

The Section 106 process is triggered when historic properties may be affected by a federally funded, licensed, or permitted action or by actions on federal land. The identification and evaluation of cultural resources for NRHP eligibility and the resolution of adverse effects on historic properties is the responsibility of the lead federal agency, in consultation with the SHPO, THPO, interested tribes, and other interested consulting parties.

American Indian Religious Freedom Act of 1978, as amended (Public Law 95-431; 92 Stat. 469; 42 USC, Section 1996)

The American Indian Religious Freedom Act says that the policy of the United States is to protect and preserve the inherent right of freedom of American Indians to believe, express, and exercise their traditional religions. This includes their access to religious sites, use and possession of sacred objects, and freedom to worship through ceremonial and traditional rites. The act is a specific expression of First Amendment guarantees of religious freedom and has no implementing regulations.

Archaeological Resources Protection Act of 1979 (16 USC, Subsection 470aa-11)

Legislation establishing requirements to protect archaeological resources and sites on public lands and Indian lands and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals. The Archaeological Resources Protection Act (ARPA) established civil and criminal penalties for the destruction or alteration of cultural resources. The US Department of the Interior (DOI) has issued regulations under the ARPA (43 CFR, Part 7), establishing definitions, standards, and procedures to be followed by all federal land managers in protecting archaeological resources on public lands and Indian lands of the United States.

Native American Graves Protection and Repatriation Act of 1990, as amended (Public Law 101-601; 104 Stat. 3048; 25 USC, Section 3001 et seq.)

The Native American Graves Protection and Repatriation Act confirms the rights of Indian tribes and Native Hawaiian organizations to claim ownership of certain cultural items, including human remains, funerary and sacred objects, and objects of cultural patrimony. Permits to excavate or remove human remains and cultural items protected by the act require Native American consultation, as do discoveries of human remains and cultural items made during federal land use activities. The Secretary of the Interior's implementing regulations are at 43 CFR, Part 10.

Consultation and Coordination with Indian Tribal Governments (2000), Executive Order 13175

This EO directs federal agencies to continue to work with Indian tribes on a government-to-government basis to address issues concerning Indian tribal self-government, tribal trust resources, and Indian tribal treaty and other rights. Its intent is as follows:

- To establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications
- To strengthen the United States government-to-government relationships with Indian tribes
- To reduce the imposition of unfunded mandates on Indian tribes

Government-to-Government Relations with Native American Tribal Governments (memorandum signed by President Clinton, April 29, 1994),* Federal Register, *Vol. 59, No. 85

This memorandum directs federal agencies to consult, to the greatest extent practicable and to the extent permitted by law, with tribal governments before taking actions that affect federally recognized tribal governments. Federal agencies must assess the impact of federal government plans, projects, programs, and activities on tribal trust resources and ensure that tribal government rights and concerns are considered during such development.

Departmental Manual 512 Chapter 2, Departmental Responsibilities for Indian Trust Resources

Establishes the policies, responsibilities, and procedures for DOI agencies operating on a government-to-government basis with federally recognized Indian tribes. Its purpose is to identify, conserve, and protect American Indian and Alaska Native trust resources to fulfill the federal Indian trust responsibility.

Secretarial Order No. 3175, Departmental Responsibilities for Indian Trust Resources

Requires DOI bureaus and offices to consult with the recognized tribal government with jurisdiction over the trust property that a proposal may affect.

Oklahoma State Burial Laws Title 21-1167, -1168.1-7 and Title 8-187.

A variety of state measures protecting cemeteries and access to cemeteries and the display, discovery, use and disposal of human remains. Requires certain institutions and museums to consult tribal leaders and state entities on the disposition of human remains.

3.9.2 Current Conditions

Cultural Overview

This overview is drawn primarily from Jon D. May (2009), "Osage County," in the *Encyclopedia of Oklahoma History and Culture*.

The cultural resources of Osage County reflect a long history of use and occupation dating back possibly 8,000 years or more and continuing to the present day. Archaeologists have identified sites in the county that are Paleo-Indian (before 6000 BC), Archaic (6000 BC to AD 1), Woodland (AD 1 to 1000), and Plains Village (AD 1000 to 1500). According to Osage oral tradition and research, the ancestors of the Osage migrated from the Ohio River Valley beginning in AD 400. From AD 500 to 1300, the ancestral Osage lived in Illinois, Missouri, and Arkansas, with the culmination of settlements in the St. Louis area and at Cahokia during the Late Woodland, Emergent Mississippian, and Mississippian periods. The Osage left Cahokia approximately AD 1300 and began their westward movement to the central and southwestern portions of Missouri. In1673, this is where the French record the first historical notation of the Osage (Hunter et al. 2013:3; Tucker 1942: Plate V).

The first recorded Euro-American exploration of the region was conducted by Lt. James B. Wilkinson in 1806. He was followed by Capt. John R. Bell of the Maj. Stephen H. Long Expedition in 1820, the Glenn-Fowler Expedition in 1821, and Capt. Nathan Boone in 1843. A branch of the Shawnee Trail, a north/south cattle and emigrant route to Texas, crossed southern and western Osage County during the mid-1800s.

As early as mid-Anno Domini (AD) 1300, the Osage built villages and had camps throughout southwestern Missouri and began traveling out to the plains for their annual hunts. Osage hunting trails were established that were also used for Osage war parties, mourning parties, and for trading expeditions (Spaulding 1968:36-66; La Flesche 1930:672-678, 1939:3-143; McDermott 1940:116-263). Some of the mid-continental Osage trails spanned portions of Oklahoma and Kansas, including Osage County.

The Osage surrendered their claim to the region in 1825 and 1839 and were removed to a Kansas reservation. In 1835 the area was included in treaty land guaranteed to the Cherokee Nation. In 1870, under the Cherokee Reconstruction Treaty of 1866, the Osage began purchasing approximately 1,570,059 acres from the Cherokee Nation. Osage Agent Isaac T. Gibson established the Osage Agency at Deep Ford (present Pawhuska) on Bird Creek in 1872. The historic Osage reservation boundary was finalized in 1875 when the Kaw, or Kansa, acquired approximately one hundred thousand acres in the reservation's northwest corner. The Kaw lands were included in Kay County at statehood.

The historic Osage Reservation was part of the Oklahoma Territory under the Organic Act of 1890 and was made a semiautonomous district by the Enabling Act of 1906. At statehood in 1907, the Osage lands were established as Osage County.

The Osage Allotment Act was approved in June 1906. Between 1906 and 1909 each enrolled Osage tribal member received an average allotment of 659.51 acres; five townsites were withheld from allotment. Each Osage received the surface rights to their allotments and could rent or, if deemed "competent," sell their lands. In some cases, this led to the formation of large ranches, as the surface land was generally considered not suitable for farming.

The Phoenix Oil Company drilled the first successful oil well on the Osage mineral estate in 1897, and development of subsurface natural resources remains the most important industry in the county. The Osage mineral estate, consisting of all subsurface minerals, is owned by the tribe and is held in trust by the federal government. Royalties are distributed annually per capita to headright[3] holders. Most headrights are owned by Osage descendants of the individuals listed as members in the 1906 roll, although many tribal members do not own headrights, and some headrights are owned by non-Osage people or organizations (May 2009).

Cultural Resources

Prehistoric and historic archaeological sites make up most of the recorded cultural resources. These sites are typically encountered in surveys that are conducted during the BIA's review of mineral or land use permit applications. Granting a permit application is a federal undertaking under the NHPA. Archaeological site types encountered are prehistoric camps and villages, prehistoric lithic or stone tool scatters, prehistoric rock art and rock shelters, prehistoric and historic graves and cemeteries, abandoned farmsteads, structural remains of the earlier periods of petroleum development, and refuse deposits.

[3]The right to an equal portion of the tribal mineral income.

Old trail routes, roads, and waterways are frequently associated with archaeological sites.[4]

The Osage Nation THPO, Oklahoma SHPO, and Oklahoma Archeological Survey (OAS) are notified of each project or permit application. These agencies carry out programs established under the NHPA to consider the effects of undertakings on properties listed on or eligible for listing on the NRHP. They also determine the potential presence of areas or locations important to contemporary tribal communities that may be disturbed by permitted activities. These can include ancestral archaeological sites, sacred sites, or traditional plant gathering or other locations that are included in the category of traditional cultural properties under the NHPA.

Cultural resources in the county also include historic districts, buildings, bridges, farmsteads, monuments and other standing structures, and groups of buildings. As of April 2015, there are 43 cultural resources that are formally listed on the NRHP; all represent the historic-era built environment.

Indian Trust Assets

All subsurface mineral resources are owned by the Osage and are held in trust by the federal government. The federal government has a trust responsibility to the Indian people when considering actions and programs that would impact tribal resources and interests. The BIA, as an agent for the Secretary of the Interior, is responsible for fulfilling the federal government's trust responsibilities to the Osage.

Under the Osage Allotment Act of 1906, most of the land surface of the original reservation was allotted to individual tribal members. Because the tribe retains subsurface mineral rights, it leases the right to drill and extract subsurface resources. Tribal members in 1906 received headrights, assuring them of an equal share of mineral rights sales. Headrights have been passed down to descendants or otherwise sold and transferred. Development and exploitation of the mineral estate, particularly oil and gas, provides the most important source of income among headright holders, including many tribal members (see **Section 3.10**, Socioeconomics and Environmental Justice). The BIA's trust responsibilities include assisting the Osage in developing their resources and protecting their sovereignty and economic interests, while ensuring compliance with obligations and oversight under federal law and agency regulations.

[4]Richard Beaty, BIA Osage Agency Archaeologist, project conference call regarding cultural resource compliance in Osage County, December 11, 2014.

3.9.3 Trends

Cultural Resources

The identification and evaluation of cultural resources under the Section 106 process is routinely integrated into the application for permit to drill and NEPA compliance. BIA personnel or private contractors conduct cultural resource surveys of individual well locations and access roads or larger block surveys covering full 160-acre leases. Personnel prepare and distribute reports to the Osage Nation Tribal Historic Preservation Officer, Oklahoma Archeological Survey, and the Oklahoma Historical Society SHPO for consultation and concurrence.

All sites encountered during surveys are inventoried and evaluated. Sites that are considered not eligible will not need additional work or consideration. If a site appears eligible for listing on the NRHP or its status is undetermined, it is avoided and a buffer area is defined. If NRHP-eligible resources are identified but cannot be physically avoided, the policy is for the BIA to develop acceptable measures to mitigate or reduce the potential for adverse effects, in consultation with the Osage Nation Tribal Historic Preservation Officer and the SHPO.[5]

Compliance activities have steadily increased the rate of site discoveries due to continued mineral and energy development and the use of block surveys to efficiently inventory the cultural resources. Although sites are generally avoided, additional information valuable to archaeological and historical research could be gained by compiling and synthesizing data from these studies.

Continued oil and gas and other development and access near sites can increase the potential for impacts on cultural resources from inadvertent damage, unauthorized collection, vandalism, and erosion. These consequences could result in a potential downward trend in site integrity and scientific potential. Tight timelines, lack of staffing, and difficulties with mitigation enforcement can lead to cultural resources not being identified or impacted.

Indian Trust Assets

Management of Indian trust assets nationally and the oil and gas program of the Osage have been criticized and have been the subject of litigation. As part of settlements, new rulemaking, and environmental commitments governing the Osage mineral estate, the current trend is increased recognition of past problems and new actions to improve the program.

[5]Richard Beaty, BIA Osage Agency Archaeologist, project conference call regarding cultural resource compliance in Osage County, December 11, 2014.

3.10 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

3.10.1 Current Conditions and Trends

Population

Population change in Osage County has increased from 2000 to 2013, but at a slower rate than in Oklahoma and the United States as a whole (see **Table 3-19**). Osage County is forecast to have a population increase slightly above that of the state average until 2075 (see **Table 3-20**).

Table 3-19
Population

Population	Osage County	Oklahoma	United States
Population 2013	47,800	3,785,742	311,536,594
Population 2000	44,437	3,450,654	281,421,906
Population change 2000-2013	3,363	335,088	30,114,688
Percent population change 2000-2013	7.6	9.7	10.7

Source: US Census Bureau American Community Survey (ACS) data 2009-2013 and 2000 census as reported in Headwaters Economics 2015

Note: ACS data in this table are calculated by using annual surveys conducted from 2009 to 2013 and are representative of average characteristics during this period.

Table 3-20
Population Projections

Population	Osage County	Oklahoma
Population 2020	51,745	4,024,202
Population 2030	55,413	4,302,501
Percent change 2020-2030	7.1	6.9
Population 2040	59,080	4,581,319
Population 2050	62,747	4,860,554
Percent change 2040-2050	6.2	6.1

Source: Oklahoma Department of Commerce 2012

Housing

The availability of housing is one indicator of the ability of a community to handle changes in population associated with development. In the planning area, the occupancy rate (87.5 percent) was the same as that for the United States as a whole and was slightly above that of the state average (86.5 percent). The type of vacant housing by category was also similar to that for the state (**Table 3-21**).

The cost of housing can reflect one component of affordability in a community. The cost of housing units in Osage County is below that of the state and national average, with a median monthly mortgage of $1,101 and a median gross rent of $599 (**Table 3-22**).

Table 3-21
Housing Occupancy (2013)

	Osage County	Oklahoma	United States
Total housing units	21,150	1,669,828	132,057,804
Occupied	18,512	1,444,081	115,610,216
	87.5%	86.5%	87.5%
Vacant	2,638	225,747	16,447,588
	12.5%	13.5%	12.5%
For rent	264	43,477	3,230,123
	1.2%	2.6%	2.4%
Rented, not occupied	35	9,127	599,884
	0.2%	0.5%	0.5%
For sale only	234	23,149	1,682,020
	1.1%	1.4%	1.3%
Sold, not occupied	37	8,618	608,590
	0.2%	0.5%	0.5%
For seasonal, recreational, occasional use	512	39,475	5,122,778
	2.4%	2.4%	3.9%
For migrant workers	6	746	34,233
	0.0%	0.0%	0.0%
Other vacant	1,550	101,155	5,169,960
	7.3%	6.1%	3.9%

Source: US Census Bureau ACS 2009-2013 data as reported in Headwaters Economics 2015

Note: The data in this table are calculated by ACS, using annual surveys conducted from 2009 and 2013, and represent average characteristics during this period.

Table 3-22
Housing Costs as a Percent of Household Income, 2013

	Osage County	Oklahoma	United States
Owner-occupied housing units with a mortgage	7,580	569,607	49,820,840
Monthly cost < 15% of household income	2,234	144,458	9,215,740
	29.5%	25.4%	18.5%
Monthly cost > 30% of household income	1,899	150,269	17,636,343
	25.1%	26.4%	35.4%
Specified renter-occupied units	3,895	475,345	40,534,516
Gross rent < 15% of household income	638	65,779	4,355,942
	16.4%	13.8%	10.7%
Gross rent > 30% of household income	1,261	198,339	19,581,493
	32.4%	41.7%	48.3%
Median monthly mortgage cost	$1,101	$1,137	$1,540
Median gross rent	$599	$699	$904

Source: US Census Bureau ACS 2009-2013 data as reported in Headwaters Economics 2015

Note: The data in this table are calculated by ACS, using annual surveys conducted from 2009 to 2013, and represent average characteristics during this period.

Jobs and Employment

Unemployment in Osage County generally followed national trends, peaking in 2010. Unemployment levels have remained below the national average, although they have been consistently higher than the state average. Unemployment over the past eight years is shown in **Table 3-23**.

Table 3-23
Average Annual Unemployment

	Osage County	Oklahoma	United States
2014	5.2%	4.5%	6.2%
2013	5.9%	5.3%	7.4%
2012	6.0%	5.3%	8.1%
2011	6.8%	5.9%	8.9%
2010	7.8%	6.8%	9.6%
2009	7.5%	6.4%	9.3%
2008	4.2%	3.7%	5.8%
2007	4.2%	4.1%	4.6%

Source: Bureau of Labor Statistics 2014

When employment is examined by industry, key sectors of the economy can be identified (see **Table 3-24**). Based on 2013 data, top economic sectors as a percent of employment were government, mining, construction, retail trade and agriculture. From 2001 to 2013, the three industry sectors that added the most new jobs were mining (including fossil fuels; 1,165 new jobs), government (600 new jobs), and real estate, rental, leasing (527 new jobs).

Mining has represented an important industry in the county since the 1920s. **Figure 3-10** shows trends in mining employment over the past 20 years. Mining employment trends have had large variations based on changes in oil and gas market value and changes in drilling technologies.

Total personal income by industry provides additional information on key economic sectors. In 2013, the three industry sectors with the largest personal income were government ($145,656,000), mining ($143,429,000), and construction ($79,566,000). From 2001 to 2013, the three industry sectors that added the most new personal income (in real terms) were mining (including fossil fuels; $88.0 million), construction ($50.6 million), and government ($42.5 million); see **Table 3-25**.

When average annual wages are examined, total average wages for all sectors for Osage County are lower than that of Oklahoma and the United States (**Table 3-26**). Average annual wages for mining and mining support activities are higher than the average wages for all sectors for Osage County, Oklahoma, and the United States. Osage County, however, has the lowest average annual wage for mining and mining support activities, compared with that for Oklahoma and the United States.

Table 3-24
Employment by Industry, 2001-2013

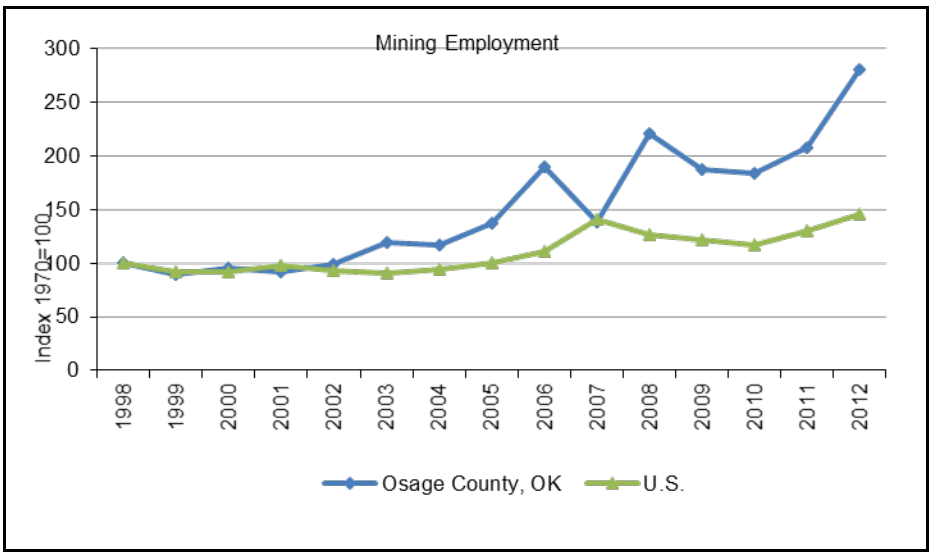
	Osage 2001	Oklahoma 2001	Osage 2013	Oklahoma 2013
Total employment (number of jobs)	16,368	380,072	20,359	682,745
Non-services related	~4,601	112,947	~6,202	292,964
	28.1%	29.70%	30.5%	42.90%
Farm	1,687	572	1,458	32,610
	10.3%	0.20%	7.2%	4.80%
Forestry, fishing, and related activities	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A
Mining (including fossil fuels)	978	55,425	2,143	143,429
	6.0%	14.60%	10.5%	21.00%
Construction	1,510	28,942	1,917	79,566
	9.2%	7.60%	9.4%	11.70%
Manufacturing	426	28,008	684	37,359
	2.6%	7.40%	3.4%	5.50%
Services related	~9,050	158,887	~10,891	240,668
	55.3%	41.80%	53.5%	35.30%
Utilities	21	1,352	20	1,410
	0.1%	0.40%	0.1%	0.20%
Wholesale trade	199	6,992	445	22,291
	1.2%	1.80%	2.2%	3.30%
Retail trade	1,725	23,789	1,647	41,167
	10.5%	6.30%	8.1%	6.00%
Transportation and warehousing	411	13,233	438	22,195
	2.5%	3.50%	2.2%	3.30%
Information	139	2,414	~73	4,398
	0.8%	0.60%	0.4%	0.60%
Finance and insurance	573	12,548	945	11,698
	3.5%	3.30%	4.6%	1.70%
Real estate and rental and leasing	623	5,838	1,150	8,409
	3.8%	1.50%	5.6%	1.20%
Professional and technical services	~702	8,713	844	21,228
	4.3%	2.30%	4.1%	3.10%
Management of companies and enterprises	26	0	96	0
	0.2%	0%	0.5%	0.00%
Administrative and waste services	841	11,424	1,095	12,289
	5.1%	3.00%	5.4%	1.80%
Educational services	194	4,038	159	1,259
	1.2%	1.10%	0.8%	0.20%
Health care and social assistance	1,003	19,817	1,003	27,844
	6.1%	5.20%	4.9%	4.10%

Table 3-24
Employment by Industry, 2001-2013

	Osage 2001	Oklahoma 2001	Osage 2013	Oklahoma 2013
Arts, entertainment, and recreation	~392	5,071	484	6,512
	2.4%	1.30%	2.4%	1.00%
Accommodation and food services	531	7,331	653	9,380
	3.2%	1.90%	3.2%	1.40%
Other services, except public administration	1,670	36,326	1,839	50,588
	10.2%	9.60%	9.0%	7.40%
Government	2,455	103,201	3,055	145,656
	15.0%	27.20%	15.0%	21.30%

Source: BEA 2013, as reported in Headwaters Economics 2015

Figure 3-10
Mining Employment 1998-2012



Source: US Bureau of Economics (BEA) data, as reported in Headwaters Economics 2015

Table 3-25
Personal Income by Industry, 2001-2013 (Thousands of 2014 Dollars)

	Osage 2001	Oklahoma 2001	Osage 2013	Oklahoma 2013
Labor earnings	380,072	90,072,686	682,745	116,534,450
Non-services related	~112,947	25,002,710	~292,964	34,534,305
	29.7%	27.8%	42.9%	29.6%
Farm	572	1,091,621	32,610	1,146,360
	0.2%	1.2%	4.8%	1.0%
Forestry, fishing, and related activities	N/A	201,862	N/A	271,932
	N/A	0.2%	N/A	0.2%
Mining (including fossil fuels)	55,425	6,423,804	143,429	14,971,282
	14.6%	7.1%	21.0%	12.8%
Construction	28,942	5,291,289	79,566	7,412,293
	7.6%	5.9%	11.7%	6.4%
Manufacturing	28,008	11,994,134	37,359	10,732,438
	7.4%	13.3%	5.5%	9.2%
Services related	~158,887	47,709,219	~240,668	60,456,694
	41.8%	53.0%	35.3%	51.9%
Utilities	1,352	1,222,267	1,410	1,598,457
	0.4%	1.4%	0.2%	1.4%
Wholesale trade	6,992	3,853,835	22,291	4,631,573
	1.8%	4.3%	3.3%	4.0%
Retail trade	23,789	6,727,473	41,167	7,446,183
	6.3%	7.5%	6.0%	6.4%
Transportation and warehousing	13,233	4,075,548	22,195	5,830,358
	3.5%	4.5%	3.3%	5.0%
Information	2,414	2,352,784	4,398	1,784,103
	0.6%	2.6%	0.6%	1.5%
Finance and insurance	12,548	3,721,358	11,698	4,676,665
	3.3%	4.1%	1.7%	4.0%
Real estate and rental and leasing	5,838	1,523,715	8,409	2,329,035
	1.5%	1.7%	1.2%	2.0%
Professional and technical services	~8,713	4,776,801	21,228	6,154,214
	2.3%	5.3%	3.1%	5.3%
Management of companies and enterprises	0	1,081,189	0	1,623,544
	0.0%	1.2%	0.0%	1.4%
Administrative and waste services	11,424	3,501,006	12,289	4,424,043
	3.0%	3.9%	1.8%	3.8%
Educational services	4,038	625,321	1,259	868,715
	1.1%	0.7%	0.2%	0.7%
Health care and social assistance	19,817	7,964,634	27,844	11,189,205
	5.2%	8.8%	4.1%	9.6%
Arts, entertainment, and recreation	~5,071	404,644	6,512	693,170
	1.3%	0.4%	1.0%	0.6%
Accommodation and food services	7,331	2,363,070	9,380	3,100,597
	1.9%	2.6%	1.4%	2.7%

Table 3-25
Personal Income by Industry, 2001-2013 (Thousands of 2014 Dollars)

	Osage 2001	Oklahoma 2001	Osage 2013	Oklahoma 2013
Other services, except public administration	36,326	3,515,574	50,588	4,106,834
	9.6%	3.9%	7.4%	3.5%
Government	103,201	17,360,756	145,656	21,543,451
	27.2%	19.3%	21.3%	18.5%

Source: BEA Table CA05N, as reported in Headwaters Economics 2015

Note: All employment data are reported by place of work. Data that were not disclosed were estimated and are indicated with tildes (~).

Table 3-26
Average Annual Wages, 2013 (2014 Dollars)

Sector	Osage County	Oklahoma	United States
All sectors	$35,802	$43,130	$50,601
Private	$35,618	$43,417	$50,495
Mining	$51,431	$96,039	$99,754
Oil and gas extraction	$56,592	$127,665	$156,786
Mining (except oil and gas)	N/A	$53,117	$73,672
Support activities for mining	$44,342	$75,514	$85,650
Non-mining	$33,139	$40,769	$50,138
Government	$36,071	$42,019	$51,166

Source: Bureau of Labor Statistics 2013 data, as reported in Headwaters Economics 2015

The production of other natural resources in the planning area is also a source of revenue. Coal bed methane, limestone, sand and gravel, and clay and shale are commonly extracted in Osage County. According to the Oklahoma Department of Mines (ODM) annual report for 2010, Osage County produced 558,668 tons of limestone (ODM 2010).

Jobs are typically reported by location of employment. When employees commute into or out of a county for employment, the income associated with jobs may be spent in other locations. In Osage County, a significant portion of the workforce travels outside of the county for work (61.1 percent as opposed to 25.3 percent state average). As a result, employment statistics for Osage County may not accurately reflect the employment of residents in the county (Headwaters Economics 2015).

For the Osage specifically, strengths and weakness of the local economy were identified in the 25-Year Vision and Strategic Plan (Osage Nation 2007). Identified strengths are the following:

- Gaming revenue
- Civic engagement in government
- Entrepreneurial mentors
- Historical revenue base
- Land base
- Natural resources

Areas identified for improvement are the following:

- Size and capabilities of workforce
- Lack of information technology infrastructure
- Lack of adequate public infrastructure
- Transportation
- Lack of housing/hotels
- Resistance to change

Income

A summary of income statistics in the planning area is provided in **Table 3-27**. In the planning area, average earnings per job and income per capita are lower than the state and national averages, while 2013 data for median household income was slightly above the state level but below the national level.

Income is composed of two major sources, labor income from employment compensation and non-labor income from dividends, interest, and rent (DIR) as well as transfer payments. DIR includes personal dividend income, personal interest income, and rental income of persons with capital consumption adjustment, as well as income related to the rental of real property and royalties from natural resource leases. These income sources are sometimes referred to as investment income or property income. Transfer payments are defined as those to persons for which no current services are performed; these are payments to individuals and to nonprofit institutions by federal, state, and local governments and by businesses.

In the planning area, non-labor income overall represents a smaller share of total income, as compared to Oklahoma and US averages (see **Table 3-28**). Transfer payments, however, make up a larger share of income than the Oklahoma and US average.

Table 3-27
Income and Employment

	Osage County	Oklahoma	United States
Average earnings per job, 2013 (2014 dollars)	$33,535	$51,689	$56,660
Per capita income, 2013 (2014 dollars)	$40,957	$42,531	$45,481
Median Household income 2013 (2013 dollars)*	$49,999	$45,724	$52,250

Source: BEA Tables CA05N and CA30, as reported in Headwaters Economics 2015

*US Census Bureau 2014a

Table 3-28
Non-Labor Share of Total Personal Income, 2013 (Thousands of 2014 Dollars)

	Osage County	Oklahoma	United States
Total personal income (in thousands)	1,965,425	163,766,920	14,377,849,832
Non-labor income	595,098	58,222,882	5,166,583,520
	30.3%	35.6%	35.9%
DIR	230,243	28,579,886	2,713,450,504
	11.7%	17.5%	18.9%
Transfer payments	364,855	29,642,996	2,453,133,016
	18.6%	18.1%	17.1%
Labor earnings	1,370,327	105,544,038	9,211,266,312
	69.7%	64.4%	64.1%

Source: BEA Table CA05N, as reported in Headwaters Economics 2015

Note: Non-labor income and labor earnings may not add to total personal income because of adjustments made by the Bureau of Economic Analysis to account for contributions for Social Security, cross-county commuting, and other factors.

Local Finance

Osage County

Osage County revenue and expenses are displayed in **Table 3-29**. Revenue in the county is primarily from ad valorum taxes (including property taxes) and various fees. Total valuation of property was $309,109,990, including $22,970,470 in real property and $43,321,601 in personal property. The county tax rate is set at 14.70 mills (or .0147 percent of assessed value). Additional taxes are imposed at the city and school district level, so exact tax rates vary by municipality. County expenditures were chiefly in the areas of roads and bridges, public safety, and administration.

Table 3-29
Osage County Finances—General Budget

	2013-2014 Actual
Liabilities, reserves, and cash fund balance	$3,858,896
Total revenue	$7,575,566
Cash balance	$3,016,893
Prior year's cash balance	$188,808
Current ad valorem tax	$2,908,006
Miscellaneous revenue	$1,461,858
Requirements	$4,077,944
Additions	$3,497,591
Deductions	-$1,892
Expenditures (2013)	$7,030,810

Source: Osage County 2014

Osage

General Budget

Major revenue sources and expenses for the Osage are displayed in **Table 3-30**. The largest funding source is gambling revenue from casinos. Top expenditures, in addition to general government, are tribal health and human services and education programs.

Oil and Gas Production and Revenue

Total oil and gas production from Osage minerals and royalties collected are shown in **Table 3-31**.

Headright Royalties

All subsurface minerals, are owned by the Osage and are held in trust for them by the BIA. Most of the tribe's original 15-million-acre Oklahoma reservation was parceled out to individual tribal members, based on the allotment provisions of the Osage Allotment Act of 1906. Within a few decades, most of the land had been sold to non-Osage ranchers. Today, the Osage Nation is a federally recognized tribe, with 18,000 total members and several townsites in Osage County in north-central Oklahoma. A small number of enrolled Osage live in the planning area, while most tribal members are scattered throughout the United States and abroad.

The tribe retains subsurface mineral rights to the entire 1.5 million acres of the original reservation. Oil and gas companies lease from the tribe the right to drill for and extract minerals from specified tracts of land on the Osage mineral estate. Most, if not all, of the oil companies that lease Osage mineral rights are not Osage owned; thus, the tribe profits from owning the minerals but is not involved in extracting them. Tribal profits are derived from the leasing fees, bonuses, and royalties that oil companies pay the tribe.

Table 3-30
General Fund—Osage 2013

Revenue and Gaming Distributions	2013-2014 Actual
Intergovernmental	$31,000
Indirect cost recoveries	$5,656,000
Investment revenue	$248,000
Other revenue	$2,521,000
Casino distribution	$40,599,000
Total	**$49,055,000**
Expenditures	
Community services	$1,514,000
Culture and language	$2,352,000
Education	$9,640,000
Environmental management	$973,000
General government	$21,333,000
Health and human services	$6,609,000
Housing services	$216,000
Public safety	$1,197,000
Capital outlay	$4,537,000
Equity contribution to Osage LLC	$2,600,000
Total	**$50,971,000**
Other financing sources	
Transfers in	$1,530,000
Transfers out	-$2,600,000

Source: Osage Nation 2014a

Table 3-31
Osage Minerals Production and Royalties

	2010	2011	2012	2013	2014
Gross oil production (barrels)	4,714,828	4,741,997	4,889,366	5,025,974	4,836,713
Oil royalties collected	$57,966,541	$69,624,382	$72,867,727	$79,169,159	$71,233,059
Gross natural gas production (thousand cubic feet)	12,723,312	13,022,399	11,857,874	9,806,792	8,823,988
Gas royalty collected	$7,263,362	$6,930,679	$3,722,984	$4,167,565	$4,857,455

Source: BIA 2015b, 2015c

Note: Data rounded to the nearest barrel and dollar.

The 1906 Act, as negotiated by the tribe, provides for almost all of this tribal mineral income to be distributed annually per capita to headright holders. The members whom revenues were initially to be distributed to were the 2,229 Osages, and this right passed to their spouses and descendants. This right to an equal portion of tribal mineral income has come to be known as an Osage headright.

Although most headrights are owned by the Osage descendants of the individuals listed on the 1906 roll, today most tribal members do not own headrights. Further, not all headright owners are Native American. Several hundred headrights are owned by non-Indians who purchased or inherited them. Royalties on mineral revenues are paid quarterly. The royalty rate for oil and gas development of Osage minerals is negotiated in the lease subject to regulations. A small portion of the tribe's mineral income is reserved for tribal government use. Royalties paid from 2000 to 2014 are displayed in **Table 3-32**.

Table 3-32
Annual Full Headright Royalty Payment

Year	Actual	Adjusted to 2015 Dollars
2000	$8,480	$11,895
2001	$10,730	$14,641
2002	$7,675	$10,308
2003	$10,450	$13,719
2004	$13,380	$17,104
2005	$19,380	$23,959
2006	$25,390	$30,416
2007	$25,250	$29,424
2008	$40,130	$45,052
2009	$20,945	$23,608
2010	$28,320	$31,418
2011	$37,375	$40,178
2012	$40,780	$42,937
2013	$36,990	$38,371
2014	$37,545	$38,333

Source: Osage Nation 2015a

Gross Production Tax

Taxes collected from oil and gas development in Osage County differ from that in other Oklahoma counties. Based on 54 Stat. 168, in lieu of all other state and county taxes, a gross production tax is collected on all oil and gas produced in Osage County, at the rate levied by the state, not to exceed 5 percent, and paid to the state of Oklahoma. Half of the distribution is apportioned to a fund for the construction and maintenance of roads and bridges in Osage County, and the other half is used for maintaining schools in the county.

Gaming Revenue

The Osage Tribe Gaming Enterprise Board oversees the Osage Casino, which is a collection of seven casinos (Hominy, Pawhuska, Sand Springs, Tulsa, Bartlesville, Skiatook, and Ponca City). Under the state-tribal compact, tribes pay monthly exclusivity fees from class III games revenue, based on a sliding scale. For the first $10 million in revenue, tribes pay 4 percent to the state; for the next $10 million, they pay 5 percent, and for revenues more than $20 million, they pay 6 percent.

Total distributions supplied to Osage County from gaming operations was $40,598,958 in 2013 (Osage Nation 2014a). The Osage Nation uses revenues from its Casinos for the following enterprises:

- Fund tribal government and programs
- Provide for the general welfare of the tribe and its members
- Promote tribal economic development
- Support charitable organizations
- Help fund operations of local government agencies of the Osage Nation

Community Services

Osage County has less than 10 percent of urban development, and there is limited infrastructure development. Communities are served by multiple municipal services: police, fire, water, power, and other utilities. In addition to county services, social welfare and community programs are provided for tribal members through Osage programs.

Utilities

Utilities are provided by wastewater collection and treatment facilities in Pawhuska and a portion of Tulsa that is within Osage County. In rural areas, residents rely on water wells and septic tanks.

Education

Osage County contains 25 schools for pre-kindergarten through 12th grade education, within 11 school districts and with a total enrollment of 3,845 in 2014 (**Table 3-33**). Student to teacher ratio can be one indication of the ability of a school to accommodate additional students. Total student-to-teacher ratios and spending per student vary throughout the county, with most lower than the state and US average of students-to-teacher ratios (16.12 and 16.01). Overall, the United States spent an average of $11,665 per student. This is some indication that increased spending per student may correlate with education ranking (Annie E. Casey Foundation 2014). In Osage County, spending varies, with most districts below the US average.

Table 3-33
Osage County Public Education

District	Enrollment	Student-to-Teacher Ratio (2012-2013)	Total Spending per Student (2010-2011)
Osage Hills	182	16.73	$7,878
Bowring	75	11.13	$13,677
Avant	80	14.00	$10,000
Anderson	271	14.54	$7,024
McCord	263	14.78	$6,359
Pawhuska	831	14.09	$8,815
Schidler	236	13.54	$9,945
Barnsdall	435	16.63	$8,215
Wynona	124	10.19	$6,450
Hominy	582	14.27	$10,272
Prue	328	13.90	$8,110
Woodland	438	14.73	$11,385

Source: State of Oklahoma 2015

The Osage provide education services to tribal members, including kindergarten through tenth grade outreach programs and education scholarships.

Health Services

The availability of health services, particularly emergency services, can be an indicator of the ability of a community to accommodate change in population.

Major medical facilities in the planning area are Fairfax Community Hospital and Pawhuska Hospital. Fairfax Community Hospital has 15 beds and had 1,264 patient visits to the emergency room. Pawhuska Hospital is a general hospital and has 27 beds and total of 4,659 patient visits to the emergency room based on 2014 surveys. Osage tribal members are also eligible to apply for Osage Nation Health, a limited benefit program, and to receive services as Indian Health Service facilities.

Public Safety

The Osage County Sheriff's Office consists of 34 sworn and 27 civilian law enforcement professionals (Osage Sheriff 2015). Additional law enforcement officers are found in cities in the county. See **Section 3.11.2**, Public Health and Safety, for additional information on fire safety operations.

The Osage Nation Police Department provides law enforcement services under the jurisdiction of the Osage Nation. The officers' primary duty is to enforce the criminal laws of the Osage Nation and the federal government when major crimes have been committed within state and local jurisdictions.

Community Values and Social Setting

The project area is generally rural, with small farming communities and rural residences scattered throughout. The borders of Osage County are contiguous with the former Osage Indian reservation. The Osage Nation is headquartered in Pawhuska. The Wah-Zha-Zhi Cultural Center in Pawhuska was established in 2004 to maintain the ancestral traditions, values, and way of life and unique identity of the Osage. The Cultural Center hosts classes on traditional craft-wear, hosts artwork exhibits, and is home to a library (Osage Nation 2012; Shop Oklahoma 2012).

Environmental Justice

Environmental justice refers to the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences of industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires that federal agencies identify and address any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations and Indian tribes.

Council of Environmental Quality (CEQ) 1997 guidance states that "In order to determine whether a proposed action is likely to have disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Indian tribes, agencies should identify a geographic scale, obtain demographic information on the potential impact area, and determine if there is a disproportionately high and adverse effect on these populations. Agencies may use demographic data available from the Bureau of the Census to identify the composition of the potentially affected population. Geographic distribution by race, ethnicity, and income, as well as a delineation of tribal lands and resources, should be examined."

Specific guidance on environmental justice terminology follows.

Low-income population—This is determined based on annual statistical poverty thresholds developed by the US Census Bureau. In 2013, the poverty level was based on total income of $11,888 for an individual and $23,624 for a family of four (US Census Bureau 2013). A low-income community may include either a group of individuals living in geographic proximity to one another or dispersed individuals, such as migrant workers or Native Americans.

Minority—A member of the following population groups: American Indian, Alaska Native, Asian, Pacific Islander, Black, or Hispanic.

Minority population area—An area is so defined if either the aggregate population of all minority groups combined exceeds 50 percent of the total population or if the percentage of the population in the area comprising all minority groups is meaningfully greater than the minority population percentage in the broader region. Like a low-income population, a minority population may include either individuals living in geographic proximity to one another or those who are dispersed.

Comparison population—For the purpose of identifying a minority population or a low-income population concentration, state populations are compared to the US population; for counties, populations are compared to the respective state population average.

Approximately 34.3 percent of the population in Osage County identified as minority, belonging to one or more racial or ethnic minority group (i.e., a group other than white of non-Hispanic origin). American Indians represent the largest minority group in the planning area; those identifying as American Indian alone represented 14.7 percent of the population, as compared to 7 percent in Oklahoma and less than one percent for the US population as a whole. (Note that this figure does not include those who are American Indian and some other race who listed themselves as two or more races; therefore, the actual percentage of American Indians may be higher.) The largest tribal groups by population in the planning area were Cherokee (2,212) and Osage (1,839). See **Table 3-34** for a detailed breakdown of racial and ethnic minorities in the planning area. Note that those identifying as Hispanic/Latino origin may also identify as one or more racial minority.

The level of people and families below poverty was lower for Osage County than the state average as of the most recent data in 2013 (see **Table 3-35**). When broken out by ethnic and racial group, people of white and non-Hispanic origin had substantially lower rates of poverty than people of racial and ethnic minorities (see **Table 3-36**).

Table 3-34
Population by Race and Ethnicity, 2013

	Osage County	Oklahoma	United States
Total population	47,800	3,785,742	311,536,594
Hispanic/Latino origin (of any race)	1,447	345,139	51,786,591
	3.0%	9.1%	16.6%
Non-Hispanic/Latino (of any race)	46,353	3,440,603	259,750,003
	97.0 %	90.9%	83.4%
White alone	31,423	2,783,609	230,592,579
	65.7%	73.5%	74.0%

Table 3-34
Population by Race and Ethnicity, 2013

	Osage County	Oklahoma	United States
Black or African American alone	5,386	273,421	39,167,010
	11.3%	7.2%	12.6%
American Indian alone	7,049	266,509	2,540,309
	14.7%	7.0%	0.8%
Asian alone	83	68,161	15,231,962
	0.2%	1.8%	4.9%
Native Hawaiian and Other Pacific Islanders Alone	59	4,283	526,347
	0.1%	0.1%	0.2%
Some other race alone	388	95,783	14,746,054
	0.8%	2.5%	4.7%
Two or more races	3,412	293,976	8,732,333
	7.1%	7.8%	2.8%
Aggregate Minority Population	16,377	10,002,133	80,944,015
	34.3%	26.5%	26.0%

Source: US Census Bureau ACS 2009-2013, data as reported in Headwaters Economics 2015

Notes: The data in this table are calculated by ACS using annual surveys conducted from 2009 to 2013 and are representative of average characteristics during this period.
Aggregate minority population includes any individuals who identified themselves as belonging to one or more ethnic or racial minority. This population is calculated by total population minus those of white, non-Hispanic origin.

Table 3-35
Poverty, 2013

	Osage County	Oklahoma	United States
People	46,267	3,671,393	303,692,076
Families	13,203	961,468	76,744,358
People below poverty*	6,476	624,209	48,810,868
	14.0%	16.7%	15.8%
Families below poverty	1,541	121,032	8,666,630
	11.7%	12.6%	11.3%

Source: US Census Bureau ACS 2009-2013 data as reported in Headwaters Economics 2015

*US Census Bureau 2014a

Note: The data in this table are calculated by ACS using annual surveys conducted from 2009 to 2013 and are representative of average characteristics during this period.

Table 3-36
Poverty by Race and Ethnicity, 2013

	Osage County	Oklahoma	United States
Hispanic or Latino (of any race)	21.1%	28.4%	24.7%
Not Hispanic or Latino (of any race)	12.3%	12.8%	10.6%
White alone	12.6%	13.9%	12.5%
Black or African American alone	21.3%	30.8%	27.1%
American Indian alone	19.5%	22.8%	28.6%
Asian alone	22.9%	15.2%	12.5%
Native Hawaiian and Pacific Islander alone	0.0%	29.6%	19.6%
Some other race	6.8%	27.0%	26.8%
Two or more races	12.0%	23.4%	20.1%

Source: US Census Bureau 2013 ACS data as reported in Headwaters Economics 2015

Note: The data in this table are calculated by ACS using annual surveys conducted from 2009 to 2013 and are representative of average characteristics during this period. Poverty prevalence is calculated by dividing the number of people by race/ethnicity in poverty by the total population of that race/ethnicity.

3.11 PUBLIC HEALTH AND SAFETY

This section provides an overview of the laws, regulations, and policies that influence the management of public safety, hazards, and potentially hazardous conditions in the planning area.

3.11.1 Regulatory Framework

25 CFR, Part 226

These regulations govern the leasing of the Osage mineral estate for oil and gas development and include several measures intended to limit risk to public health and safety. For example, the regulations prohibit lessees from allowing unavoidable nuisances on the property they control and require pollution prevention measures to avoid migration of oil, gas, or saltwater into freshwater-bearing formations.

Occupational Safety and Health Act

The Occupational Safety and Health Act of 1970 recognizes that personal injuries and illnesses incurred in a work setting result in reduced productivity, wage loss, and medical expenses. As a result of the act, the Occupational Safety and Health Administration was established to ensure the health and safety of workers by setting and enforcing standards, providing training, outreach, and education, establishing partnerships, and encouraging continual improvement in workplace safety and health (29 CFR, Part 1910).

Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), created a tax on the chemical and petroleum industries and provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for releasing hazardous waste at these sites, and established a trust fund to provide for cleanup when no responsible party can be identified (EPA 2015e).

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act of 1976 (RCRA) charges the EPA with controlling the generation, transportation, treatment, storage, and disposal of hazardous waste (42 USC, Section 6901 et seq.). RCRA also promulgated a framework for managing nonhazardous solid wastes. The 1986 amendments to the RCRA enabled the EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances.

Toxic Substances Control Act

The federal Toxic Substances Control Act of 1976 and RCRA established a program administered by the EPA for regulating the generation, transportation, treatment, storage, and disposal of hazardous waste.

Clean Water Act

The CWA (33 USC, Section 1251 et seq.) was enacted to restore and maintain the chemical, physical, and biological integrity of the Waters of the United States. Oil pollution prevention regulations describe the requirements for facilities to prepare, amend, and implement spill prevention control and cleanup (SPCC) plans. A facility is subject to SPCC regulations if the total aboveground oil storage capacity exceeds 1,320 gallons or the underground oil storage capacity exceeds 42,000 gallons, and if, due to its location, the facility could reasonably be expected to discharge oil into or on the Navigable Waters of the United States.

BIA Regional 10-Year Fire Management Plan for the Eastern Oklahoma Regional Office

The fire management plan (FMP) defines the Eastern Oklahoma Regional Office program to manage wildland fires in its service area. The FMP identifies the region's planned activities and management practices for initial attack, extended attack, and prescribed fire or fuels management. The FMP is a strategic plan that defines a program to manage wildland and prescribed fire, based on approved land management goals and objectives. The FMP provides for firefighter and public safety and includes fire management strategies, tactics, and alternatives (BIA 2009).

Pipeline and Hazardous Materials Safety Administration

The Pipeline and Hazardous Materials Safety Administration, a federal agency within the US Department of Transportation, is the primary federal regulatory agency responsible for ensuring the safety of America's energy pipelines, including crude oil pipeline systems. As a part of the responsibility, the Pipeline and Hazardous Materials Safety Administration established regulatory requirements for the construction, operation, maintenance, monitoring, inspection, and repair of hazardous liquid pipeline systems.

3.11.2 Current Conditions

Osage County is dominated by farmland and grazed pastures, with residents living in rural communities. The Osage County Sheriff's department and several local agencies provide law enforcement. In addition, the Osage Nation Police Department is charged with enforcing all tribal, state, and federal laws in Osage County. The chief of police is responsible for the day-to-day operations of the police department (Osage Nation 2012). The Osage Nation and the federal government provide fire and emergency response in the county.

Hazardous substances are defined as any solid, liquid, contained gaseous or semisolid waste, or any combination of wastes that pose a substantial present or potential hazard to human health and the environment. Hazardous substances are primarily generated by industry, hospitals, research facilities, and the government. Improper management and disposal of hazardous substances can lead to pollution of groundwater or other drinking water supplies and the contamination of surface water and soil. The primary federal regulations for the management and disposal of hazardous substances are CERCLA and RCRA.

Health and safety concerns include hydrogen sulfide gas that could be released as a result of drilling, hazards introduced by heavy truck traffic, and hazardous materials used or generated during construction, drilling, and production. Hydrogen sulfide is extremely toxic in concentrations above 500 ppm and is known to occur in varying concentrations in Osage County (BIA 2015a).

3.11.3 Trends

Oil and gas development will continue to introduce risks to public health and safety in Osage County. The risk level depends on such factors as the amount of development and nature and type of conservation measures.

3.12 Visual Resources

Visual resources refer to the visible features on a landscape, such as land, water, vegetation, animals, and structures. These features contribute to the scenic or visual quality and appeal of the landscape (BLM 1984).

3.12.1 Regulatory Framework

There are no federal or tribal laws or programs regarding visual resources in the planning area. At the local level, the 2030 Osage County Comprehensive Plan (Osage County 2011) has been developed to adopt public land use goals and policies to guide development of the county and includes goals and policies that are meant to preserve visual qualities in the county.

The 2030 Osage County Comprehensive Plan (2011) is a local document meant to guide future physical and economic development. This plan is a collaboration of the Osage County Board of Commissioners, the Osage County Industrial Authority, and the Pawhuska-Osage County Planning Commission. Among the goals and policies that have been adopted for residential land use and recreation, trails, and open space areas, protecting scenic vistas is a stated policy and enhancing visual character is a stated goal. Preservation of public and private open spaces, low impact development, and green building techniques are methods called out for accomplishing this (Osage County 2011).

3.12.2 Current Conditions

The BIA does not maintain a visual resources inventory, but the visual conditions of the planning area can be generally described by its physiographic province. This is a subdivision of physiographic regions that divide the continent based on similar landforms and landscapes. Osage County is in the Central Lowland Province, within the Osage Plains physiographic section (Oklahoma Atlas Institute 2015; Oklahoma Historical Society 2009). The average relief is between three hundred and five hundred feet (Oklahoma Historical Society 2009). Elevation typically does not change more than 300 feet across the county. Topography is generally flat, with some rolling hills, becoming more varied in the eastern portion of the county where there are more lakes and rivers.

Tallgrasses were the area's predominant vegetation until the late nineteenth century when Euro-American settlers began clearing land for agriculture and wood (Oklahoma Historical Society 2009). Today, these grasses can be observed in the Tallgrass Prairie Preserve in north-central Osage County. The grassy plains give most of the landscape a tan and light green appearance. Vegetation is darker green around lakes and rivers; more of this dark green vegetation is found in the eastern portion of the county, where there are more of these features.

Another significant visual resource in the planning area is the Osage Nation Heritage Trail Byway. This 70-mile-long byway bisects the entire county and provides unique views and vistas not found along more local roadways, such as the following (America's Scenic Byways 2015; Osage County 2011; Travel OK 2015):

- Buffalo habitat
- The Osage Hills, which are characterized by rolling hills and rolling tallgrass prairie
- Historic landmarks, such as the estates of Oklahoma's historic oil barons and the Constantine Theatre

Lakes, rivers, and state parks are other visual resources in the planning area, offering scenic and recreational value.

The most prominent human-made modifications to the visual landscape are the roads. Several major roadways bisect the county. Cities and towns in the county are characteristic of rural areas. Oil and gas rigs are also visible throughout the landscape.

Night skies are affected by unnatural light sources in the area, including glows from cities and towns. The most populated cities in the county produce the most light pollution, including Tulsa (partially within Osage County), Bartlesville, and Ponca City. Lighting from oil and gas-related construction also reduces nighttime darkness. Night skies would be most preserved in undeveloped areas, such as the Tallgrass Prairie Preserve and state parks in the county.

Viewers of the visual landscape are the residents, tourists, and through-travelers. The population of Osage County is 47,472 (US Census Bureau 2010; more details on county demographics can be found in **Section 3.10**, Socioeconomics and Environmental Justice).

3.12.3 Trends

The landscape is experiencing some modification due to energy development. As shown in **Table 3-42**, Oil and Gas Development Potential, 84 percent of the planning area has high or moderate-to-high oil and gas potential. Based on this potential and predicted nationwide price increases (discussed further in **Section 3.16**, Mineral Extraction), oil and gas activity in the planning area is expected to increase over the next 20 years, accompanied by an increase in visual changes. Features with concentrated recreation, such as lakes and rivers, would be more sensitive to landscape changes, which could affect visual qualities.

3.13 NOISE

Noise is defined as unwanted sound and can be intermittent or continuous, steady or impulsive. Human response to noise is extremely diverse and varies according to the type of noise source, the sensitivity and expectations of the receptor, the time of day, and the distance between the noise source and the receptor.

The decibel (dB) is the accepted unit of measurement for noise. Because human hearing is not equally sensitive to all sound frequencies, depending on the amplitude of the sound, various frequency weighting schemes have been developed to approximate the way people hear sound. The A-weighted decibel scale (dBA) is normally used to approximate human hearing response to sound. Examples of sound noise levels are shown in **Table 3-37**.

In general, sound waves travel away from the noise source as an expanding spherical surface. The energy contained in a sound wave is spread over an increasing area as it travels away from the source. It decreases in loudness at greater distances from the noise source. A doubling of distance results in an

Table 3-37
Example Noise Levels

Characterization	dBA	Example Noise Condition Or Event
Threshold of pain	130	Surface detonation, 30 pounds of trinitrotoluene (TNT) at 1,000 feet
	125	F/A-18 aircraft takeoff with afterburner at 470 feet
Possible building damage	120	Mach 1.1 sonic boom under aircraft at 12,000 feet
	115	F/A-18 aircraft takeoff with afterburner at 1,600 feet
	110	Peak crowd noise, pro football game, open stadium
	105	Emergency vehicle siren at 50 feet
	100	F/A-18 aircraft departure climbout at 2,400 feet
Extremely noisy	95	Locomotive horn at 100 feet
8-hour workplace limit	90	Heavy truck, 35 mph at 20 feet; Leaf blower at 5 feet
Very noisy	85	Power lawn mower at 5 feet; City bus at 30 feet
	80	2-Axle commercial truck, 35 mph at 20 feet
Noisy	75	Street sweeper at 30 feet; Idling locomotive, 50 feet
	70	Auto, 35 mph at 20 feet; 300 feet from busy 6-lane freeway
Moderately noisy	65	Typical daytime busy downtown background conditions
	60	Typical daytime urban mixed use area conditions
	55	Typical urban residential area away from major streets
	50	Typical daytime suburban background conditions
Quiet	45	Typical rural area daytime background conditions
	40	Quiet suburban area at night
Very quiet	30	Quiet rural area, winter night, no wind
	20	Empty recording studio
Barely audible	10	Audiometric testing booth
Threshold of Hearing	0	—

Source: Beranek 1988

approximately 6-dB reduction in sound pressure level for single point sources of noise; doubling the distance results in a 3-dB reduction for multiple point sources moving in a straight line, such as a highway (Hedge 2011). Loudness—the subjective perception of sound by humans—is generally considered to double for approximately every 6- to 10-dB increase in sound level.

3.13.1 Regulatory Framework

Originally, the EPA had the authority to control noise levels to protect human health and welfare, in accordance with the Noise Control Act of 1972 (42 USC, Section 4901 et seq.). Subsequently, the Quiet Communities Act of 1978 (Public Law 95-609) amended the Noise Control Act and encouraged state and local governments to establish noise control programs. In 1981, the federal government transferred substantial authority to regulate noise from the EPA to state and local governments.

There are no tribal laws regulating noise in Osage County. At the local level, a comprehensive land use plan has been developed to adopt public land use goals and policies to guide development of the county and includes goals and policies that are meant to preserve visual qualities in the county.

The 2030 Osage County Comprehensive Plan is a local document meant to guide future physical and economic development (Osage County 2011). This plan is a collaboration of the Osage County Board of Commissioners, the Osage County Industrial Authority, and the Pawhuska-Osage County Planning Commission. Exterior noise reduction measures are included in the plan to mitigate any negative impacts on adjacent areas, such as sensitive receptors (Osage County 2011). Screening, buffering, setbacks, and landscaping are methods called out for accomplishing noise reduction (Osage County 2011).

3.13.2 Current Conditions

Existing Noise Sources

Noise levels in the project area are representative of a rural environment. Noise sources in rural areas are, vehicles on area roadways, agricultural equipment, and natural sounds, such as wind, weather, and wildlife. Ambient sound levels typical of rural areas range between 30 and 40 dBA (EPA 1978).

The oil and gas industry is also a major contributor of noise in the planning area, as it is one of the most important economic industries in the county (see **Section 3.10**, Socioeconomics and Environmental Justice). Sources of noise from oil and gas development are truck traffic, drilling and completion activities, well pumps, and compressors (Earthworks 2015). **Section 4.13**, Noise, in the following chapter provides typical noise levels for different oil- and gas-associated activities.

Existing Sensitive Receptors

Sensitive receptors in the county are residents of the cities, towns, and communities and users of recreation sites in the county. The population of Osage County is 47,472 (US Census Bureau 2010; more details on county demographics can be found in **Section 3.10**, Socioeconomics and Environmental Justice). Cities in Osage County are the following (US Census Bureau 2010):

- Barnsdall (population 1,243)
- Bartlesville (partially in Osage County; total population 35,750)
- Hominy (population 3,565)
- Pawhuska (population 3,584)
- Ponca City (partially in Osage county, total population 25,387)
- Sand Springs (partially in Osage county; total population 18,906)

- Shidler (population 441)
- Tulsa (partially in Osage County; total population 603,403)

Towns in Osage County are as follows (US Census Bureau 2010):

- Avant (population 320)
- Burbank (population 141)
- Fairfax (population 1,380)
- Foraker (population 19)
- Grainola (population 31)
- Osage (population 156)
- Prue (population 465)
- Skiatook (partially in the county; total population 7,397)
- Webb City (population 62)
- Wynona (population 437)

Landowners adjacent to oil and gas developments may be particularly sensitive to noises from this industry. Users of recreation sites would be those visiting the Tallgrass Prairie Preserve, lakes, rivers, and state parks. Sensitive receptors in the county also include wildlife and livestock; refer to **Section 3.5**, Fish and Wildlife, and **Section 3.8**, Agriculture, for information about these sensitive receptors.

3.13.3 Trends

The population in Osage County grew 7.6 percent from 2000 to 2013 and is projected to change at almost the same rate by 2030 (US Census Bureau ACS data 2009-2013 and 2000 census, as reported in Headwaters Economics 2015; Oklahoma Department of Commerce 2012). This is a slower rate than in Oklahoma and the United States as a whole (see **Table 3-19**, Population). This slow growth indicates that the number of sensitive receptors is not likely to increase significantly in the near future.

Approximately 84 percent of the planning area has high or moderate-to-high oil and gas potential (BLM GIS 2015). Based on this potential and predicted nationwide price increases (discussed further in **Section 3.16**, Mineral Extraction), oil and gas activity in the planning area is expected to increase over the next 20 years. Therefore, noise associated with this industry is also expected to increase.

3.14 LAND USE PLANS, UTILITIES, AND TIMBER HARVESTING

3.14.1 Regulatory Framework

This section discusses the regulatory framework guiding land use activities, utilities, and timber harvesting in the planning area.

Tribal Trust Lands

When the federal government acquires land in trust for a tribe, the property is not subject to state or local land use regulations; only tribal land use regulations are applicable on trust lands. However, the BIA desires to cooperate with local and state authorities on matters related to land use. The trust land overseen by the BIA consists of approximately 1.4 million acres, which encompass the Osage Mineral Reserve covering Osage County (BIA 2015d). **Table 1-1**, Planning Area Surface Ownership, describes surface landownership in Osage County.

The BIA Osage Agency carries out land use planning and oversees mineral leasing on tribal trust lands in the planning area. The agency branches include Executive Direction and Trust Services, which is divided into six subsections: Real Estate Services, Probate and Estate Services, Natural Resources, Mineral Subsurface Leasing, Mineral Lease Management, and Mineral Field Operations (in accordance with the memorandum of understanding with the EPA and the Osage Nation).

The predominant classification of land use by the County Assessor within the planning area is rural agriculture, which covers approximately 95 percent of the land area. Rural residential and rural commercial comprise approximately 2.6 percent and 2 percent of land use (Osage County 2011).

The Osage Agency reviews and approves development of trust property, consistent with the applicable federal laws and regulations. The agency may also consider tribal laws.

Osage County Land Use Plan

The Osage County Comprehensive Plan is a local document meant to guide future physical and economic development (Osage County 2011). This plan is a collaboration of the Osage County Board of Commissioners, the Osage County Industrial Authority, and the Pawhuska-Osage County Planning Commission. The Industrial Authority understands the importance of properly managing growth and development in Osage County and has begun to prepare an industrial land use plan with the Indian Nations Council of Governments. This is a voluntary association of local and tribal governments in the Tulsa metropolitan area that provides planning and coordination services in areas such as land use, transportation, and community and economic development. The Industrial Authority also provided the Osage County Tourism Oversight Committee with a seed grant to begin preparing a plan for tourism and marketing.

The planning period and stages of implementation of the goals, policies, and objectives of the Comprehensive Plan has been divided into the following periods:

- Short term—Adoption of the Comprehensive Plan and five years beyond, 2011 to 2016
- Mid-term—From six to ten years after adoption of the Comprehensive Plan, 2017 to 2022
- Long term—From 11 years after adoption of the Comprehensive Plan to the end of the planning period and 2030; the long term also includes those objectives that will take place throughout the planning period, as described at the end of this chapter, 2011 to 2030

Objectives identified in the Comprehensive Plan address the following:

- Land use planning
- Land use intensity
- Public and quasi-public areas and facilities
- Public utilities
- Transportation
- Housing
- Economic development
- Image and appearance
- Quality of life

In general, the objectives for land use planning in Osage County support the preservation and protection of land used for agriculture and ranching (Osage County 2011).

BIA

The BIA manages lands in Osage County in accordance with 25 CFR, Subchapter H-Land and Water, as follows:

- Part 150 regulations set forth authorities, policies, and procedures governing the recording, custody, maintenance, use, and certification of title documents and the issuance of title status reports for Indian land.
- Part 151 regulations set forth the authorities, policies, and procedures governing the acquisition of land by the United States in trust status for individual Indians and tribes. Acquisition in fee simple status is not covered by these regulations, even though such

land may, by operation of law, be held in restricted status following acquisition. Acquisition of land in trust status by inheritance or escheat (reversion of lands) is not covered by these regulations.

- Part 152 regulations set forth the authorities, policy, and procedures for issuing patents in fee, certificates of competency, removal of restrictions, and sale of certain Indian lands.
- Part 158 regulations set forth the authorities, policies, and procedures for the application and order for change in designating homesteads, exchanging restrictive lands, instituting partition proceedings and partition records, approving deeds, and distributing proceeds of partition sales.
- Part 162 regulations set forth the authorities, policies, and procedures for leasing certain interests in Indian land.
- Part 169 regulations set forth the authorities, policies, and procedures for granting rights-of-way over and across tribal land, private land, and government land.

3.14.2 Current Conditions

Regional Setting

With a total land area of 1,476,500 acres, Osage County is the largest of 77 counties in Oklahoma. It is in the northeastern portion of the state and is bounded by Kansas to the north, Kay, Noble, and Pawnee Counties to the west, the Arkansas River to the southwest, and Washington and Tulsa Counties to the east. Although most of the 1,474,500-acre planning area is sparsely populated, an extension of metropolitan Tulsa extends into the far southeastern corner. Except for large floodplains along the Arkansas River and several other major streams, gently rolling hills generally characterize the county's topography (BIA 2014).

The population of Osage County is 47,981, and the estimated growth rate between 2010 and 2014 is approximately one percent (US Census Bureau 2014b). Lands in the planning area are generally rural, with small farming communities and rural residences scattered throughout.

The Tallgrass Prairie Preserve in the northern portion of Osage County was bought by TNC in 1989. Additional land purchases and leases have occurred since then, and TNC now manages approximately 35,200 acres of preserved area (OK GAP GIS 2008). TNC has worked with numerous energy companies on all of their preserves and their approach has been to use collaborative conservation within the context of local economies. As of 2013, the Tallgrass Prairie Preserve contained 220 operating oil and gas wells (TNC 2013), with associated roads and utilities (e.g., power lines and pipelines). The preserve has free-ranging bison herds, scenic turnouts, hiking trails, and picnic tables (TNC 2015).

Utilities

The primary utility infrastructure in the planning area consists of underground pipelines used to transport commodities to refining centers outside the planning area; these are gas, oil, formation water, and secondary recovery chemicals from in and next to the planning area. The Osage Agency and the Department of the Interior have no regulatory authority over interstate pipeline operations (including spill prevention and cleanup), unless those pipelines are on restricted or Indian trust lands in Osage County. The Superintendent of the Osage Agency must approve route locations of interstate lines on restricted Indian lands. In addition, the Osage Agency estimates that there are several hundred miles of pipelines used for brine disposal or injection in use in the county (BIA 2014).

An estimated 38,600 oil wells have been drilled in the planning area since drilling began in 1896. Approximately 17,000 oil and gas wells and 2,700 underground injection wells remain unplugged in the planning area (Osage Nation Environmental and Natural Resources Department 2006). There are approximately 1,000 miles of pipelines identified by the National Pipeline Mapping System (NPMS) in the planning area, most of which are used for crude oil and natural gas transportation (NPMS GIS 2015).

Due to the rural nature of the planning area, electrical transmission and distribution infrastructure is primarily associated with interstate transmission lines, rural developments, wind and hydroelectric power generation, and oil and gas activity. There are approximately 300 miles of transmission lines in Osage County (BIA GIS 2015). Most communities in the planning area are served by the electric utility company Earth Power Resources, Inc.

Proposed wind energy developments in Osage County are the Osage Wind Project and the Mustang Run Wind Farm. The Osage Wind Project is a 150-megawatt wind development west of Pawhuska in Osage County. The Osage Wind Project is expected to produce enough power for approximately 45,000 homes (Tradewind Energy 2014). The 136-megawatt Mustang Run Wind Farm is 13 miles west of Pawhuska and is currently being developed (KEIN 2015).

Figure 3-11, Rights-of-Way, displays the location of transmission lines, pipelines, and wind projects in the planning area.

Timber Harvesting

Osage County is in the Cross Timbers ecological region (EPA 2012). Forest management is coordinated with other resource and cultural programs of the Osage Nation. Timber harvesting and sale is conducted in cooperation with the BIA Agency Superintendent and the Eastern Oklahoma Regional Forester.

Timber management in the planning area is limited to forest lands having the potential to produce accessible commercial timber. These lands are restricted to bottomlands and mixed hardwood stands on drainage terraces in the

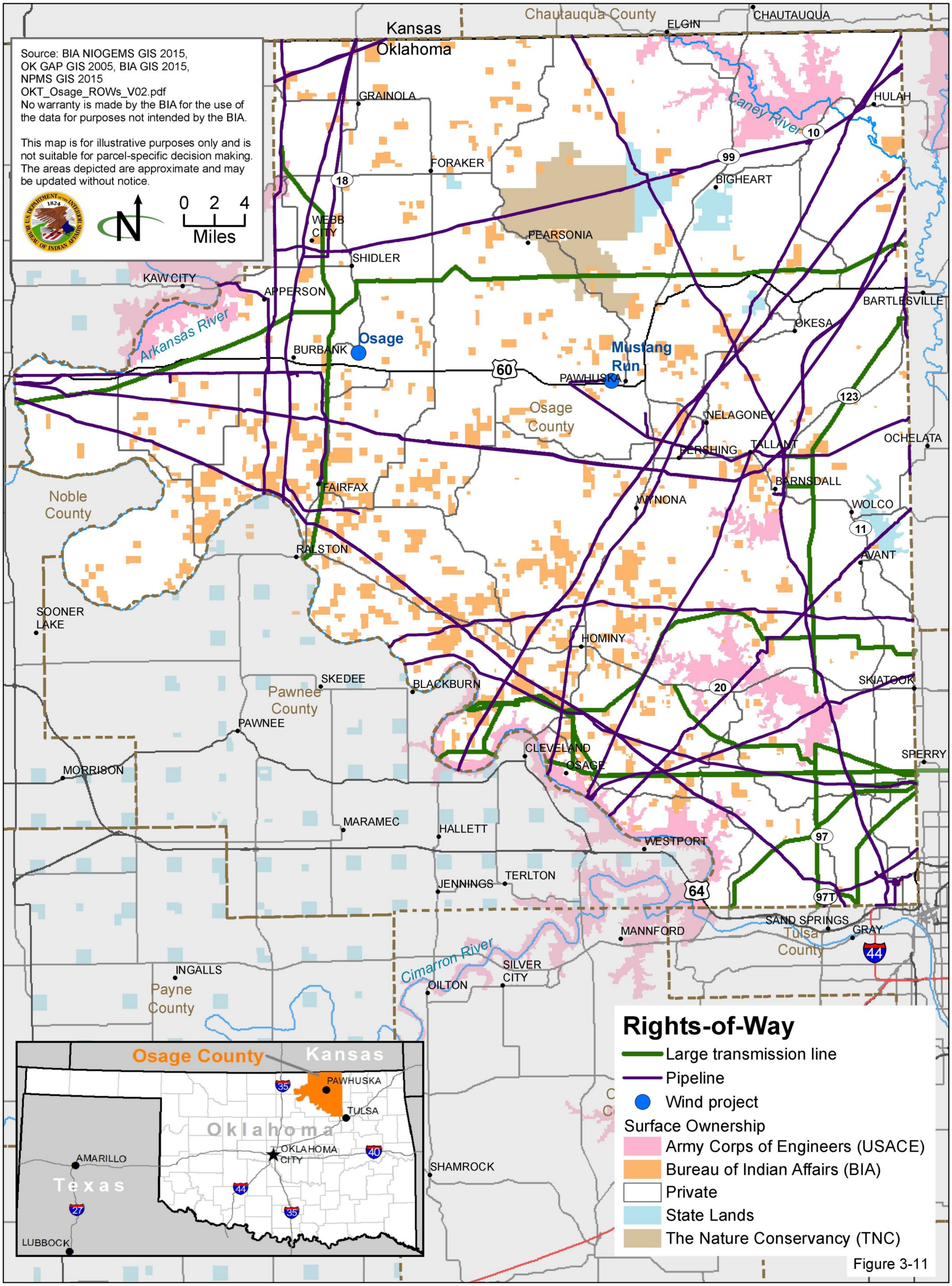

Source: BIA NIOGEMS GIS 2015, OK GAP GIS 2005, BIA GIS 2015, NPMS GIS 2015
OKT_Osage_ROWs_V02.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
N
Kansas
Oklahoma
Chautauqua County
Noble County
Osage County
Pawnee County
Payne County
Tulsa County
Caney River
Arkansas River
Cimarron River
Osage
Mustang Run
Rights-of-Way
Large transmission line
Pipeline
Wind project
Surface Ownership
Army Corps of Engineers (USACE)
Bureau of Indian Affairs (BIA)
Private
State Lands
The Nature Conservancy (TNC)
Osage County
Kansas
Oklahoma
Texas
PAWHUSKA
TULSA
OKLAHOMA CITY
AMARILLO
LUBBOCK

Figure 3-11

southern part of the planning area. Commercial operators cut native timbers as a cash crop, mostly oak, ash, hackberry, cottonwood, sycamore, cherry, and elm, with specialty cash crops of walnut and pecan (Osage Nation Environmental and Natural Resources Department 2006).

The hardwood community consists primarily of short oak trees that are not prime timber for harvest. However, forested areas have been cleared to create open sections for rangeland, pastures, and farmland (BIA 2014). Osage County has not had any timber sales in the last 10 years; however, trespassers have illegally harvested approximately 4 acres of restricted land.

3.14.3 Trends

Land Use Plans

Future land uses in the planning area will continue to include rural residential developments, agriculture (primarily for field crops and tame pastures), oil and gas activities, and wind energy generation. Osage County and the Osage will continue to share land use authority in the planning area. Osage County will continue to maintain and refine the Osage County Comprehensive Plan.

Utilities

The location and extent of future mineral (e.g., oil and gas) and renewable energy (e.g., wind) development in the planning area will directly influence the location and intensity of future utility development. Utility infrastructure to support this activity is likely to include oil and gas pipelines and electrical distribution and transmission lines. Future population growth in the southeastern portion of the county may also create demand for new electrical infrastructure.

Timber Harvesting

Historical harvesting and land use practices have resulted in fewer acres available for timber harvesting. Of the total acreage in Osage County, 47,600 acres are forested, 40,900 acres are upland woodlands, and 6,600 acres are terrace and bottomland forests. Wet bottomland soils typically limit access of logging equipment to early summer through mid-winter (Osage Nation Environmental and Natural Resources Department 2006).

3.15 Traffic and Transportation

3.15.1 Regulatory Framework

The Osage Nation published a draft Long Range Transportation Plan in 2014 that, when finalized, will serve as the primary planning document for the Osage Nation Roads Department. The plan prioritizes identifying and inventorying roads eligible for the Indian Reservation Roads System so that funding can be sought for road improvements (Osage Nation 2014b).

The Osage Nation Roads Department is responsible for communicating with federal, state, county, and local officials to ensure that the different entities are collaborating, that efforts are being maximized, and that the safety and well-being of travelers within those boundaries are being addressed (Osage Nation 2015b).

The Oklahoma Department of Transportation is updating its Long Range Transportation Plan, a document that focuses on highways and bridges, public transportation, freight movement, passenger rail, bicycle and pedestrian networks, and access to air and water ports (Oklahoma Department of Transportation 2015). There are eight field divisions across the state, each responsible for road repairs, maintenance, and cleaning within their boundaries. Osage County is in Field Division 8.

3.15.2 Current Conditions

In Osage County there are about 2,000 miles of paved highways, which are maintained by district offices of the Oklahoma State Department of Transportation, Division of Highways. Several new roads are funded for pending construction. In addition, about 3,000 miles of oil company roads are maintained by the lessees. Approximately 150 miles of unpaved gravel roads are constructed annually to carry out new oil and gas field operations (BIA 2014).

The Osage Nation maintains its own inventory of transportation facilities in the county that are eligible for Tribal Transportation Program (TTP) funding. A TTP route is a public road that is in or provides access to an Indian reservation, Indian trust land, or restricted Indian land. The Osage Nation's TTP inventory predominantly uses the county, township, and state roads in its jurisdictional boundaries, which serve all people in Osage County (see **Table 3-38**). The Osage Nation Long Range Transportation Plan's primary focus is on tribal economic development, cultural sites, tribal residences, and headquarters (Osage Nation 2014b).

Regional transit is provided by Cimarron Public Transit System (CPTS), which operates approximately 34 vans. The only portion of the Osage Nation service area that CPTS travels through is from Ponca City through Osage County to Bartlesville. CPTS also has contract services in various parts of Osage County, mostly with health-related agencies. Hominy has a local dial-a-ride transit service, which serves the elderly primarily.

Primary Roads

In addition to a network of county, tribal, and private roads, several federal and state highways traverse Osage County.

US Highway 60 crosses Osage County from Bartlesville in Washington County west to the county line just south of Ponca City in Kay County. Annual average daily traffic (AADT) on this road ranges between 1,900 and 6,700, depending on

Table 3-38
Osage Transportation Facility Inventory

Class	Description	Miles
Class 1	Major arterial roads serving traffic between two large population centers and carrying an average traffic volume of 10,000 vehicles or more per day.	0
Class 2	Rural minor arterial roads serving traffic between large population centers and smaller towns and communities. Generally designed for relatively high overall speeds, with minimum interference to through-traffic, and carrying fewer than 10,000 vehicles per day.	278.1
Class 3	Streets and roads serving residential and urban areas.	475.2
Class 4	Rural major collectors of traffic from rural local roads.	456.3
Class 5	Local rural roads serve areas around villages or provide access to farming areas, schools, tourist attractions, and various small enterprises. This class also includes roads and vehicular trails for such activities as administering forests, grazing areas, mining and oil operations, and recreation.	896.3
Class 6	Minor arterial streets in the communities that provide access to major arterial roads.	0
Class 7	City collector streets in communities that provide access to city streets.	1.5
Class 8	Paths, trails, walkways, and other routes for public traffic, bicycles, trail bikes, snowmobiles, all-terrain vehicles, and other non-vehicular traffic.	45.4
Class 9	Parking facilities next to TTP routes and scenic byways, such as rest areas, scenic pullouts, ferry boat terminals, and transit terminals.	0
Class 10	Public airstrips within the boundaries of the TTP system. This class is for inventory and maintenance only.	0
Class 11	Overlapping routes. This class requires no funding because it is already in the inventory under another route number but is in the system to be complete. An example of a class 11 route is Highway 11 overlapping Highway 60: two different routes that, at some point, overlap.	45.7
Total		**2198.5**

Source: Osage Nation 2014b

the location (Oklahoma Department of Transportation 2013). US Highway 60 is a two-lane paved road with center striping and paved shoulders. In March 2008, the Oklahoma Department of Transportation Scenic Byways Program approved the Osage's request to designate US Highway 60 as a state scenic byway.

State Highway 11 enters the southeast corner of Osage County near Skiatook and travels northwest to Pawhuska. It shares its route with US Highway 60 for approximately 20 miles west of Pawhuska to the intersection with State Highway 18. State Highways 11 and 18 then travel north to Shidler, where State Highway 11 continues west across Kaw Lake to the county border. AADT on this road ranges between 450 and 5,300, depending on the location (Oklahoma Department of Transportation 2013). State Highway 11 is a two-lane paved road with center striping and paved shoulders.

State Highway 18 traverses western Osage County in a north-south direction, passing through the towns of Shidler and Fairfax. AADT varies between 290 and 1,600, depending on the location (Oklahoma Department of Transportation 2013). State Highway 18 is a two-lane paved road with center striping and paved shoulders.

Other primary roads in Osage County are State Highways 10, 99, and 123. These are all two-lane paved roads with center striping and paved shoulders. AADT is generally under 4,000, except in the vicinity of Tulsa, where AADT on State Highway 20 is 16,300 (Oklahoma Department of Transportation 2013).

3.15.3 Trends

Traffic and transportation trends will likely mirror population changes. Population growth will likely increase the number of vehicles on roads in Osage County, especially near Tulsa.

3.16 Mineral Extraction

3.16.1 Regulatory Framework

Osage Allotment Act of 1906

This law provides for the competitive leasing of lands on any Indian reservation or lands owned by the Osage.

BIA Regulations on Leasing of Osage Reservation Lands for Oil and Gas Mining (25 CFR, Part 226)

These regulations govern the BIA's administration of fluid mineral leasing and development in the Osage Mineral Estate.

3.16.2 Current Conditions

The planning area, Osage County, falls within two large oil and gas plays. The Excello-Mulky play overlaps the eastern portion of the planning area, and the Mississippian play overlaps the western portion. Most oil and gas development in the planning area to date has occurred in the 277 oil and gas fields in Osage County. **Table 3-39** lists the number of fields with each type of resource in the planning area.

Table 3-39
Oil and Gas Fields[1]

Resource	Number of Fields	Acres of Fields
Coal bed methane	16	78,900
Gas	22	20,500
Oil	220	669,500
Oil and gas	19	34,600

Source: USGS GIS 2014

There are 2,973 active oil wells, 20,052 active gas wells, 61 active wells producing both oil and gas, and 303 other active wells in the planning area (Information Handling Services 2015). **Table 3-40** shows the number of active wells for each resource broken down by horizontal, directional, and vertical well bore. As shown in the table, 99 percent of the active wells in the planning area are vertical. **Figure 3-12** shows wells and oil and gas fields in the planning area. In addition to extraction wells, the planning area contains 1,765 injection wells. One injection well is horizontal, and the rest are vertical (Information Handling Services 2015).

Table 3-40
Active Oil and Gas Wells

Resource	Number of Wells
Oil	26,052
Vertical	25,932
Directional	11
Horizontal	109
Gas	2,973
Vertical	2,885
Directional	23
Horizontal	65
Oil and gas	61
Vertical	61
Directional	0
Horizontal	0
Other	303
Vertical	296
Directional	1
Horizontal	6

Source: Information Handling Services 2015

Table 3-41 shows the number of vertical, horizontal, and directional wells completed in 2013 and 2014. In addition to the oil and gas wells shown, six injection wells were completed in 2013, and another six were completed in 2014 (Information Handling Services 2015).

As shown in **Tables 3-40** and **3-41**, oil extraction is much more prevalent in the planning area than gas extraction. Most wells are vertically drilled, with directional drilling as the second most common well drilling method. The percentage of horizontal or directional oil wells drilled in 2014 (13 percent) is much higher than the overall percentage of active horizontal or directional oil wells (less than one percent). This suggests that horizontal and directional drilling are being used more now than they have been historically. These types of wells may make up a larger portion of total wells in the planning area in the future.

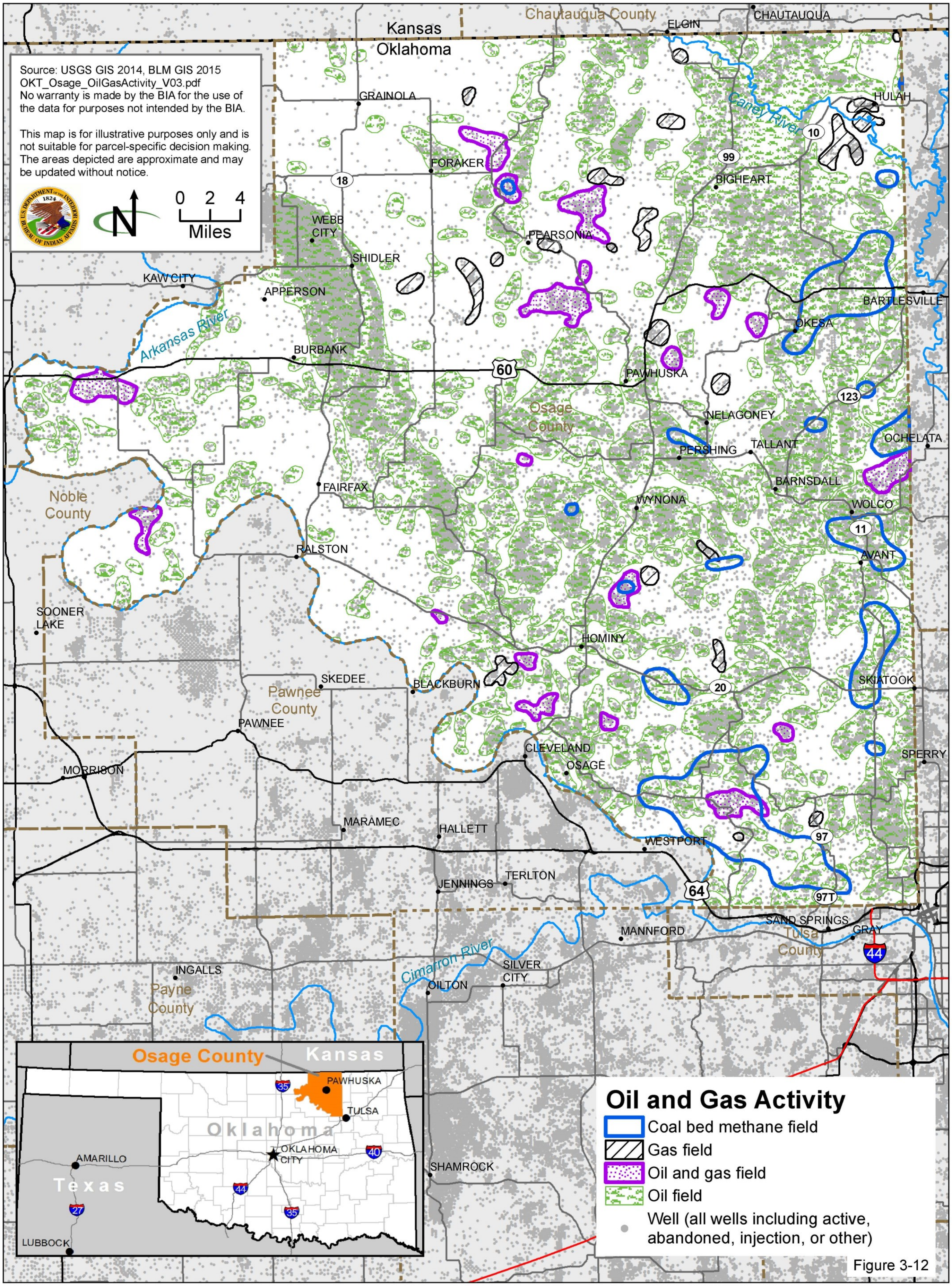

Source: USGS GIS 2014, BLM GIS 2015
OKT_Osage_OilGasActivity_V03.pdf
No warranty is made by the BIA for the use of the data for purposes not intended by the BIA.
This map is for illustrative purposes only and is not suitable for parcel-specific decision making. The areas depicted are approximate and may be updated without notice.
0 2 4
Miles
Kansas
Oklahoma
Chautauqua County
Osage County
Noble County
Pawnee County
Payne County
Tulsa County
Arkansas River
Caney River
Cimarron River
Osage County
Kansas
Oklahoma
Texas
Oil and Gas Activity
Coal bed methane field
Gas field
Oil and gas field
Oil field
Well (all wells including active, abandoned, injection, or other)

Figure 3-12

Table 3-41
Annual Oil and Gas Well Completions

Resource		Number of Wells
	2013	
Oil		74
	Vertical	60
	Directional	0
	Horizontal	14
Gas		2
	Vertical	1
	Directional	0
	Horizontal	1
	2014	
Oil		47
	Vertical	41
	Directional	4
	Horizontal	2
Gas		1
	Vertical	1
	Directional	0
	Horizontal	0

Source: Information Handling Services 2015

In 2014, wells in Osage County produced 4,836,712 barrels of oil and 8,823,988 thousand cubic feet of gas (6.3 percent of total oil and 0.5 percent of total gas produced in Oklahoma; BIA 2015a, 2015b, Information Handling Services 2015). This is a decrease compared with 2013, during which wells produced 5,025,973 barrels of oil and 9,806,792 thousand cubic feet of gas (BIA 2015b, 2015c). Oil and gas production in Osage County for the first six months of 2015 was 2,358,289 barrels of oil and 4,037,482 thousand cubic feet of gas (BIA 2015b, 2015c).

3.16.3 Trends

The BLM has classified oil and gas development potential throughout Oklahoma, including the planning area, ranging from no potential to high potential (BLM [in preparation]). **Table 3-42** shows development potential and existing wells in the planning area.

As shown in **Table 3-42**, 84 percent of the planning area has high or moderate-to-high oil and gas potential. Most wells (94 percent) are in these areas, and future development can be expected to follow the same pattern.

The Energy Information Administration predicts that nationwide oil prices will rise by between 0.8 and 1.4 percent per year between 2012 and 2040 (in 2012 dollars; Energy Information Administration 2014). Natural gas prices are

Table 3-42
Oil and Gas Development Potential

Development Potential	Acres	Percent	Existing Wells (Including Injection and Abandoned Wells)	Percent
High	973,200	66	33,868	76
Moderate to high	268,200	18	7,943	18
Moderate	231,600	16	2,781	6
Low to moderate	1,300	<1	1	<1
Low	200	<1	0	0
Total	**1,474,500**	**102**	**44,593**	**100**

Source: BLM GIS 2015

predicted to rise at a rate of 3.7 percent per year between 2012 and 2040 (in 2012 dollars; Energy Information Administration 2014). Based on the oil and gas development potential and predicted nationwide price increases, oil and gas activity in the planning area is expected to increase over the next 20 years.

The BLM's reasonably foreseeable development scenario for Oklahoma, Kansas, and Texas estimates that approximately 4.6 million barrels of oil will be produced from Indian minerals in the planning area in 2035; this is a 8 percent reduction below 2013 production levels for the planning area. The BLM's scenario also estimates that 15 million thousand cubic feet of gas will be produced from Indian minerals in the planning area in 2035; this is a 54 percent increase over 2013 production levels for the planning area (BLM [in preparation]).

3.17 Recreation and Special Use Areas

3.17.1 Regulatory Framework

While the BIA manages no lands in the planning area specifically for recreation, private, state, and local agencies in Osage County provide diverse opportunities for recreation. Some examples are biking, boating, camping, hiking, horseback riding, hunting, fishing, off-highway vehicle riding, swimming, and playing tennis.

The BIA and its partners encourage responsible use through land use ethics programs, such as Tread Lightly and Leave No Trace. Public recreation is offered on all BIA-administered lands in Osage County where legal access exists.

The Osage County Comprehensive Plan is a local document meant to guide future physical and economic development (Osage County 2011). The development of the county's economic potential for tourism and recreation for residents and visitors depends on the preservation of its natural and human-made recreation and open spaces. Some of Osage County's objectives for parks, recreation, trails, and open space areas are listed below; a complete list of objectives can be found in Chapter 4 of the 2030 Osage County Comprehensive Plan (Osage County 2011):

- Preserve, maintain, and develop recreation and open spaces for the use and enjoyment of residents, visitors, and tourists
- Meet present and future active and passive recreation needs by setting aside lands for parks, recreation, and open space
- Protect natural open space areas identified as Development Sensitive and Conservation Areas to preserve the natural vegetation, wildlife, and environment, while reducing potential hazards to human life from improperly building on steep slopes with erodible soils or flooding potential

3.17.2 Current Conditions

Hunting and Fishing

Oklahoma provides a diverse hunting experience, with over 12 different ecological regions. The Oklahoma Department of Wildlife Conservation (ODWC) provides habitat conservation and management across the state at designated WMAs. Oklahoma game species are antelope, bear, dove, deer, elk, furbearers, feral hogs, mountain lion, quail, peregrine, pheasant, turkey, waterfowl, and various other small game and migratory birds.

Hunting seasons vary for the various species, but in general people hunt in the fall and winter. Additionally, the ODWC manages and stocks lakes and ponds throughout the state. Fish species produced and stocked annually are largemouth bass, smallmouth bass hybrid, walleye, brown trout, and rainbow trout. Annual fish stockings average 11 million fish.

Wildlife Management Areas

In the planning area, there are seven designated WMAs that provide opportunities for hunting, fishing, and camping. Some of the WMAs include USACE-operated and controlled reservoirs, though the ODWC operates the park or WMA. The USACE creates reservoirs for flood control, water supply, irrigation, hydropower, navigation, recreation, and fish and wildlife (Oklahoma Department of Wildlife Conservation 2015b; see **Table 3-43**).

Table 3-43
Wildlife Management Areas in Osage County

WMA	Area (Acres)	County	Management Agency
Hulah	14,000	Osage	USACE
Osage (Rock Creek Unit and Western Wall Unit)	9,700	Osage	ODWC
John Dahl	500	Osage	ODWC
Candy	3,600	Osage	USACE
Kaw	1,100	Osage	USACE
Keystone	2,900	Creek, Osage, and Pawnee	USACE
Skiatook	4,000	Osage	USACE

Source: OK GAP GIS 2008

Recreation Areas in Osage County

Osage Hills State Park offers 900 acres for recreation and includes picnic tables and shelters, recreational vehicle campsites, cabins, a swimming pool, hiking trails, a ball field, and a tennis court. Fishing for bass, crappie, catfish, and perch is common in Lookout Lake or in Sand Creek at the south end of the park. The park is also used for fall foliage viewing (OHSP 2015). A trail system of three trails is open for hiking and mountain biking. These unpaved trails are centrally located in the park.

Keystone State Park is along the southern boundary of Osage County, on the south side of the Arkansas River. This park provides fishing areas for striper, walleye, bass, and catfish. It also provides other recreation opportunities, such as boating, water skiing, swimming, camping, picnicking, and hiking (Keystone 2015; see **Table 3-44**).

Table 3-44
State Parks in Osage County

Recreation Area	County	Size (Acres)	Activities	Management Agency
Osage Hills State Park	Osage	900	Biking, camping, fishing, hiking, swimming, tennis	Oklahoma Tourism and Recreation Department
Keystone State Park	Osage and Pawnee	700	Biking, boating, camping, fishing, hiking, off-highway vehicle riding	Oklahoma Tourism and Recreation Department

Sources: OTRD 2015; OK GAP GIS 2008

The USACE operates and controls the Copan/Hulah Lake Project in northeast Osage County. Facilities and services are available around the project. Copan Dam is a rolled, impervious, earthfill embankment, with a 5,200-foot-long concrete spillway. State Highway 10 extends across the dam. Hulah Lake provides opportunities for fishing and hunting, camping, picnicking, swimming, boating, and sightseeing. Approximately 8,900 acres of project lands is licensed to the ODWC for wildlife management (Hulah 2015).

TNC bought the Tallgrass Prairie Preserve in the northern portion of Osage County in 1989. Additional land has been purchased and leased since then, and TNC now manages approximately 35,200 acres of preserved area (OK GAP GIS 2008). TNC has worked with numerous energy companies on all of their preserves where there is active energy development. Their approach has been to use collaborative conservation within the context of local economies (TNC Robert G. Hamilton 2013). The preserve is open to the general public, with no admission charge, every day from dawn to dusk. The preserve has free-range bison herds, scenic turnouts, hiking trails, and picnic tables (TNC 2015).

3.17.3 Trends

The estimated population of Osage County only slightly increased from 2013 to 2014 (0.12 percent increase), whereas surrounding communities such as Tulsa expanded at a higher rate of approximately 1 percent between 2013 and 2014 (US Census Bureau 2014b). Recreation use is expected to slightly but steadily increase in Osage County as the population continues to rise. Osage County will continue to maintain and refine the Osage County Comprehensive Plan and to implement the objectives listed for parks, recreation, trails, and open space.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes the anticipated effects that would result from the management actions and resource conservation measures (RCMs) under all three alternatives. This chapter is organized by topic, similar to **Chapter 3**, Affected Environment. Each topic area includes a section that identifies indicators, methods, and assumptions and analyzes impacts for each of the alternatives.

This impact analysis identifies impacts that may result in some level of change to the resource, regardless of whether that change is beneficial or adverse. The impact analysis does not include a subjective qualifier (beneficial or adverse) to the impact; instead, it states the nature, magnitude, and context for the change.

The evaluations in this section are confined to the actions that have more prominent, immediate, or direct effects. Some of the proposed management actions and potential future development may affect only certain resources and alternatives. If an activity or action is not addressed in a given section, no impacts are expected or the impact is expected to be negligible.

Impact analysis is a cause-and-effect inquiry. The detailed impact analyses and conclusions are based on the interdisciplinary team's knowledge of resources and the project area, on literature reviews, and on information provided by experts in the Bureau of Indian Affairs (BIA) and other agencies. The baseline used for the impact analysis is the current condition or situation, as described in **Chapter 3**, Affected Environment. Impacts on resources and resource uses are analyzed and discussed in detail, commensurate with resource issues and concerns identified throughout the process. At times, impacts are described using ranges of potential impacts or in qualitative terms.

4.1.1 General Methodology for Analyzing Impacts

Potential impacts or effects are described in terms of type, context, duration, and intensity, which are generally defined as follows:

- Type of impact—Because types of impacts can be interpreted differently by different people, this chapter does not differentiate between beneficial and adverse impacts (except in cases where such characterization is required by law, regulation, or policy). The presentation of impacts for key issues is intended to provide the BIA decision-makers and readers with an understanding of the tradeoffs associated with each alternative.
- Context—This describes the area or location (site-specific, local, planning area-wide, or regional) in which the impact would occur. Site-specific impacts would occur at the location of the action, local impacts would occur within the general vicinity, planning area-wide impacts would affect a greater portion of the county, and regional impacts would extend beyond the planning area (county) boundaries.
- Duration—This is the length of time that an effect would occur, either short term or long term. Short-term is defined as anticipated to begin and end within the first five years after the action is implemented; long-term is defined as lasting beyond five years to the end of or beyond a 50-year project horizon.
- Intensity—This analysis discusses impacts using quantitative data wherever possible. If quantitative analysis is not possible, qualitative statements are used.
- Direct and indirect impacts—Direct impacts are caused by an action or implementation of an alternative and occur at the same time and place. Indirect impacts result from implementing an action or alternative but usually occur later in time or are removed in distance and are reasonably certain to occur.
- Cumulative impacts—Cumulative impacts are described at the end of each resource section. They are the direct and indirect effects of a proposed alternative's incremental impacts when they are added to other past, present, and reasonably foreseeable actions, regardless of who carries out the action (40 Code of Federal Regulations [CFR], Subpart 1508.7). The list of actions used for cumulative impact analysis is provided in **Section 4.1.3**, Past, Present, and Reasonably Foreseeable Future Actions.

Analysis shown under an alternative may be referenced in the other alternatives with such statements as "impacts would be the same as, or similar to, Action Alternative 2" or "impacts would be the same as Action Alternative 1, except for…" as applicable. The environmental consequences analysis in the Workover programmatic environmental assessment (PEA) and the Leasing PEA is incorporated into this chapter by reference.

The scope of the analysis focuses on impacts on resources and uses on BIA-administered tribal mineral estate. This is because the decisions being made by the BIA apply only to oil and gas leasing and development that the BIA administers. Because leasing land for oil and gas development does not allow drilling, but merely sets the land aside for that use, the impacts of the leasing actions covered by this EIS are generally limited to the surface. Likewise, well workovers included in this EIS generally only impact the surface.

This EIS analyzes the impacts of leasing and workover activities and includes a general analysis of the surface and underground impacts of drilling and other development activities. Specific surface and underground impacts of drilling and other development activities as a result of a proposed permit will be assessed in site-specific National Environmental Policy Act (NEPA) review tiered to this EIS.

4.1.2 Analytical Assumptions

Several assumptions were made to facilitate the analysis of the projected impacts. These assumptions set guidelines and provide reasonably foreseeable projected levels of development in the planning area and time frame. These assumptions should not be interpreted as constraining or redefining the management objectives and actions proposed for each alternative, as described in **Chapter 2**, Alternatives.

The following general assumptions apply to all resource categories. Any specific resource assumptions are provided in the methods of analysis section for that resource topic:

- Sufficient funding and personnel would be available for implementing the final decision.
- Implementing actions from any of the alternatives would be in compliance with all valid existing rights, federal regulations, BIA policies, and other requirements.
- Additional site-specific NEPA and environmental analyses would be conducted on individual permit applications as needed.
- The Superintendent would issue an order or notice to lessees (NTL) applying the RCMs listed under the selected alternative as mandatory requirements for all oil and gas-related activities under BIA-approved leases.
- RCMs would provide reasonable constraints but would not preclude lease development.
- Local climate patterns of historic record and related conditions for plant growth would continue.

- In the future, as tools for predicting climate change in a management area improve and changes in climate affect resources and necessitate changes in how resources are managed, the BIA may be able to reevaluate decisions made as part of this planning process and to adjust management accordingly.
- The functional capability of all developments would be appropriately maintained.
- The discussion of impacts is based on the best available data. Knowledge of the planning area and professional judgment, based on observation and analysis of conditions and responses in similar areas, are used to infer environmental impacts where data are limited.
- Acreage figures and other numbers used in the analyses are approximate projections for comparison and analysis only. Readers should not infer that they reflect exact measurements or precise calculations. Acreage calculations are rounded to the nearest 10 acres for acreages less than 1,000 and to the nearest 100 acres for acreages of 1,000 or more.

4.1.3 Cumulative Effects

Cumulative impacts are those on the environment that result from implementing any one of the alternatives, in combination with other actions outside the scope of this EIS, either in the planning area or next to it.

Cumulative impact analysis is required by Council on Environmental Quality (CEQ) regulations because environmental conditions result from many different factors that act together. The total effect of any single action cannot be determined by considering it in isolation, so it must be determined by considering the likely result of that action in conjunction with many others.

Evaluating potential impacts considers incremental impacts that could occur from the proposed project, as well as impacts from past, present, and reasonably foreseeable future actions. Management actions could be influenced by activities and conditions on adjacent lands beyond the planning area boundary; therefore, assessment data and information could span multiple scales, landownerships, and jurisdictions. These assessments involve determinations that often are complex and, to some degree, subjective.

Cumulative Analysis Methodology

The cumulative impacts discussion in each section considers the alternatives in the context of the broader human environment, specifically, actions that occur outside the scope of this environmental impact statement (EIS) or outside the geographic area covered by the planning area.

Because of the programmatic nature of the Osage County Oil and Gas EIS and cumulative assessment, the analysis tends to be broad and generalized. This is so as to address the effects that could occur from a reasonably foreseeable management scenario, combined with other reasonably foreseeable activities or projects. Consequently, this assessment is primarily qualitative for most resources because of a lack of detailed information that would result from project-level decisions and other activities or projects. Quantitative information is used whenever available and as appropriate to portray the magnitude of an impact.

The analysis assesses the magnitude of cumulative impacts by comparing the environment in its baseline condition with the expected impacts of the alternatives and other actions in the same geographic area. The magnitude of an impact is determined through a comparison of anticipated conditions against the naturally occurring baseline, as depicted in the affected environment (**Chapter 3**) or the long-term sustainability of a resource or social system.

The following factors were considered in this cumulative impact assessment:

- Tribal, federal, nonfederal, and private actions
- Potential for synergistic effects or synergistic interaction among or between effects
- Potential for effects across political and administrative boundaries
- Other spatial and temporal characteristics of each affected resource
- Comparative scale of cumulative impacts across alternatives

Temporal and spatial boundaries used in the cumulative analysis are developed on the basis of resources of concern and actions that might contribute to an impact. The baseline year for the cumulative impacts analysis is 2015; the scope of this analysis is a 20-year planning horizon.

Spatial boundaries vary and are larger for resources that are mobile or migrate (e.g., deer populations), compared to stationary resources. Occasionally, spatial boundaries could be contained within the planning area boundaries or an area within the planning area. Spatial boundaries were developed to facilitate the analysis and are included under the appropriate resource section heading.

Past, Present, and Reasonably Foreseeable Future Actions

Past, present, and reasonably foreseeable future actions are considered in the analysis to identify whether and to what extent the environment has been degraded or enhanced, whether ongoing activities are causing impacts, and what the trends are for activities in and impacts on the area. Projects and activities are evaluated on the basis of proximity, connection to the same environmental systems, potential for subsequent impacts or activity, similar impacts, the likelihood a project will occur, and whether the project is reasonably foreseeable.

Projects and activities considered in the cumulative analysis were identified by reviewing existing decisions and formal proposals, identifying actions highly probable based on known trends, and reviewing federal and non-federal actions outside the scope of this EIS.

Effects of past actions and activities are manifested in the current condition of the resources, as described in the affected environment (**Chapter 3**). Reasonably foreseeable future actions are those that proponents have committed to or that are known proposals that would take place within a 20-year planning period. Reasonably foreseeable future action scenarios are projections made to predict future impacts; they are not actual planning decisions or resource commitments. Projections, which have been developed for analysis only, are based on current conditions and trends and represent a best professional estimate. Unforeseen changes in such factors as economics, demand, and federal, state, and local laws and policies could result in different outcomes than those projected in this analysis.

Other potential future actions have been considered and eliminated from further analysis. This is because there is only a small likelihood these actions would be pursued and implemented within the 20-year planning period or because so little is known about the potential action that formulating an analysis of impacts would be premature. In addition, potential future actions to protect the environment (such as new potential threatened or endangered species listings or regulations related to fugitive dust emissions) have less likelihood of creating major environmental consequences, alone or in combination with this planning effort.

Federal actions such as species listing would require the BIA to reconsider decisions created from this action because the consultations and relative impacts might no longer be appropriate. These potential future actions may have greater capacity to affect resource uses in the planning area; however, until more information is developed, no reasonable estimation of impacts can be developed.

Data on the precise locations and overall extent of resources in the planning area are considerable, although the information varies according to resource type and locale. Furthermore, the understanding of the impacts on and the interplay among these resources is evolving. As knowledge improves, management measures (adaptive or otherwise) would be considered to reduce potential cumulative impacts, in accordance with law, regulations, and relevant BIA and Osage Nation policies.

Projects and activities identified as having the greatest likelihood to generate potential cumulative impacts when added to the Osage County Oil and Gas EIS alternatives are displayed in **Table 4-1**.

Table 4-1
Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions

Project	Description	Status
Environmental Assessment for the Oil & Gas Leasing Program of the Osage Indian Tribe	This document outlines the general framework within which the BIA administers oil and gas development in the Osage Mineral Reserve in Osage County.	Completed in 1979. The new EIS is intended to review and modify this plan.
Programmatic Environmental Assessment (PEA) for Leasing Activities	This document outlines alternatives for and discloses consequences of oil and gas leasing in the Osage Mineral Reserve in Osage County.	Completed in November 2014.
Programmatic Environmental Assessment for Approving Workover Operations	This document outlines alternatives for and discloses consequences of approving workover operations on existing wells in the Osage Mineral Reserve in Osage County, including temporarily abandoned and currently active oil and gas wells and facilities.	Completed in April 2015.
Osage Nation Environmental and Natural Resources Department Integrated Resource Management Plan (IRMP)	This is the Osage Nation's first IRMP, a long-range, strategic-level plan that integrates the management actions applied to the tribe's natural resources and other resources of value. It is intended to give tribal leaders the information necessary to make informed decisions concerning natural resources.	Completed in December 2005.
Osage Wind Project	This is a 150-megawatt (MW) wind farm encompassing 8,400 acres, located approximately 13 miles west of Pawhuska, Oklahoma. Developed by Tradewind Energy, Inc.	Construction underway.
Mustang Run Wind Project	This is a 136 MW wind farm encompassing 9,500 acres, located approximately 13 miles west of Pawhuska, Oklahoma. Developed by Tradewind Energy, Inc.	Construction date unknown.
Osage County Rural Water District #15 Phase 1A Capital Improvement	Two projects are proposed to improve storage and transmission. A new 300,000-gallon water tower is proposed along Highway 20 west of Skiatook to replace two standpipes. A smaller project involves the	Operation expected 2015.

Table 4-1
Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions

Project	Description	Status
	construction of 1.5 miles of 8-inch polyvinyl chloride (PVC) pipe along 88th Street east of NW 52nd Avenue in Skiatook, Oklahoma.	
The Osage Nation Long-Range Transportation Plan 2016-2036	The plan outlines the policies, objectives, and projects intended to improve the transportation system for the Osage Nation through 2040. It includes 26.9 miles of route and bridge additions and 10.6 miles of new sections to existing routes.	Plan completed in 2015.
Osage Nation Heritage Scenic Byway	The Oklahoma Department of Transportation (ODOT) designated US Highway 60 as a state scenic byway in 2008, with the purpose of developing tourism stops along the highway.	Tourism stops are under construction.
Oklahoma Department of Transportation Construction Work Plan	This plan is an eight-year work plan created by ODOT for road and bridge construction throughout Oklahoma from 2011-2018. The plan proposes to improve 30.52 miles of BIA class 2 roads and to construct eight bridges in Osage County.	The Osage Nation is considering these projects while it focuses on Osage tribal transportation needs.
Residential Land Use Plans	A five-year plan exists to develop a 50-lot, single-family home subdivision in Pawhuska on the remaining 18 acres of a 23-acre parcel owned by the Housing Authority. The plan will add to a 30-unit apartment complex that was built on the site in 2006.	Construction anticipated within the next five years.
Tribal Transportation Improvement Plan	This plan, created by the Osage Nation Roads Department, prioritizes eight road construction or replacement projects covering approximately 30 miles to be carried out between 2016 and 2020. The plan also includes one bridge replacement project to be completed in 2019 and four more planned bridge replacement projects to be carried out if funding can be secured.	Plan completed summer 2015. Projects expected to be constructed at various times between 2016 and 2020.

Table 4-1
Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions

Project	Description	Status
Other Transportation Projects in Osage County	Additional projects are approximately 30.8 miles of road improvements and at least six bridge improvements or replacements.	Fifteen specified projects and four proposed projects to be completed in the next five years.
Pawhuska Casino	Casino construction project covering 70 acres. Includes a fuel station, casino, a hotel-meeting room-pool complex, and parking facilities.	Fee-to-trust land transfer in progress; permitting and construction would occur afterwards. Completion date unknown.
Bartlesville Casino	Casino construction project covering 120 acres. Includes a casino, hotel, and parking facilities.	Fee-to-trust land transfer in progress; permitting and construction would occur afterwards. Completion date unknown.
Osage Prairie Bike Trail Extension	This is a 24-mile project to extend Osage Prairie Trail on old Midland Valley Railroad right-of-way to Barnsdall, Oklahoma, and later to Pawhuska, Oklahoma, and Tallgrass Prairie Preserve. Trail currently begins in north Tulsa and ends in Skiatook.	Project on hold, pending resolution of issues with railroad right-of-way.
Spearhead Pipeline (Enbridge)	This is a 650-mile, 24-inch pipeline between Flanagan, Illinois, and Cushing, Oklahoma, transporting 193,300 barrels per day (bpd) of crude oil. Approximately 11.3 miles of the pipeline run through Osage County.	In operation since the 1950s.
Flanagan South Pipeline (Enbridge)	This is a 593-mile, 36-inch-diameter interstate pipeline between Pontiac, Illinois, and Cushing, Oklahoma, transporting 585,000 bpd of crude oil. After pumping power enhancements are completed, the pipeline will be capable of transporting 880,000 bpd. It parallels the Spearhead crude oil right-of-way. Approximately 11 miles of the pipeline run through Osage County over 34 tracts.	In operation.

Table 4-1
Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions

Project	Description	Status
Bureau of Land Management (BLM) Wild Horse and Burro Long-Term Holding Facility	There are 11 wild horse and burro long-term holding facilities covering 130,400 acres.	In operation.
Agriculture and Livestock Grazing	Ranching is the main enterprise in Osage County. About 95 percent of the county is in agricultural use (Osage County 2011, p. III-47). The BIA administers 271 active farming and grazing leases in Osage County, covering approximately 61,300 acres of BIA-administered surface. Another 144 leases covering 29,500 acres are pending.	Ongoing.
BIA Eastern Oklahoma Region Fire Plan	This is a 10-year, strategic fire management plan for 2010-2020, for the BIA Eastern Oklahoma Regional Office. It defines a program to manage wildland and prescribed fire on BIA-administered surface, based on approved land management goals and objectives.	Completed in May 2009.
US Fish and Wildlife Service (USFWS) American Burying Beetle Oklahoma Industry Conservation Plan	Short-Term Oil & Gas Industry Conservation Plan developed by the USFWS to provide a means for participants in the oil and gas industry to promote conservation of the American burying beetle.	Completed in May 2014.
Other Surface Leases	The BIA administers 70 active business leases in Osage County, covering approximately 14,700 acres. These leases authorize uses such as hunting, tank battery sites, gas storage locations, smoke shops, casinos, and residences. Another 49 leases covering approximately 12,000 acres are pending.	Ongoing.
Limestone Quarries	The BIA administers four active limestone or dolomite leases in Osage County: • The Candy Creek Crusher limestone quarry covers approximately 90 acres. • The Pawhuska limestone quarry covers approximately 640 acres. • The Burbank limestone quarry	Ongoing.

Table 4-1
Past, Present, and Reasonably Foreseeable Projects, Plans, or Actions

Project	Description	Status
	covers approximately 160 acres. • The Sooner Cattle Company limestone quarry covers approximately 40 acres There are no pending limestone or dolomite leases on tribal or allotted land in Osage County.	
Sandstone Leases	The BIA administers three active sandstone leases in Osage County. Two leases cover approximately 80 acres of BIA-administered surface each, and one covers approximately 70 acres. The Hobo Stone sandstone lease is pending and would cover approximately 20 acres.	Ongoing.
Sandy Soil Leases	The BIA administers five active sandy soil leases in Osage County, covering approximately 900 acres of BIA-administered surface.	Ongoing.

4.1.4 Incomplete or Unavailable Information

The CEQ established implementing regulations for NEPA requiring that a federal agency identify relevant information that may be incomplete or unavailable for an evaluation of reasonably foreseeable significant adverse effects in an EIS (40 CFR, Subpart 1502.22). If the information is essential to a reasoned choice among alternatives, it must be included or addressed in an EIS. Knowledge and information is, and will always be, incomplete, particularly with complex ecosystems considered at various scales.

The best available information pertinent to the decisions to be made has been used in developing this EIS. Considerable effort has been taken to acquire and convert resource data, from both the BIA and outside sources, into digital format for use in the EIS.

Certain information was unavailable for use in developing this plan because inventories have either not been conducted or are not complete. Some of the major types of data that are incomplete or unavailable are planning area-wide field surveys for cultural and paleontological resources, critical habitat designations for the American burying beetle (ABB), and quantitative projections of oil and gas production by alternative.

The number, type, and significance of these resources were estimated, based on previous surveys and existing knowledge. In addition, some impacts cannot be quantified given the proposed management actions. Where this gap occurs, impacts are projected in qualitative terms or, in some instances, are described as unknown. Subsequent project-level analysis (such as NEPA analysis for applications for permits to drill [APDs]) will provide the opportunity to collect and examine site-specific inventory data required to determine appropriate application of this planning-level guidance. In addition, ongoing inventorying by the BIA and other agencies in the planning area continue to update and refine information for the area.

4.2 TOPOGRAPHY, GEOLOGY, PALEONTOLOGY, AND SOILS

4.2.1 Methods and Assumptions

Impacts on these resources were evaluated based on maximum potential surface disturbance. Because this is a programmatic-level EIS, it is not possible to know the exact location of specific construction projects.

Indicators

Topography and Geology

Indicators of topographic or geologic change were not used due to the rate and unpredictability of such changes, from sedimentation over millions of years to sudden shifts in surface geology as a result of faulting. Instead, indicators were formed based on the potential effects of geologic hazards on management scenarios. As such, the indicator is the location of the management activity in relation to geologic hazards, including fault features and areas of repeat earthquake activity.

Paleontology

Paleontological resources constitute a fragile and nonrenewable scientific record of the history of life. Resource condition is assessed by field observations, paleontological reports, commercial site reports, and project review. The primary resource indicator is whether there is a loss of those characteristics that make the fossil locality or feature important for scientific use. Natural weathering, decay, erosion, improper collection, surface disturbing activities, and vandalism can remove or damage those characteristics that make the paleontological resource scientifically important.

Soils

For this evaluation, impacts would be considered significant if the following conditions were to occur:

- Accelerated soil erosion is uncontrolled or soil productivity is not restored to approximate preconstruction conditions in an area within five years of construction

- Accelerated erosion rates in soils increase to the extent that human-made facilities are damaged, resulting in possible safety hazards
- Accelerated erosion rates in soils with high to severe erosion hazards remain uncontrolled, thereby increasing sedimentation to the extent that local water is impaired
- Additional areas of salt scarring from improper management or accidental release of produced fluids or large quantities of saline water

Assumptions

In general, direct impacts on these resources would result from surface-disturbing activities that would occur during the construction phase of the project. These activities are construction of the following:

- Well pads
- New access roads
- Flow lines, produced water lines, and satellite compressors at the central delivery point
- Construction staging areas
- Additional transmission lines

Direct impacts at the project-specific level could alter topography, unearth paleontological resources, compact soils, or increase erosion rates of soil resources. Short-term impacts would occur typically during the construction phase of the project, including reclamation of the construction site. Burying power lines instead of constructing overhead lines would result in larger quantities of soil displacement during construction but may result in less disturbance after the construction period. Impacts continuing beyond construction are considered long term. Permanent impacts can be minimized by proper construction and operation, as well as proper abandonment and reclamation of unnecessary features.

Future impacts on topography, geology, paleontology, and soil resources would be concentrated in areas of high to moderate oil and gas potential. This is because these areas are more likely to see continued or increased oil and gas development and associated ground disturbance. Lessees would be required to comply with all applicable laws and regulations, including the regulations at 25 CFR, Part 226, addressing development of the Osage minerals estate. Adhering to applicable laws and regulations would minimize impacts on these resources.

4.2.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Surface disturbing activities associated with oil and gas production, such as road and well pad construction, can lead to soil compaction and increased erosion. Surveys associated with surface disturbing activities could increase the potential for inadvertent discovery of paleontological resources. This, in turn, may result in damage during discovery, before the BIA is notified.

Oil and gas production creates a risk of releasing produced fluids or saline water into the ecosystem. This can result in the salinization of the surrounding soils, which may result in a salt scar, or it can make area on the landscape unable to support vegetation due to the high salt content of the soils. Toxic hydrogen sulfide gas (H_2S) is considered a geologic hazard that may be released as a result of well blowouts, incomplete combustion during flaring, or leakage from pipelines and abandoned wells. Injection of produced water into disposal wells can cause earthquakes (i.e., induced seismicity) due to increased pressure underground (Weingarten et al. 2015; OGS 2015).

Under all alternatives, the BIA would apply RCMs to oil and gas permits to ensure compliance with applicable laws and regulations, such as the Endangered Species Act (ESA), the Paleontological Resource Preservation Act, Section 106 of the National Historic Preservation Act, and the Soil and Water Resources Conservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs could result in incidental protection of soils and paleontological resources if surface disturbance were reduced. Reducing surface disturbance levels during oil and gas exploration and production would reduce the potential for compaction or erosion impacts on soils and the accidental discovery of paleontological resources.

4.2.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the best management practices (BMPs) listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). None of the BMPs are specific to topography, geologic hazards, or paleontological resources. However, soil RCMs would continue to limit surface disturbance by enforcing the confinement of work vehicles to existing roads. Limiting vehicle disturbance of areas beyond existing roads would continue to reduce the potential for inadvertent discovery of paleontological resources and reduce the footprint of impacts on soils, which may result in lower compaction or erosion rates during exploration and production. Additionally, erosion control measures to effectively minimize soil movement during workovers would result in less soil loss from these activities.

Prohibiting venting or flaring of gas without Superintendent approval could reduce the release of H_2S from workover activities. Requirements to store chemicals appropriately and to line pits with impermeable materials would continue to limit the risk of fluid and saline water release from workover activities.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix I, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). These RCMs may limit surface disturbance, which would reduce the potential for accidental paleontological discoveries and reduce the potential for soil compaction and erosion due to the smaller footprint of exploration and production activities.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analyses and would apply RCMs on a case-by-case basis. As described in **Section 4.2.2**, these RCMs would ensure compliance with applicable laws and regulations. The extent of reduction in impacts as a result of case-by-case application of RCMs cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level. The No Action Alternative would not provide a county-wide framework that site-specific NEPA analyses could be tiered to. This could result in fragmented decision-making, which may increase surface disturbance and therefore impacts on these resources. Additional exploration and production could continue to result in accidental discovery of paleontological resources, additional soil compaction and erosion, and the potential for H_2S gas release, induced seismicity, and/or produced fluid release.

4.2.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. None of the RCMs are specified for topography or paleontological resources. However, soil and air quality (i.e., flaring) RCMs discussed under **Section 4.2.3** would apply to all oil and gas activities; not just workovers. Applying these RCMs to all oil and gas activities would reduce overall surface disturbance compared with the No Action Alternative, if similar measure were not applied to oil and gas development activities on a site-specific basis under that alternative. Reducing surface disturbance would reduce the potential for accidental paleontological discoveries, soil compaction, and erosion. Additional parameters to prevent excessive erosion by managing the construction of new roads and storing stockpiled topsoil so that it is protected from erosion would further reduce erosion impacts on soils compared to the No Action Alternative.

Because flaring restrictions would apply to all oil and gas activities under Action Alternative 1, the risk of releasing H_2S would be further reduced compared to the No Action Alternative if similar measures were not applied on a site-specific basis under that alternative. Requiring construction contractors to implement environmental and safety programs and requiring placement of warning signs where necessary to protect public safety (such as near wells known to contain H_2S) would reduce the risk of human exposure to this toxic gas.

Under Action Alternative 1, specific RCMs would be applicable to geologic resources. Lessees would be required to consult with the BIA Division of Energy and Mineral Development to address potential seismicity impacts. Another measure would require the lessee to obtain the appropriate permits before workover operations begin for underground injection or conversion to saltwater injection or disposal wells. Consultation and appropriate permitting would provide additional data on the local geology before drilling and could allow earlier recognition and resolution of induced seismicity problems compared to the No Action Alternative. However, because the lessee would be required to obtain appropriate permits for underground injection to comply with applicable laws under all alternatives, protections for geologic resources may not increase compared to the No Action Alternative, unless consultation with the BIA, Division of Energy and Minerals, resulted in additional protective measures.

4.2.5 Action Alternative 2

Impacts on topography, geology, and paleontological and soil resources under Action Alternative 2 would be similar to those under Action Alternative 1; however, additional RCMs applied to all oil and gas activities under Action Alternative 2 would make this alternative the most protective of these resources.

The application of no-drilling buffers around sensitive resources, such as cultural resources, could further reduce surface disturbance, which may result in a reduced potential for accidental discovery of paleontological resources, soil compaction, and erosion. Requiring closed loop systems in areas subject to inundation during floods would reduce the risk of releasing drilling fluids and saline water into nearby soils.

4.2.6 Cumulative Impacts

The cumulative impact analysis area for topography, geology, paleontology, and soils is the planning area. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect topography, geology, paleontology, and soils are uses that would disturb the surface. Examples are as follows:

- Oil and gas development
- Osage and Mustang Run Wind Projects (totaling 17,900 acres)
- Road and bridge improvements (including 129 miles of road improvement or construction)
- Residential and casino construction (213 acres)
- Existing oil and gas pipelines (1,243 miles of pipe

- Long-term wild horse and burro holding facilities (130,400 acres)
- Agricultural and livestock grazing use (61,300 acres, with an additional 29,500 acres pending)
- Planned and unplanned fires
- Other surface leases (14,700 acres)
- Active quarries (2,060 acres with an additional 20 acres pending)

All of these activities have created or have the potential to create both short-term and long-term impacts on soils, topography, and paleontology. Impacts on topography and geology would be from altering the landscape during construction projects and additional understanding of the local geology through further oil and gas exploration. Destruction of paleontological resources may occur from additional incidental discoveries as a result of surface disturbance. Long-term soil compaction and erosion can also occur as a result of surface disturbance. Short-term impacts on soils generally are temporary disturbance during construction and road maintenance.

These activities can be offset by the appropriate use of RCMs to reduce surface disturbance and limit soil erosion. Long-term impacts would result from completing wind energy or oil and gas facilities.

Alternatives Analysis

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Oil and gas production would increase the amount of surface disturbance on the landscape and could increase the potential for H_2S or produced fluids or saline water to be leaked or improperly disposed of on the landscape. Oil and gas production may also result in additional paleontological discovery. Impacts on topography, geology, and paleontological and soil resources from oil and gas development in the planning area would be reduced under Action Alternative 1 and would be further reduced under Action Alternative 2. However, these resources would still be impacted by the other projects discussed under **Section 4.2.6**. Cumulative impacts in Osage County would be reduced under Action Alternatives 1 and 2.

4.3 Water Resources

4.3.1 Methods and Assumptions

Indicators

Indicators of impacts on water resources are as follows:

- Alteration of the physical characteristics of streams, springs/seeps/fens, wetlands, riparian areas, and groundwater aquifers that affect the properly functioning condition and sustainability of these resources

- Number of federal water quality standard exceedances for surface water and groundwater
- Changes in water quality that affect the survival rate of downstream aquatic or riparian species
- Miles of roads constructed
- Number of wells drilled
- Number of spills of hazardous materials
- Volume of water depleted

Every management action that could directly or indirectly alter aquifer properties, water quality or quantity, or the physical features of water bodies can have accompanying temporary or permanent impacts on water resources.

The discussion of impacts on water resources includes the effects of surface- and subsurface-disturbing actions on water quality, water quantity, and cumulative watershed health.

Assumptions

The analysis includes the following assumptions:

- The degree of impact attributed to any one disturbance or series of disturbances would be influenced by several factors, such as proximity to drainages and groundwater wells, location in the watershed, time and degree of disturbance, reclamation potential of the affected area, vegetation, precipitation, and mitigating actions applied to the disturbance.
- In general, the shallower the groundwater, the more susceptible the aquifer is to contamination. Mineral development is the primary activity that could impact shallow groundwater quality and quantity. Locations in the planning area where groundwater is at less than 100 feet below the surface or where the aquifers are unconfined are considered to be the most likely to be impacted by mineral development.

  Unconfined aquifers or those with water table levels of 100 feet or less below the surface are more vulnerable to leaks and spills of contaminants at the surface. However, groundwater at greater depths is vulnerable to mine dewatering, casing failure, contamination from enhanced hydraulic conductivity caused by fracturing and drilling, and contamination from chemicals used in those activities.

4.3.2 Impacts Common to All Alternatives

Oil and gas development is expected to continue increasing in the planning area under all alternatives (see **Section 3.16.3**, Mineral Extraction, *Trends*, and **Section 4.16.2**, Mineral Extraction, Impacts Common to All Alternatives).

Oil and gas development can impact water resources in several ways, as follows:

- Surface disturbance (e.g., road, power line, pipeline, and well pad construction) can increase runoff or change the physical characteristics of water bodies.
- Subsurface disturbance can change aquifer properties.
- Leaks and spills can contaminate groundwater and surface water with naturally occurring pollutants or chemicals used for oil and gas extraction.

Oil and gas development also uses water. After use, this water may or may not go back into the natural system.

Surface-disturbing activities, such as road, power line, pipeline, and well pad construction, can remove or disturb essential soil-stabilizing agents, such as vegetation diversity, soil crusts, litter, and woody debris. These soil features function as living mulch by retaining moisture and discouraging annual weed growth (Belnap et al. 2001). Loss of one or more of these agents increases potential erosion and sediment or pollutant transport to surface water bodies, leading to surface water quality degradation.

Surface-disturbing activities under certain circumstances can also lead to soil compaction, which decreases water infiltration rates. It also elevates the potential for overland flow, which can increase erosion and sediment or pollutant delivery potential to the surface water bodies in the area, leading to surface water quality degradation.

Surface-disturbing activities in areas of low reclamation potential, such as "fragile soils" and slopes greater than 40 percent, or fragile areas, such as stream channels, floodplains, and riparian habitats, are at higher risk for erosion. Disturbance in such areas creates greater potential for erosion and sediment delivery to surface waters, thereby degrading water quality.

Surface-disturbing activities in stream channels, floodplains, and riparian habitats are more likely to alter natural morphologic stability and floodplain function. Morphologic destabilization and loss of floodplain function accelerate stream channel and bank erosion, increase sediment supply, dewater near-stream alluvium, cause the loss of riparian and fish habitat, and deteriorate water quality (Rosgen 1996). Altering or removing riparian habitats can reduce the hydraulic roughness of the bank and increase flow velocities near the bank (National

Research Council 2002). Increased flow velocities near the bank can accelerate erosion, decreasing water quality.

When surface-disturbing impacts are allowed to alter natural drainage patterns, the runoff critical to recharging and sustaining locally important aquifers, springs/seeps/fens, wetlands, and associated riparian habitats is redirected elsewhere. As a result, these sensitive areas can be dewatered, compromising vegetative health and vigor, while degrading the proper function and condition of the watershed.

Directional and horizontal drilling greatly decrease the extent of potential surface disturbance and the potential for adverse impact on surface resources. It also enables the drilling and testing of resources beneath sensitive areas, such as steep slopes, streams, and rivers, while minimizing impacts on those areas. The amount of directional offset possible from the surface location to the bottom hole location is not unlimited; it has generally been less than 2,500 feet in most directional wells or two miles in most horizontal wells drilled to date, although longer offsets have been drilled. As described in **Section 3.16.2**, Mineral Extraction, Current Condition, directional and horizontal drilling are both used in the planning area. However, vertical drilling is still the most common method of oil and gas extraction in the planning area.

Subsurface disturbances can alter natural aquifer properties; for example, they can enhance hydraulic conductivity of existing fractures, breach confining units, and change hydraulic pressure gradients. This can increase the potential for contaminating surface water and groundwater. Furthermore, altering natural aquifer properties can dewater locally important freshwater sources, such as groundwater, springs, seeps, fens, and streams.

Use, storage, and transportation of fluids, such as saline produced water, hydraulic fracturing fluids, and condensate, creates the possibility of spills that could migrate to surface water or groundwater. Spills of these fluids can impact water quality and human health. The US Environmental Protection Agency is studying the potential for hydraulic fracturing to contaminate shallow groundwater sources. The determination thus far is that the potential for contamination exists but that actual contamination is rare (EPA 2015f).

Hydraulic fracturing occurs in gas-producing formations at depths greater than 5,000 feet. Water, sand, and chemical additives are pumped into the formation at extremely high pressure to create fractures that allow gas to flow into the well. Theoretically, improperly completed wells or perforations into zones of geological weakness—faults or fractures—could create conduits that allow fracturing fluids, produced water, and methane to migrate to groundwater. If groundwater is contaminated, there are few cost-effective ways to reclaim it; thus, the long-term impacts of groundwater contamination would be considerable.

If aquifers were to become contaminated from oil and gas development, changes in groundwater quality could impact downstream users who divert groundwater. Municipal and public wells, domestic wells, springs, and surface waters that are hydrologically connected to groundwater could be affected by changes in its quality. The extent of potential contamination would depend on the point of contamination and volume of the contaminant. Rigorous well casing protocols can reduce the risk of such contamination. Under all alternatives, the BIA would apply the requirements found in 25 CFR, Subparts 226.59 and 226.60, to help prevent groundwater contamination.

Oil and gas development uses water for well stimulation (including hydraulic fracturing and enhanced oil recovery), well drilling with water-based drilling muds, and other minor uses, such as dust suppression and equipment cleaning. Well stimulation uses the most water during oil and gas development; an average hydraulic fracturing well uses 2.5 million gallons of water over the life of the well (Ceres 2014). Enhanced oil recovery (pumping water underground to increase pressure in a well to boost lagging oil production) can require far larger volumes of water than the average well requirements for hydraulic fracturing (Getches-Wilkinson Center for Natural Resources, Energy, and the Environment 2015). However, in Osage County, the average water use for a hydraulic fracturing well is lower, in the range of approximately 1.5 million gallons.[1]

Under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA and Section 106 of the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs would reduce impacts on water resources by helping ensure that water quality standards are met.

4.3.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). Applying these RCMs would help reduce the extent of surface disturbance and vegetation removal from these activities, thereby reducing impacts on runoff and surface water quality. Chemical storage restrictions and spill prevention measures required for tank batteries and storage pits would reduce the risk of shallow groundwater and surface water contamination from spills.

[1]Galen Crum, Osage Minerals Council, e-mail to Katie Patterson, EMPSi, and Jeannine Hale, BIA Osage Agency, on June 16, 2015.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix I, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would help reduce impacts on surface water and groundwater quality from new oil and gas leases in a manner similar to that described for activities within the scope of the Workover PEA.

Oil and gas permits for activities outside the scope of the Leasing and Workover PEAs would be subject to RCMs applied on a case-by-case basis. As described in **Section 4.3.2**, these RCMs would ensure compliance with applicable laws and regulations and would reduce impacts on water resources. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.

As described in **Section 4.3.2**, the regulations at 25 CFR, Part 226, would help reduce surface water and groundwater contamination from oil and gas activities. The BIA would continue to prohibit drilling within 200 feet of established watering places, in accordance with 25 CFR, Subpart 226.57. This restriction would protect some sensitive water bodies from the impacts of surface disturbance described in **Section 4.3.2**. However, because the BIA does not have a standard definition for “established watering place,” some sensitive water bodies may be overlooked when applying the regulation. As a result, these sensitive water bodies could be impacted by surface disturbance, as described in **Section 4.3.2**.

4.3.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. Although water use is governed by 25 CFR, Subpart 226.48, impacts on water quantity and water quality by oil and gas operations could be further reduced through an RCM that requires lessees to minimize the use of virgin groundwater and surface water and encourages water recycling.

Under Action Alternative 1, the BIA would define established watering place to include lakes, streams (perennial and intermittent), pools created by ephemeral or intermittent streams and drainage ways, wetlands, marshes, sloughs, springs, human-made ponds, natural ponds, and tributaries to any of these surface waters. As a result, these water bodies would be ensured protection by a 200-foot no-drilling buffer, in accordance with 25 CFR, Subpart 226.57. This buffer would protect these water bodies from the direct impacts of surface disturbance described in **Section 4.3.2**. However, surface disturbance in other areas could still impact these water bodies through increased runoff and sediment transport.

Direct impacts on surface water quality and physical features of water bodies would be reduced by the requirement to avoid creating new water crossings and to ensure free flow of water where such crossings are necessary. These restrictions would reduce the risk of erosion, impacts on water quality, and loss of fish habitat, described in **Section 4.3.2**.

Erosion control measures, including road construction standards, would also reduce direct and indirect erosion and sediment transport impacts on water resources. The requirement to bury power lines could increase surface disturbance and could therefore increase erosion and runoff impacts on water resources. However, power lines would be required to be buried only where feasible and appropriate, given other resource protection needs. Because of this, impacts from disturbance in highly erodible areas or sensitive water features would be mitigated.

Additional requirements could be applied on a site-specific basis to protect specific identified sensitive resources. These measures could further reduce surface disturbance and protect water resources; however, their impacts would be analyzed through site-specific NEPA analyses.

Measures to prevent damage to existing well bores and require monitoring by lessees would help reduce the risk of spills and water contamination described in **Section 4.3.2**. Overall, impacts on water resources under Action Alternative 1 would be reduced, compared to the No Action Alternative, if similar protective measures were not applied on a site-specific basis under the No Action Alternative.

4.3.5 Action Alternative 2

Impacts on water resources under Action Alternative 2 would be similar to those under Action Alternative 1; however, additional RCMs applied to all oil and gas activities under Action Alternative 2 would make this alternative the most protective of water resources.

Under Action Alternative 2, the BIA would define established watering places as lakes, streams (perennial and intermittent), pools created by ephemeral or intermittent streams and drainage ways, wetlands, marshes, sloughs, springs, human-made ponds, natural ponds, tributaries to any of these surface waters, and groundwater wells.

Defining "established watering place" in this way would protect these water bodies in a manner similar to that described under Action Alternative 1. However, because groundwater wells would also be protected by the no-drilling buffer, impacts on groundwater would be further reduced under this alternative.

Groundwater impacts could also be reduced by requiring baseline and follow-up sampling of drinking water wells near proposed well drilling. While this testing would not necessarily prevent groundwater contamination, it would help identify sources of contamination earlier to reduce further contamination. The requirement would also increase the understanding of local groundwater movement and could help reduce impacts of leaks or spills by facilitating more rapid containment.

Direct impacts of surface disturbance on water resources described in **Section 4.3.2** would be reduced by the requirements to avoid changes to area hydrology and drainage patterns and to use directional drilling, where appropriate, to place pipelines under wetlands and other important aquatic resources. Requiring the use of closed loop systems on drilling sites subject to flooding and requiring use of chemically inert materials during access road construction would decrease the risks of drilling fluids and other chemicals entering the water system as runoff.

Direct and indirect impacts of surface disturbance on water resources described in **Section 4.3.2** would be reduced by the requirement to reduce or eliminate habitat fragmentation in important grassland prairie habitat. Impacts would be reduced on water resources within the 325,300 acres currently defined as important grassland prairie habitat. This is because overall surface disturbance would be reduced in these areas.

Similarly, impacts of surface disturbance would be reduced within no-drilling buffers surrounding sensitive cultural site types. Some site types would be defined based on their proximity to water bodies (i.e., camps and villages and waterways), providing direct protections of these water bodies from impacts of surface disturbance described in **Section 4.3.2**. Protective impacts from no-drilling buffers for these site-types would increase over the No Action Alternative if the water body would not be protected by the 200-foot buffer in 25 CFR, Subpart 226.57, or if the no-drilling buffer applied under this alternative were larger than 200 feet.

In other cases, no-drilling buffers surrounding a certain site type may indirectly protect a nearby water body. Overall disturbance could be reduced by these buffers, which would also reduce indirect impacts on water resources in the planning area described in **Section 4.3.2**.

Overall, Action Alternative 2 would be the most protective of water resources if similar measures were not applied on a site-specific basis under Action Alternative 1 and the No Action Alternative. Action Alternative 2 would provide the most upfront assurance of water resource protection.

4.3.6 Cumulative Impacts

The cumulative impact analysis area for water resources is the planning area. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect water resources are uses that would disturb the surface. Examples are as follows:

- Oil and gas development
- Osage and Mustang Run Wind Projects (totaling 17,900 acres)
- Road and bridge improvements (including 129 miles of road improvement or construction)
- Residential and casino construction (213 acres)
- Existing oil and gas pipelines (1,243 miles of pipe)
- Long-term wild horse and burro holding facilities (130,400 acres)
- Agricultural and livestock grazing use (61,300 acres with an additional 29,500 acres pending)
- Planned and unplanned fires
- Other surface leases (14,700 acres)
- Active quarries (2,060 acres with an additional 20 acres pending)

All of these activities have created or have the potential to create new surface disturbance in Osage County, which would impact water resources, as described under **Section 4.3.2**.

Alternatives Analysis

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. This would increase the amount of surface disturbance on the landscape.

Impacts on water resources from oil and gas development in the planning area would be reduced under Action Alternative 1 and would be reduced further under Action Alternative 2. However, these resources would still be impacted by the other projects discussed under **Section 4.2.6**. Cumulative impacts in Osage County would be reduced under Action Alternatives 1 and 2.

4.4 AIR QUALITY AND CLIMATE

4.4.1 Methods and Assumptions

Indicators

Air Quality

Indicators of impacts on air quality are as follows:

- National Ambient Air Quality Standards (NAAQS) monitoring data
- Air quality index values
- Visibility and other air quality-related values

Climate

Indicators of impacts on climate are as follows:

- Differences in annual recorded temperatures, seasonal durations, annual snowpack levels, and precipitation amounts and timing
- Changes in greenhouse gas (GHG) emissions, sources, and trends for the United States and Osage County

Assumptions

Air Quality

The analysis is based on the following assumptions:

- Air quality impacts can be either localized or regional, depending on the pollutant being analyzed.
- Weather may cause local or regional air quality impacts.

Climate

The analysis assumes that there is a correlation between levels of GHGs produced and climate change.

4.4.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. This is a primary contributor of GHG emissions in the United States and also emits criteria pollutants (those monitored using the NAAQS). Additionally, vegetation removal and surface disturbance create loose soils, which can increase dust (particulate matter) levels. Therefore, impacts on air quality and climate would result under all alternatives.

Continuing to develop oil and gas resources would lead to increases in GHG emissions, which contribute to climate change, and an increase in the emission of criteria pollutants, which could exceed the NAAQS and have impacts on public health and visibility. For more information, see **Section 3.4**, Air Quality and Climate.

Differences among the alternatives would result if the level of oil and gas activity were to differ by alternative, or if restrictions on oil and gas activities among the alternatives resulted in differences in the amount of emissions produced. However, the amount of oil and gas development in the planning area is not likely to change based on the alternatives; the action alternatives would streamline the permitting process but are unlikely to impact the level of development that would occur in the planning area.

Under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA and Section 106 of the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. RCMs could have a beneficial impact on air quality and GHG emission levels if they were to reduce emissions and dust levels associated with oil and gas development.

4.4.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope).

One of these conservation measures would continue to prohibit the venting or flaring of gas from these activities without prior written approval from the BIA Osage Agency Superintendent. Venting and flaring emit carbon dioxide and methane (a GHG and a precursor to ozone). They can also emit volatile organic compounds, hazardous air pollutants, and other criteria pollutants. Globally, venting and flaring are responsible for about 1 percent of total carbon dioxide emissions and 4 percent of the total methane emissions caused by human activity (GAO 2004).

If this measure were to reduce the amount of venting and flaring that occurs during oil and gas development in the planning area, it would impact air quality and climate by continuing to limit the amount of GHGs, H_2S, and other pollutants released into the atmosphere in the planning area. The degree to which air quality and climate would be impacted under this alternative would depend on the degree to which this measure would limit venting and flaring.

The requirements to avoid or minimize soil and vegetation disturbance, to keep all disturbance within the confines of the historic well pad, and to promptly reclaim disturbed areas associated with workovers would also continue to limit impacts of dust from workover activities on air quality in the planning area. These impacts are described under **Section 4.4.2**.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). These measures would help reduce impacts on air quality and climate from new oil and gas leases in a manner similar to that described above for activities within the scope of the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. As described in **Section 4.4.2**, these RCMs would ensure compliance with applicable laws and regulations. If restrictions were not placed on venting and flaring, the impacts on air quality and climate under the No Action Alternative would be the greatest out of all the alternatives.

Oil and gas development could emit a larger quantity of GHGs, H_2S, and criteria pollutants. The extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.

The No Action Alternative would not provide a county-wide framework that site-specific NEPA analyses could be tiered to. This could result in fragmented decision-making, which may increase air pollutant emissions and impacts on air quality and climate.

4.4.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and applications for permit to drill (APDs) and other permitted activities. Impacts would be similar to those described under the No Action Alternative. The major difference is that all oil and gas activities would be subject to RCMs, such as flaring restrictions, thereby further reducing impacts on air quality and climate. Overall, impacts of oil and gas development on air quality and climate under Action Alternative 1 would be reduced, compared to the No Action Alternative, if similar protective measures were not applied on a site-specific basis under the No Action Alternative.

4.4.5 Action Alternative 2

Impacts on air quality and climate under Action Alternative 2 would be similar to those under Action Alternative 1. However, additional restrictions on surface disturbance, such as the requirement to minimize habitat fragmentation in important grassland prairie habitat, could further reduce dust (particulate matter) emissions in the planning area. The requirement to reclaim sites using stockpiled topsoil with native seed stock could also reduce bare soils and resulting dust compared with the No Action Alternative. Therefore, Action Alternative 2 would result in the least impacts of air pollutants on air quality and climate out of all the alternatives.

4.4.6 Cumulative Impacts

The cumulative impact analysis area for air quality and climate is the planning area. Past, present, and reasonably foreseeable future actions and conditions within the cumulative impact analysis area that have affected and will likely continue to affect air quality and climate are those surface disturbances and activities that produce GHG emissions, NAAQS criteria pollutants, or affect air quality values. Examples are the Workover PEA, Leasing PEA, and surface disturbances, such as new casino or road development. Air quality and climate can be indirectly impacted by transportation projects that result in additional vehicle traffic.

Alternatives Analysis

Under the No Action Alternative, NAAQS monitoring data and GHG emissions would continue on their current trend. This is because the No Action

Alternative would not implement any additional conservation measures or other restrictions that are not already identified in the past, present, or reasonably foreseeable future actions.

The incremental impact of implementing Action Alternative 1 and Action Alternative 2 would be a reduction in NAAQS criteria pollutant and GHG emissions trends. This is because both alternatives would apply standardized RCMs to all oil and gas activities in Osage County, not just those covered by the Workover PEA or Leasing PEA. This effect would be greatest under Action Alternative 2 because the RCMs applied under that alternative would lead to the greatest reduction in air pollutant emissions.

4.5 Fish and Wildlife

4.5.1 Methods and Assumptions

Indicators

Indicators of impacts on fish, wildlife, and migratory birds are as follows:

- Extent and condition of available habitat
- Likelihood of death, injury, or direct disturbance
- Likelihood of habitat disturbance

Fisheries

Impacts specific to aquatic species and their habitats are the following:

- Sediment and turbidity—Increased sediment loading in waters containing sediment-intolerant fish species, loss of recruitment, stress, nutrient loading, and habitat loss
- Habitat alteration—Changes in habitat that make it nonfunctional for select species or more conducive to competitive species
- Loss or reduction of streamside vegetation and cover—Increased temperatures, stress, reduced productivity, and impacts on food webs
- Water quality alteration—Actions that alter important water quality parameters, including pH, dissolved oxygen, temperature, hardness, alkalinity and salinity, and turbidity
- Water depletions—Habitat loss, water quality changes, sediment accumulation, habitat complexity loss, and food source reduction
- Potential direct destruction of aquatic wildlife from motorized vehicles

Wildlife and Migratory Birds

Impacts specific to wildlife and migratory birds are the following:

- Disturbance or loss of plant communities, food supplies, cover, breeding sites, and other habitat components necessary for population maintenance used by any species to a degree that would lead to substantial population declines
- Disturbance, fragmentation, or loss of seasonally important habitat (e.g., critical for overwintering or successful breeding) to a degree that would lead to substantial population declines
- Interference with a species' movement pattern that decreases its ability to breed or overwinter successfully to a degree that would lead to substantial population declines

Assumptions

This analysis is based on the following assumptions:

- Disturbance of a key or critical component of a species habitat would be detrimental, with the degree of detriment dependent on the importance of the habitat component to the maintenance of the population.
- Habitat conditions and quality are directly linked to the health, vigor, and cover of vegetative communities, particularly desired plant communities that fish and wildlife species depend on, and soil conditions and water quality and quantity.
- Impacts on terrestrial wildlife from displacement would depend on the location, extent, timing, or intensity of the disruption.
- In the context of this analysis, avoidance means reduced use and does not imply a complete absence of use by wildlife.
- Impacts on populations that exceed the current carrying capacity that would not reduce those populations below the carrying capacity would not be considered significant.

4.5.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Oil and gas development could impact fish and wildlife species or habitats through disturbance, direct habitat loss, reduced habitat effectiveness, habitat modification, degradation, and fragmentation, direct mortality, habitat avoidance, and interference with movement patterns. Surface disturbance and vegetation removal may remove or degrade habitat or certain wildlife species, depending on the size and location of the project.

Birds and other wildlife species may be impacted by oil field waste pits because they are attracted to oil-covered ponds. Potential impacts are the following:

- Entrapment in oil and drowning
- Death or illness from ingestion of toxic quantities of oil

- Cold stress if oil were to damage the insulation provided by feathers
- Increased susceptibility to disease and predation (USFWS 2000)

Under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA and Migratory Bird Treaty Act (MBTA), and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. These RCMs would limit the extent of surface disturbance and resulting habitat degradation or disturbance of wildlife associated with these activities.

The measures would also incorporate protective actions for migratory birds and the ABB found in other guidance documents. Special status species conservation measures would likely benefit other species as well. Guidance is provided in the USFWS Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects (USFWS 2014c). It includes recommendations, such as anti-perching devices on the ends of pipes for flaring, that would reduce but not eliminate the risk of bird deaths from oil and gas activities.

4.5.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). These RCMs would help reduce the extent of habitat disturbance or direct disturbance to fish and wildlife from these activities.

Vegetation protection measures would require lessees to avoid removing or damaging trees, shrubs, and groundcover to the extent possible and would require them to restore disturbed areas by reestablishing vegetation using seed, sod, or other approved methods. These measures would help to maintain suitable bird nesting and bat roosting habitat. However, habitat fragmentation, noise disturbance, and risk of mortality or injury (e.g., through collision with vehicles or entrapment in oil pits) could still occur to fish and wildlife.

For new oil and gas leases, the BIA may choose to apply appropriate best management practices listed in Appendix I, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would help reduce impacts on fish, wildlife, and migratory birds from new oil and gas leases in a manner similar to that described for activities within the scope of the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific

NEPA analyses and would apply RCMs on a case-by-case basis. As described in **Section 4.5.2**, these RCMs would ensure compliance with applicable laws and regulations and could reduce impacts on fish, wildlife, and migratory birds. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level. The No Action Alternative would not provide a county-wide framework to which site-specific NEPA analyses could be tiered. This could result in fragmented decision-making, which may increase impacts of oil and gas development on fish and wildlife. This is because inconsistent conservation measures may be applied and may be unlikely to address fish and wildlife conservation on the landscape level.

4.5.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. These RCMs would reduce potential impacts on fish and wildlife and their habitats.

Under Action Alternative I, power lines would be buried where economically feasible and when the BIA determines that benefits to fish and wildlife resources outweigh any negative environmental impacts caused by surface disturbance at the time of installation and future removal of the lines. Burying power lines may reduce bird deaths caused by collision and reduce avoidance of suitable habitat for certain prairie birds (Pruett et al. 2009); however, disturbance in areas with thin soils and limestone may result in visual scarring.

Noise control measures would reduce the potential for habitat avoidance or other behavioral impacts.

Implementing measures to minimize the use of virgin surface water (i.e., non-recycled water) needed for drilling and hydraulic fracturing of wells would help to maintain suitable fish habitat with adequate water levels. Additionally, conservation measures to avoid creating new crossings over streams, lakes, and wetlands would limit bank erosion, which could degrade aquatic habitats. Overall, impacts of oil and gas activities on fish and wildlife under Action Alternative 1 would be reduced, compared to the No Action Alternative, if similar protective measures were not applied on a site-specific basis under the No Action Alternative.

4.5.5 Action Alternative 2

Impacts on fish, wildlife, and migratory birds under Action Alternative 2 would be similar to those under Action Alternative 1; however, additional RCMs applied under Action Alternative 2 would make this alternative the most protective of these resources. Action Alternative 2 would build on Action Alternative 1 by adding more specific RCMs that would be applied in specific areas, based on information about where sensitive resources need to be protected.

Two additional conservation measures that would be applied as mandatory permit conditions are reducing or eliminating habitat fragmentation from human-made features, such as power lines, pipelines, roads, tank batteries, and pump jacks. The affected area would be 325,300 acres of important grassland prairie habitat for migratory and nonmigratory birds. If new infrastructure were necessary, it would be located near other infrastructure or at the edge of the open prairie, where feasible. This would help to preserve native grassland habitats, such as the Tallgrass Prairie Preserve, which is considered an Important Bird Area. In addition, tall structures, such as power lines, tank batteries, and pump jacks, would not be sited on prairie ridges and hilltops.

Raptors are key predators of such species as the prairie chicken, and they may perch on tall structures to survey hunting areas. As a result, prairie birds may avoid structures due to the perceived threat (Pruett et al. 2009). Limiting tall structures on prairie ridges would likely benefit prairie birds.

Cultural site buffers under Action Alternative 2 would likely indirectly benefit fish and aquatic species and populations. An example of this is a 160-foot buffer around water bodies, which would be extended up to 500 feet in the presence of high ground near undulating streams. This would come about by limiting ground disturbance near riparian areas and reducing the potential for bank erosion. As a result, impacts on aquatic habitats would be reduced.

Action Alternative 2 would provide the greatest protection to fish, wildlife, and migratory birds by requiring more biological RCMs than the No Action Alternative or Action Alternative 1.

4.5.6 Cumulative Impacts

The cumulative impact analysis area for fish and wildlife is the planning area. Past, present, and reasonably foreseeable future actions and conditions within the cumulative impact analysis area that have affected and will likely continue to affect fish and wildlife are oil and gas leasing and development, agricultural and livestock grazing, renewable energy projects, and other infrastructure. In addition, the USFWS ABB Conservation Plan is also likely to affect fish and wildlife in the planning area.

Oil and gas leasing and development, in combination with tallgrass prairie conversion to agriculture, is likely to continue to affect birds, mammals, and other species that depend on prairie habitats for nesting, foraging, and cover. Approximately 95 percent of the county is in agricultural use (Osage County 2011, p. III-47), and further conversion of native habitats to agriculture would result in long-term habitat loss or fragmentation for tallgrass prairie-dependent species.

Infrastructure developments (e.g., pipelines, transportation projects, and wind farms) could cross multiple land jurisdictions and contribute to habitat fragmentation. In addition, tall infrastructure could increase prairie bird habitat avoidance. In areas where tall infrastructure is highly concentrated or overlaps with oil and gas development, increased predation and potential population declines may occur for prairie birds.

Past, present, and reasonably foreseeable actions could affect trends in water quality and quantity, which could subsequently affect fish and other aquatic communities. Surface-disturbing activities, as described in **Table 4-1**, could remove or disturb soil-stabilizing agents, such as vegetation, soils crusts, and wood debris. Loss of one or more of these agents could increase erosion and sediment transport to surface water bodies, which could degrade habitat for sediment-intolerant fish species.

In addition, continued agricultural use would likely contribute to eutrophic[2] conditions in some streams and lakes, by means of nutrient input (e.g., poultry wastes, fertilizer runoff, and cattle and hog feedlot wastes). Eutrophication during periods of drought or low water levels could create anoxia conditions,[3] which may decrease habitat suitability for some fish species. Anoxia conditions could destroy other aquatic communities, such as mollusks, which are unable to escape the bottom of aquatic systems where anoxia conditions are most severe (Oklahoma Department of Wildlife Conservation 2005c).

Alternatives Analysis

Under the No Action Alternative, trends for fish and wildlife, as described in **Section 3.5.3**, are likely to continue because no additional BMPs, RCMs, or other restrictions on oil and gas activities would be implemented. The cumulative impacts of oil and gas development, agricultural and livestock grazing, and other infrastructure projects would be greatest under this alternative. Implementing the USFWS ABB Conservation Plan may reduce, but would not eliminate, the effects of oil and gas development on fish and wildlife species that occupy ABB habitat.

Under the action alternatives, implementing standardized conservation measures would reduce impacts on fish and wildlife, compared to the No Action Alternative. Noise restrictions would reduce the potential for wildlife habitat avoidance. Avoiding and minimizing soil and vegetation disturbance would help preserve important tallgrass prairie habitats and other wildlife habitats in the planning area.

Minimizing the use of virgin water would reduce but not eliminate the potential for loss of habitat for fish and aquatic communities. This is because water depletions could result in more shallow scour pools. Minimizing the use of virgin water would mitigate the effects of anoxia conditions, particularly during times of drought or low water levels.

[2]Deprived of oxygen
[3] Low oxygen levels

Cumulative effects would be least under Action Alternative 2, as this alternative would implement the most restrictive conservation measures.

4.6 VEGETATION, WETLANDS, AND NOXIOUS WEEDS

4.6.1 Methods and Assumptions

Indicators

Indicators of impacts on vegetation, wetlands, and noxious weeds are as follows:

Upland Vegetation

- Acres and condition of upland vegetation communities
- Extent of fragmentation of upland vegetation communities

Wetlands

- Acres and condition of wetlands and riparian communities
- Extent of fragmentation of wetlands and riparian communities

Noxious Weeds

- The potential for noxious weed or invasive species introduction or spread
- The potential for increases or decreases in noxious weed or invasive species populations
- Acres of ground-disturbing activities

Assumption

The impacts on vegetation and wetland resources would be concentrated in areas of high to moderate oil and gas potential. This is because these areas are more likely to see continued or increased oil and gas development and associated ground disturbance or vegetation removal.

4.6.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production (see **Section 3.16.3**, Mineral Extraction, *Trends*, and **Section 4.16.2**, Mineral Extraction, *Impacts Common to All Alternatives*).

Temporary and permanent vegetation removal associated with construction and workover operations directly impacts vegetation and wetland resources. Vegetation could be removed by surface-disturbing activities, such as constructing new or expanding existing access roads or well pads. Where access roads cross wetlands or riparian areas, vegetation could be removed to facilitate construction. Wetlands could be directly impacted by filling, draining, or otherwise altering surface or subsurface hydrology. Where disturbed areas were reclaimed and revegetated, impacts would be temporary. If disturbed areas were not reclaimed and revegetated, for example where a permanent access road or monitoring well was installed, impacts would be permanent.

Indirect impacts on vegetation and wetland resources could include a change in species composition due to invasive plant or noxious weed establishment or spread. Surface-disturbing activities and increased personnel and vehicle presence would facilitate noxious weed establishment or spread. In reclaimed areas, vegetation composition may shift from forest- or shrub-dominated to herbaceous-dominated communities. Indirect impacts on vegetation and wetland resources may also result from changes in watershed function and condition, including changes in groundwater or surface water availability or increased erosion or siltation from runoff. Wetland vegetation communities may be particularly sensitive to such impacts.

Fugitive dust from roads or workover activities could cover existing vegetation, which could affect plant photosynthesis and respiration. Impairment of these functions could lower plant vigor and growth rate and increase a plant's susceptibility to disease. There is the potential for accidental grass or brush fire from unauthorized vehicle ingress into vegetated areas during certain seasons, but the potential is generally low.

Under all alternatives, the BIA would apply RCMs to oil and gas permits to ensure compliance with applicable laws and regulations, such as the Clean Water Act and the Federal Noxious Weed Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs would reduce impacts on vegetation and wetlands by reducing surface disturbance, reducing the spread of noxious weeds, and restricting discharge of dredge and fill materials into waterways.

Under all alternatives, lessees must comply with the regulations at 25 CFR, Part 226, which contains measures to reduce environmental impacts from oil and gas development in Osage County. Pit lining standards would help prevent surface water contamination, thereby protecting wetlands from degradation. Drilling buffers around established watering places would reduce adverse direct and indirect impacts on wetland and riparian vegetation associated with aquatic systems. The extent of this protection would depend on how established watering places were defined under each alternative.

4.6.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). These RCMs would help reduce the extent of surface-disturbing activities from these activities, would reduce direct and indirect adverse impacts on native vegetation, and would reduce the potential for noxious weed spread.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix I, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would help reduce impacts on vegetation and wetlands from new oil and gas leases in a manner similar to that described for activities within the scope of the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analyses and would apply RCMs on a case-by-case basis. As described in **Section 4.6.2**, these RCMs would ensure compliance with applicable laws and regulations and would reduce impacts on vegetation and wetlands. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.

The No Action Alternative would not provide a county-wide framework that site-specific NEPA analyses could be tiered to. This could result in fragmented decision-making and inconsistent application of protective measures for vegetation, which may result in increased impacts on these resources. Generally, direct and indirect impacts on vegetation, wetlands, and noxious weeds resulting from APDs and other permit applications outside the scope of the Leasing and Workover PEAs would be similar to those described in **Section 4.6.2**.

As described in **Section 4.6.2**, potential impacts on vegetation and wetlands resources and noxious weeds would be highest in those areas with high or moderate-to-high oil and gas potential. This is because oil and gas development would be concentrated in these areas.

Table 4-2 summarizes acres of potential vegetation types and wetlands and National Wetland Inventory water features in areas of high or moderate-to-high oil and gas potential.

Table 4-2
Acres of Potential Vegetation and National Wetland Inventory Wetlands in Areas of High or Moderate-to-High Oil and Gas Potential

Resource	Acres	Percent of Planning Area-wide Resource
Post oak-blackjack forest	709,500	92
Tallgrass prairie	502,700	77
Bottomland forest	26,900	65
Wetlands[1]	29,700	69

Sources: OBS GIS 1943; NWI GIS 2015b; BLM GIS 2015

[1]This category includes all National Wetlands Inventory mapped features in the planning area.

As shown in **Table 4-2**, most of the vegetation and wetlands resources in the planning area are in areas of high or moderate-to-high oil and gas potential. This indicates the potential is high for oil and gas development to directly and indirectly impact these resources.

4.6.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. Applying RCMs under Action Alternative 1 would generally have beneficial impacts on vegetation, including wetlands, and would reduce the establishment and spread of noxious weeds.

Non-vegetation-specific RCMs under Action Alternative 1 would also help protect vegetation. For example, water quality measures prohibiting activities and crossings in stream channels and wetlands without proper authorization would protect wetland and riparian vegetation from destruction. This would come about by minimizing ground disturbance, potential noxious weed establishment and spread, wetland fill and vegetation removal, riparian vegetation removal, sedimentation, and erosion.

Where authorized, removal or disturbance of wetland and riparian vegetation would be minimized or mitigated by US Army Corps of Engineers permit conditions of approval. Special status species measures would limit habitat disturbance by implementing USFWS protocol for ABB and other species, thereby reducing vegetation removal or disturbance. Erosion control measures would beneficially impact vegetation by reducing siltation and runoff and the potential for noxious weed transport, establishment, and spread.

Under Action Alternative 1, the BIA would define "established watering place" to clarify where the 200-foot no-drilling buffer would apply. Established watering places under this alternative are lakes, streams (perennial and intermittent), pools created by ephemeral or intermittent streams and drainage ways, wetlands, marshes, sloughs, springs, human-made ponds, natural ponds, and tributaries to any of these surface waters.

Some of these aquatic features might not be considered established watering places under the No Action Alternative. In such a case, the standard definition under this alternative could reduce adverse impacts on wetland and riparian vegetation by broadening the aquatic features considered to be established watering places and increasing the area of wetland and riparian vegetation subject to the 200-foot no-drilling buffer. Increasing the area subject to the no-drilling buffer would also have a beneficial impact on noxious weeds by reducing surface disturbance, which facilitates noxious weed establishment and spread.

Under Action Alternative 1, the acreage of potential impacts on vegetation and wetland resources would be the same as the No Action Alternative. This is because the acreage of vegetation and wetland resources in areas of high to moderate-to-high oil and gas potential (**Table 4-2**) would not change. However, applying RCMs under Action Alternative 1 and clarifying the definition of "established watering place" would generally have beneficial impacts on vegetation, including wetlands and noxious weeds, for the reasons described above. Overall, impacts of oil and gas activities on vegetation under Action Alternative 1 would be reduced, compared to the No Action Alternative, if similar protective measures were not applied on a site-specific basis under the No Action Alternative.

4.6.5 Action Alternative 2

Impacts on vegetation, wetlands, and noxious weeds under Action Alternative 2 would be similar to those under Action Alternative 1; however, additional RCMs applied under Action Alternative 2 would further reduce impacts and make this alternative the most protective of vegetation and wetlands.

Under Action Alternative 2, the BIA would describe "established watering place" to clarify where the 200-foot no-drilling buffer would apply. The definition under Action Alternative 2 would be the most expansive of all the alternatives. Established watering places under this alternative include those listed under Action Alternative 1 plus groundwater wells. The definition under Action Alternative 2 could further reduce adverse impacts on vegetation compared to Action Alternative 1 by reducing surface disturbance, vegetation removal, and the potential for noxious weed establishment and spread.

Under Action Alternative 2, the BIA would build on the RCMs in Action Alternative 1 by adding more specific RCMs. These would be applied in specific areas, based on available information about where sensitive resources need to be protected.

Applying RCMs under Action Alternative 2 would generally have beneficial impacts on vegetation, including wetlands and noxious weeds. By stockpiling the upper foot of topsoil for use in site reclamation, revegetation would be hastened by using native seed stock and organic soil components stored in topsoil.

Requiring replanting of appropriate vegetation to stabilize disturbed wetland buffers and requiring directional drilling to place pipelines under wetlands and other important aquatic resources would reduce the alteration of wetland hydrology, such as filling and draining, that could result from oil and gas activities.

Non-vegetation-specific RCMs under Action Alternative 2 would also have beneficial impacts on vegetation. For example, fish and wildlife measures would beneficially impact tallgrass prairie vegetation by reducing or eliminating fragmentation from human-made features in prairie habitat. Vegetation would also be beneficially impacted by implementing no-drilling buffers around sensitive cultural sites. These buffers would reduce surface disturbance, vegetation removal, and the potential for noxious weed establishment and spread.

Under Action Alternative 2, the acreage of potential impacts on vegetation and wetland resources would be the same as the No Action Alternative. This is because the acreages of vegetation and wetlands in areas of high to moderate-to-high oil and gas potential would not change (**Table 4-2**). However, building on RCMs applied under Action Alternative 1 and adding more specific measures that would apply to a broader range of actions would generally have beneficial impacts on vegetation, including wetlands and noxious weeds, for the reasons described above. Therefore, Action Alternative 2 would likely have the greatest reduction in potential impacts from oil and gas activities on vegetation and wetlands, and the greatest reduction in noxious weed establishment and spread, of all the alternatives.

4.6.6 Cumulative Impacts

The cumulative impact analysis area for vegetation, wetlands, and noxious weeds is the planning area. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will continue to affect vegetation, wetlands, and noxious weeds are as follows:

- Oil and gas leasing and development
- Agriculture and livestock grazing
- Other development for renewable energy and infrastructure

Vegetation management plans, including the Osage Nation IRMP, the BIA Eastern Oklahoma Region Fire Plan, and the USFWS ABB Conservation Plan, have also affected and will continue to affect vegetation in the planning area.

Generally, impacts on vegetation from the actions described above could occur due to loss or modification of vegetation communities, altered species composition and vegetation structure, establishment and spread of noxious weeds, and soil disturbance, including compaction, erosion, topsoil removal, and loss of native seed banks. Alternatively, vegetation conservation and habitat restoration actions would have beneficial impacts on vegetation by reducing weed establishment and spread.

Tallgrass prairie has declined greatly in acreage due to agricultural conversion throughout the region; however, large expanses of this vegetation type still occur in the planning area (Hoagland 2008). Historic use of tallgrass prairie for pasture (Duck and Fletcher 1943) led to the conversion to exotic pasture grasses and is an ongoing threat in tallgrass prairie in the region. Frequency and extent of fire in these systems has dramatically declined as a result of fire suppression and reduction in fuels due to grazing. This can give rise to changes in the plant community, loss of riparian vegetation, and invasion of native or nonnative species, including eastern red-cedar.

Invasive plants are generally spreading or increasing in density in some parts of the planning area, especially in oil and gas fields, along roadways, transmission lines, and other rights-of-way, and at the margins of agricultural operations where ground disturbance is concentrated and where increased human activities have increased the number of potential invasive plant introductions (Smith and Knapp 2001). Typically, as ground disturbance increases in areas of weed populations, the likelihood that invasive plants would move into this disturbance increases. Linear development, such as transmission lines, pipelines, roads, and fences, in particular can facilitate long-distance weed dispersal (Sheley 1996; Forest Service 2012).

It is likely that impacts from climate change will affect vegetation in the planning area within the cumulative impacts planning horizon. Current climate change models are projecting a range of potential shifts in climate, including increasing temperatures and more intense rainfall. This is despite a decrease in average amounts of total annual precipitation (Karl et al. 2009). Altered climatic patterns would likely influence species distribution within vegetation communities in the planning area. This may be particularly true in those communities that are sensitive to impacts from drought or altered fire regimes, or that are susceptible to weed establishment and spread.

Alternatives Analysis

Under the No Action Alternative, current vegetation, wetlands, and noxious weed trends described in **Section 3.6.3** would continue. This is because no additional RCMs or other restrictions on oil and gas activities would be implemented beyond those currently being applied. The cumulative impacts on vegetation, wetlands, and noxious weeds would be greatest under the No Action Alternative.

Under the action alternatives, adverse cumulative impacts on vegetation and wetlands would be incrementally reduced. This is because RCMs would be standardized across all oil and gas activities, rather than limited to those leasing and workover activities covered under the Leasing and Workover PEAs, respectively. Generally, measures would result in reduced ground disturbance and improved revegetation of temporarily disturbed areas, lessening the potential for noxious weed establishment and spread.

Where current vegetation, wetland, and noxious weed trends are influenced by oil and gas activities, the action alternatives could result in incremental improvements in current trends. As conservation measures and other restrictions are slightly more robust under Action Alternative 2, cumulative impacts may be more reduced under it.

4.7 SPECIAL STATUS SPECIES

4.7.1 Methods and Assumptions

Indicators

Indicators of impacts on special status species are as follows:

- Acres of habitat for special status species that would be removed temporarily and over the long term
- The likelihood that activities would cause or be likely to cause injury, substantial interference with normal breeding, feeding, or sheltering behavior, or nest abandonment
- Direct impact on a special status plant individual or population
- Elimination, reduction, or adverse effects on a unique or rare natural plant community

Assumptions

This analysis is based on the following assumptions:

- The health of special status species is directly related to the overall health and abundance of their habitat. Special status plant health is also directly related to an abundance of individual plants, as well as the condition and abundance of their habitat. This impact analysis on special status species includes an assessment of whether managing oil and gas activities under each alternative could lead to the destruction, degradation, or modification of habitat, as well as impacts that could improve wildlife, plant, and aquatic habitat.
- Some impacts would be direct; others would be indirect and would affect special status species and their habitats by changing another resource. Direct impacts on special status species habitat are disruption, potential trampling, direct destruction of special status species, and actions that reduce total numbers of a special status species.
- Indirect impacts are loss of habitat suitable for colonization due to surface disturbance, introduction of noxious weeds, increased noise, and general loss of habitat due to surface occupancy or surface compaction. Potential indirect impacts are those that cannot be absolutely linked to one action, such as decreased plant health from reduced air or water quality.
- Only impacts on federally listed, proposed, or candidate species, or state threatened or endangered species, are discussed in this section.
- In the event of changes to the listing status of a species included in this EIS, or if new species are listed with habitat in the planning area, consultation with USFWS will be required to identify appropriate avoidance and minimization measures for these species.

4.7.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production (see **Section 3.16.3**, Mineral Extraction, *Trends*, and **Section 4.16.2**, Mineral Extraction, *Impacts Common to All Alternatives*).

Oil and gas development could impact special status species or habitats through disturbance, direct habitat loss, reduced habitat effectiveness, habitat modification, degradation, and fragmentation, direct mortality, habitat avoidance, and interference with movement patterns. These potential disturbances are directly linked to changes in vegetation conditions and water quality and quantity. Under all alternatives, oil and gas development actions would require infrastructure, including well pads, access roads, pipelines, transmission lines, and others. Construction and operation of this infrastructure would result in direct habitat loss, degradation, and fragmentation, displacement, potential death of individuals, and nest abandonment.

Death may be caused by collision with or electrocution from power lines, collision with vehicles on access roads, or contact with oil waste ponds, resulting in toxicity from oil ingestion, potential drowning, cold stress from loss of insulation, and susceptibility to disease. Indirect effects are behavioral changes, such as avoiding nesting habitat due to noise or traffic, increased predation from power lines or spread of predator populations, invasive plant spread displacing native habitat, and water quality impairment and exposure to hazardous materials in the event of a spill.

Under all alternatives, existing leases would be valid and no areas would be closed to new leasing for wildlife or special status species. However, also under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA, and to prevent environmental degradation. Section 7 of the ESA (l6 United States Code [USC], Section 1531 et seq.) requires federal agencies, in consultation with the USFWS, to ensure that their actions are not likely to jeopardize the continued existence of any listed species or to result in adverse effects on designated critical habitat of such species. The ESA also prohibits any action that results in a take of any federally protected plant, fish, or wildlife species.

Measures to ensure compliance with the ESA and to prevent environmental degradation may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs would reduce impacts on special status species by helping ensure compliance with the laws intended to protect them. Specific RCMs to protect federally threatened or endangered species would be determined on a case-by-case basis through consultation with the USFWS for each permit application.

The paragraphs below discuss certain special status species likely to be affected by the alternatives in more detail. There would be no effect on other listed or candidate species found in the planning area—northern long-eared bat, red knot, piping plover, neosho mucket mussel, and interior least tern—under any of the alternatives. This is because they do not nest, roost, or reproduce in affected habitat.

American burying beetle

Activities associated with oil and gas development are likely to result in take of ABBs and to have adverse effects on their habitat. Death or injury to adults, larvae, or eggs may result from the following:

- Crushing and collision
- Temporary and permanent impacts on breeding, feeding, and sheltering habitat
- Increased habitat fragmentation
- Vegetation community changes

Also expected to result in take of the ABB are human, vehicle, and equipment movement and surface disturbance from construction and installation of well pads, pipelines, access roads, transmission lines and substations and operation and maintenance. This is due to the beetle's small size and the difficulty of avoiding them when working in habitat areas (USFWS 2014a). For the same reason, human, vehicle, and equipment movement and ground disturbance from construction and installation of well pads, pipelines, access roads, transmission lines, and substations and operation and maintenance are also expected to result in take of ABB.

Additional indirect effects are to limit the species' foraging and reproduction efficiency. Species that ABB use for food and reproduction and those species' habitats in project areas would be impacted, thereby reducing the ABB's available food sources, reproductive potential, and habitat use. Activities that would remove vegetation or alter soil moisture may degrade habitat, reduce habitat connectivity, and cause the loss of breeding and sheltering habitat. Additionally, these activities may increase the potential for introducing nonnative invasive species (USFWS 2014a).

Greater Prairie Chicken, Sprague's Pipit, and Whooping Crane

Tallgrass prairies, particularly in northwestern Osage County, provide high value nesting habitat for greater prairie chicken and Sprague's pipit. The planning area contains 24,200 acres of the highest-value greater prairie chicken habitat, and over 300,000 acres of additional high-value habitat (OGRPCST GIS 2015). These areas also provide migratory habitat for whooping crane. Oil and gas development activities can result in habitat fragmentation and degradation.

Noise and traffic at breeding and nesting grounds disturbs reproduction for closely related prairie-nesting birds, and consequences may include lek or nest abandonment (Aldridge and Boyce 2007; Pitman et al. 2005). Whooping crane may face increased energy expenditures from loss of migratory stopover habitat.

Raptors, Including Ferruginous Hawk, Bald Eagle, and Golden Eagle

Raptors do not nest in prairie vegetation but could be impacted by noise disturbance or power lines while in flight. They could suffer the loss of foraging habitat, although this would likely be minor or temporary. Raptors, including bald eagle, can be injured or killed by collision or electrocution from overhead power lines, unless these lines have avian-safe features designed to minimize electrocution and collision risk (APLIC 2012).

Rattlesnake Master Borer Moth

The candidate species rattlesnake master borer moth depends on the perennial rattlesnake master, which is a plant native to the tallgrass prairie. The rattlesnake master plant is the sole food source for the moth (USFWS 2013). Removing or destroying this plant as a result of surface disturbance associated with oil and gas activities would remove the sole food source for the rattlesnake master borer moth.

4.7.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). These measures would limit the extent of surface disturbance associated with these activities. Requiring lessees to follow USFWS established protocol regarding areas where the ABB is known or expected to exist would reduce impacts on the ABB from surface-disturbing activities associated with workovers.

Lessees would also be required to follow guidance in the USFWS Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects (April 2014) for activities within the scope of the Workover PEA. Measures for protecting migratory birds are to avoid work during nesting season when possible and clearing vegetation outside of nesting season to discourage nesting. If work must occur during nesting season, project proponents should have qualified surveyors conduct preconstruction surveys to avoid harming nesting birds. These measures would help protect greater prairie chicken, Sprague's pipit, and other prairie-nesting birds from disturbance and death during nesting season. Whooping cranes do not nest in Osage County but may benefit from fewer disturbances in migratory stopover habitat. Controls on noxious weeds and reduced drilling footprints for air quality and cultural goals would also indirectly benefit special status species in the planning area.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would help reduce impacts on special status species from new oil and gas leases in a manner similar to that described for activities within the scope of the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. Lessees, in cooperation with the BIA, would need to go through a separate ESA Section 7 consultation process to determine the measures required for each permit application; they would not be permitted to simply comply with one biological opinion issued for all oil and gas development in Osage County.

American Burying Beetle

Under the No Action Alternative, lessees and the BIA would go through a separate Section 7 consultation for each drilling permit. The likely outcome of the consultation process would be RCMs to protect ABB, similar to those in the USFWS ABB Industry Conservation Plan for Oklahoma (USFWS 2014a). This plan includes goals to conserve ABB habitat in conservation priority areas and to restore habitat in impacted areas. The restoration program would mitigate losses of habitat in affected areas and would protect ABB habitat in previously unprotected areas. This would improve the likelihood of survival and reproduction of the species (USFWS 2014a). However, whether these specific measures would be applied under the No Action Alternative is uncertain.

Greater Prairie Chicken, Sprague's Pipit, and Whooping Crane

Under the No Action Alternative, lessees would be required to follow guidance in the USFWS Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects (April 2014) for activities within the scope of the Workover PEA. The BIA may also apply this same requirement to new leases, with impacts described under **Section 4.7.2**. However, no specific RCMs would be identified up front to avoid harming greater prairie chicken, Sprague's Pipit, or whooping crane or their habitat as a result of oil and gas activities outside the scope of the Leasing and Workover PEAs.

The BIA would apply RCMs on a case-by-case basis where necessary to ensure compliance with the MBTA. The greater prairie chicken and Sprague's pipit would continue to be disturbed by noise and traffic at breeding and nesting grounds; habitat fragmentation and degradation would continue in tallgrass prairie from drilling. Whooping crane may face increased energy expenditures from loss of migratory stopover habitat. If applied, RCMs based on the Leasing PEA to control noxious weeds and reduce drilling footprints for air quality and cultural resource protection would also indirectly benefit the special status prairie birds in the vicinity.

Raptors, Including Ferruginous Hawk, Bald Eagle, and Golden Eagle

Under the No Action Alternative, noise disturbance and overhead power lines would continue to pose a threat to raptors. Impacts from activities within the scope of the Workover PEA would be mitigated by following guidance in the Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects (USFWS 2014c). These include documenting bald eagle use and conducting eagle nest surveys before development. If an area is determined to be used by eagles, then installing power lines should be avoided when possible, flared gas pipes should be fitted with anti-perching devices, and existing poles should be marked or designed according to Avian Power Line Interaction Committee (APLIC) guidelines to minimize electrocution risk. These measures would reduce the risk of eagle and other raptor deaths from oil and gas development. If the BIA applied these requirements to new leases in accordance with the Leasing PEA, impacts could be mitigated further.

Rattlesnake Master Borer Moth

Unless a protective RCM was applied to a specific permit on a case-by-case basis, efforts would not be made to identify or avoid this plant before disturbing its habitat under the No Action Alternative.

4.7.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. Permit applicants would be able to obtain an incidental take permit under the ESA by complying with these RCMs instead of going through the Section 7 consultation process for a separate incidental take permit for each oil and gas permit application.

American Burying Beetle

Like the No Action Alternative, under Action Alternative 1, lessees would be required to protect the federally endangered ABB. However, additional detail would be provided up front on what would be required to accomplish this protection for all oil and gas activities, rather than just activities within the scope of the Workover PEA. Providing this detail up front may result in more consistent and enhanced protection to ABB populations compared to the No Action Alternative.

Greater Prairie Chicken, Sprague's Pipit, and Whooping Crane

Under Action Alternative 1, all oil and gas activities would have to follow guidance in the USFWS Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects (April 2014). Impacts would be similar to those described under the No Action Alternative; however, because these RCMs would be applied to all oil and gas activities rather than only to workovers, protections for these bird species would increase. Under Action Alternative 1, power lines would also be buried where feasible, reducing the risk of predation and habitat avoidance. Power lines would be buried only where economically feasible and when the BIA determines that benefits to wildlife outweigh negative environmental impacts of surface disturbance from installation and future removal of the lines.

Longer term impacts of habitat loss and fragmentation from development would remain unchanged.

Raptors, Including Ferruginous Hawk, Bald Eagle, and Golden Eagle

Under Action Alternative I, power lines may be buried where feasible and appropriate. Burying power lines would reduce raptor deaths from collision but would increase surface disturbance. In addition, lessees would be required to follow guidance in the Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects (USFWS 2014c) for all oil and gas activities. Impacts would be similar to those described under the No Action Alternative; however, because these RCMs would be applied to more oil and gas activities, protections for these bird species would increase.

Rattlesnake Master Borer Moth

Under Action Alternative 1, lessees would be required to avoid removing or damaging vegetation to the extent possible and would restore disturbed areas. These restrictions could indirectly protect rattlesnake master plants, reducing the potential for harming the rattlesnake master borer moth.

4.7.5 Action Alternative 2

Impacts on special status species under Action Alternative 2 would be similar to those under Action Alternative 1; however, additional RCMs applied under Action Alternative 2 would make this alternative the most protective of special status species.

American Burying Beetle

Like Action Alternative 1 under Action Alternative 2, lessees would be required to follow the provisions of the USFWS 2014 Industry Conservation Plan to protect the ABB. In addition, under Action Alternative 2, the BIA would apply a no-drilling buffer around culturally sensitive areas, such as historic sites, sacred sites, and grave sites. These buffers would also protect ABB and other special status species found in these areas by reducing surface disturbance.

Greater Prairie Chicken, Sprague's Pipit, and Whooping Crane

Like Action Alternative 1, under Action Alternative 2, all activities associated with oil and gas drilling would have to follow guidance in the USFWS Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects (April 2014). Impacts of these requirements would be the same as those described for Action Alternative 1.

In addition, under Action Alternative 2, the BIA would apply an RCM to reduce or eliminate habitat fragmentation from power lines, pipelines, roads, and other features in 325,300 acres of important grassland prairie habitat by collocating it near other infrastructure or at the edge of the open prairie (OGRPCST GIS 2015). Moreover, lessees would be required to avoid locating tall structures on hilltops, which would minimize predation from these structures. These measures would reduce habitat fragmentation and avoidance, benefitting greater prairie chicken, Sprague's pipit, whooping crane, and other migratory birds that use this habitat.

Action Alternative 2 would also observe a buffer zone around leks during breeding season (March through May) in the morning when birds are active. This measure would reduce noise, traffic, and deaths from ground disturbance for breeding greater prairie chickens and other prairie-nesting birds.

Raptors, Including Ferruginous Hawk, Bald Eagle, and Golden Eagle
Impacts on these species would be the same as those described under Action Alternative 1.

Rattlesnake Master Borer Moth
Under Action Alternative 2, lessees would be required to identify rattlesnake master plants before conducting new surface-disturbing activities and to avoid disturbing these plants whenever possible. If a rattlesnake master plant were found on a project site, the BIA would be consulted. Potentially, the plants could be relocated to suitable prairie habitat.

Action Alternative 2 would provide the most protection to special status species. In contrast to the No Action Alternative or Action Alternative 1, it would apply more proactive biological RCMs to minimize disturbance, limit habitat fragmentation and degradation, and reduce species deaths. All prairie-dwelling migratory birds and other species, including the rattlesnake master borer moth, would receive increased protection from the RCMs to minimize destruction and fragmentation of grassland prairie habitat.

4.7.6 Cumulative Impacts

The cumulative impact analysis area for special status species is the regional habitat range for each species. Past, present, and reasonably foreseeable future actions and conditions within the cumulative impact analysis area that have affected, and will likely continue to affect, special status species are oil and gas leasing and development, agricultural conversion, quarries, wind farms, and road, casino, and residential development, as discussed in **Table 4-1**.

Oil and gas leasing and development, in combination with converting tallgrass prairie habitat to agricultural use, is likely to continue to affect ABB and special status bird species that use prairie habitat for nesting, foraging, and protection from predators. As discussed, ABB's small size make them difficult to avoid. The proliferation of oil and gas projects across ABB habitat in Oklahoma means an indeterminate but potentially vast number of individuals will be taken during project construction.

Under the No Action Alternative and Action Alternative 1, the rattlesnake master borer moth also would cumulatively lose an indeterminate but potentially large number of individuals from loss of its host plant and sole food source, the rattlesnake master plant. Losses would occur during construction of oil and gas and infrastructure projects across the region.

Infrastructure development (e.g., oil and gas pipelines, roads projects, and wind farms) across public and private lands would all contribute to habitat fragmentation for special status prairie birds, including greater prairie chicken. Approximately 95 percent of the county is already in agricultural use (Osage County 2011, p. III-47); further conversion of native habitats to agriculture would result in permanent habitat loss and fragmentation for special status birds that nest and forage in tallgrass prairie. In areas where infrastructure is highly concentrated or overlaps with oil and gas development, increased predation may result from the proliferation of tall structures that provide vantage for predators. The concentration of disturbances may result in population declines for special status prairie birds.

Alternatives Analysis

Under the No Action Alternative, trends toward habitat loss, fragmentation, and degradation from agricultural conversion and development for special status species described in **Section 3.7.3**, Special Status Species, *Trends*, are likely to continue. No additional RCMs or other restrictions on oil and gas activities would be implemented under this alternative beyond what is already being applied. The cumulative impacts of oil and gas development, agriculture and livestock grazing, and other infrastructure projects would be greatest under this alternative. For the ABB, trends of death and injury and the loss and fragmentation of habitat are expected to continue. Implementing the USFWS ABB Conservation Plan may reduce, but not eliminate, the effects of oil and gas development on ABB and species that share ABB habitat.

Under the action alternatives, use of standardized conservation measures applied to all oil and gas activities (rather than only to workovers) would reduce impacts on special status species compared to the No Action Alternative. Requiring lessees to follow APLIC guidelines for installation of power lines for all oil and gas activities would reduce impacts on raptors and prairie-dwelling birds. Minimizing soil and vegetation disturbance would help preserve tallgrass prairie habitats for special status species.

Cumulative effects would be minimized under Action Alternative 2 because it would require additional RCMs to avoid impacts on the rattlesnake mater borer moth. However, under all alternatives, the habitat fragmentation and disturbance impacts from other development projects in the planning area would continue.

4.8 AGRICULTURE

4.8.1 Methods and Assumptions

Indicator

The indicator of impacts on agriculture is temporary and permanent reductions in farmland acres in the planning area.

Assumption

Impacts on agriculture and farmlands were evaluated based on maximum potential surface disturbance. Because this is a programmatic-level EIS, it is not possible to know the exact location of specific construction projects.

4.8.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Typical oil and gas operations do not irreversibly convert farmland to other uses. However, surface-disturbing activities, such as construction of well pads, access roads, and reserve pits, can affect soil properties, increase erosion, and reduce water infiltration. Any of these could affect the characteristics unique to prime or unique farmlands.

Under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the Farmland Protection Policy Act and the American Indian Agricultural Resource Management Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs could result in incidental protection of farmlands if surface disturbance were reduced to comply with the laws.

4.8.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). Applying these measures would reduce short- and long-term impacts on non-prime farmland. Agricultural uses would benefit from requiring the prompt reclamation (no later than 90 days after rig removal) of surface disturbance around wells or the complete reclamation of the area around wells no longer in production. Benefits would come from ensuring areas are returned to their original state as soon as possible. Confining vehicles to existing and new roads would decrease off-road vehicle traffic. This, in turn, could decrease disturbance of agricultural lands.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, it would help reduce impacts on non-prime farmland in a manner similar to that described for activities within the scope of the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. As described in **Section 4.8.2**, these RCMs would ensure compliance with applicable laws and regulations and could reduce impacts on non-prime farmlands. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.

The lack of consistently applied RCMs under the No Action Alternative would result in continued risk of conflict with agricultural land, particularly when leasing and development occurs near agricultural uses. The No Action Alternative would have the least beneficial indirect effects on agricultural uses due to its lack of standardized RCMs.

4.8.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. Because the RCMs for workovers described under the No Action Alternative would apply to all oil and gas activities under Action Alternative 1, the impacts of surface disturbance and off-road vehicle traffic on non-prime farmlands would be reduced under this alternative. Additional RCMs to reduce erosion would indirectly benefit farmlands, as described in **Section 4.8.2**.

Reducing sound levels so as not to disturb wildlife and sensitive human receptors would minimize impacts on livestock; under this alternative, RCMs call for noise control, including noise buffers, mufflers, and submersing pumping units. Excluding any livestock from oil and gas activities by properly enclosing all production equipment, facilities, and tanks, including well-head and aboveground piping, would also minimize impacts on livestock. Overall, impacts of oil and gas activities on agriculture under Action Alternative 1 would be reduced, compared to the No Action Alternative, if similar protective measures were not applied on a site-specific basis under the No Action Alternative.

4.8.5 Action Alternative 2

Impacts under Action Alternative 2 would be similar to those under Action Alternative 1. However, because more specific RCMs would be applied, and proactive protective buffers would be added around specific resources, additional indirect beneficial impacts on agriculture could occur. This could be especially true if the buffers were to coincide with agricultural lands or prime farmlands.

4.8.6 Cumulative Impacts

The cumulative impact analysis area for agriculture is the planning area. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect agriculture are projects that disturb farmland acres or soils. This may include wind projects, road and bridge improvements, and fire management plans, where these projects cross or are next to agricultural lands.

Generally, farmlands are not considered when siting large facilities, such as those for wind energy. Road improvements may temporarily affect the edge of farmlands during improvement construction, where roads cross through farmland acres.

Currently, the BIA administers 271 active farming and grazing leases covering 60,300 acres and is pending the administration of an additional 144 leases, covering 29,000 acres. The ongoing administration and management of these leases would reduce the possibility of agricultural lands being converted to other uses.

Alternatives Analysis

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. This would increase the amount of surface disturbance on the landscape and may conflict with agricultural uses. Impacts on agriculture from oil and gas development in the planning area would be reduced under Action Alternative 1 and further reduced under Action Alternative 2. However, these resources would still be impacted by the other projects discussed under **Section 4.8.6**. Cumulative impacts in the planning area would be reduced under Action Alternatives 1 and 2.

4.9 Historical, Cultural, and Archaeological Resources

This section discusses potential impacts on historical, cultural, and archaeological resources. Collectively, these resources indicate locations of human activity, occupation, or use, such as archaeological sites, historic buildings and structures, and historic trails used by peoples and cultures of the past. Cultural resources can also include natural features, plants, and animals or places that are considered to be traditionally important or sacred to a culture, subculture, or community. This section also addresses Indian trust assets, which are legal interests held by the federal government for federally recognized Indian tribes or nations or for individual Indians.

4.9.1 Methods and Assumptions

Indicators

Cultural Resources

The primary impact indicator for cultural resources is the damage or loss of the integrity or setting of National Register of Historic Places (NRHP)-eligible cultural resources or locations important to contemporary tribal communities. The integrity of cultural resources is assessed by the ability of the cultural, archaeological, or historic property to convey the important traditional, scientific, and public values for which it is determined to be historically significant. Specific indicators relevant to the BIA decision are as follows:

- Extent and relative depth of ground-disturbing activities or removal of structural features that are permitted and their potential to affect known or unknown intact cultural resources or areas of importance to traditional communities
- Increased access to or activity in areas where resources are present or are anticipated
- Extent that an action changes the potential for erosion or other natural process that could affect cultural resources
- Extent that the action alters the visual or aural setting of cultural resources, culturally significant landscapes, and/or traditional cultural properties

Indian Trust Assets

The primary impact indicator for trust assets is the extent to which actions could improve or hinder the management of assets, property, or property rights held in trust by the federal government for beneficiaries. Specific indicators relevant to the BIA decision are the following:

- Constraints on developing or using the mineral estate, including prohibitions, timing, location, and methods of oil and gas development
- The extent to which required environmental compliance processes, constraints and resource protection measures can be addressed more efficiently and with more certainty for lessees and operators

For detailed analysis of socioeconomic impacts from each alternative, see **Section 4.10**, Socioeconomics and Environmental Justice.

Assumptions

- Leasing is an administrative process and would not directly impact cultural resources. Subsequent completion of the Section 106 process, NEPA analysis, and permit approval would be required on a project-specific basis before the ground is disturbed or other actions take place that could directly impact cultural resources.
- NRHP-eligible cultural resources and locations important to contemporary tribal communities would be avoided whenever possible when considering APDs and other actions.

- The demand for development of Osage County gas and oil mineral estate would continue, would be affected by market forces, and would remain an important source of income for Osage treasury and headright holders.

4.9.2 Impacts Common to All Alternatives

Cultural Resources

Under all alternatives, the BIA would apply RCMs to oil and gas permits to ensure compliance with applicable laws and regulations, such as the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected.

The BIA would complete the required Section 106 process, including surveys and consultations. Impacts on cultural resources that appear to be eligible for listing on the NRHP or locations important to contemporary tribal communities would be avoided and a buffer would be defined. If avoidance is not possible, the BIA would develop acceptable measures to reduce the potential for adverse effects, in consultation and coordination with the Osage Nation Tribal Historic Preservation Officer, State Historic Preservation Office, the Oklahoma Archeological Survey, and other parties, if necessary.

Resolving adverse effects through the Section 106 process would mitigate any significant impacts under NEPA. The infrastructure and access roads remaining in place for operations and maintenance could lead to indirect impacts on cultural resources from increased access, trespass, vandalism, erosion, and changes to setting.

Indian Trust Assets

Under all alternatives, the BIA would apply RCMs to ensure compliance with applicable laws and regulations and to prevent environmental degradation. These measures could constrain infrastructure siting. Constraints would not preclude lease development but may involve additional expense and delays for lessees. These constraints may influence investment decisions and could impact income derived from the mineral estate owned by the federal government in trust for the Osage. However, there would be beneficial impacts from RCMs that provide information on standards that can be referenced to reduce uncertainty about compliance requirements.

4.9.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). These measures would constrain development of the mineral estate but would reduce uncertainty about compliance requirements, in a manner similar to that described under **Section 4.9.2**.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix I, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, impacts would be similar to those described for activities within the scope of the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis, including Section 106 compliance, and would apply RCMs on a case-by-case basis. As described in **Section 4.9.2**, these RCMs would ensure compliance with applicable laws and regulations, including the NHPA. Resolving adverse effects through the Section 106 process would mitigate any significant impacts.

Cultural Resources

The potential for impacts would be the same as described in **Section 4.9.2**. The beneficial effects of providing additional cultural RCMs and county-wide standards would not be realized under the No Action Alternative.

Indian Trust Assets

The potential for impacts would be the same as described in **Section 4.9.3**. The No Action Alternative would not provide a standard framework applicable to Osage County for tiering site-specific NEPA analysis. While it is possible that fewer constraints would be applied to oil and gas development under this alternative, the beneficial effects of developing and using the Osage mineral estate through simplifying and standardizing compliance guidance would not be realized under the No Action Alternative.

4.9.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities including non-permitted lease activities, workover activities, and APDs and other permitted activities.

Cultural Resources

The potential for impacts would be the same as that described under the No Action Alternative. However, Action Alternative 1 would also provide beneficial impacts by formalizing protective measures already in practice and including them as permit conditions, thus offering additional clarity on standards applicable county-wide.

Indian Trust Assets

The potential for impacts would be similar to those described under the No Action Alternative. By consistently applying RCMs to all permitted oil and gas activities in the planning area, additional constraints could be placed on developing the mineral estate, if similar site-specific protective measures were not applied under the No Action Alternative. However, these RCMs are designed to add certainty about compliance requirements through standards applicable county-wide, which would assist in efficiently developing and using the Osage mineral estate.

4.9.5 Action Alternative 2

Under Action Alternative 2, the BIA would apply additional RCMs to oil and gas activities.

Cultural Resources

The potential for impacts would be similar to that described for Action Alternative 1. However, Action Alternative 2 would include proactive guidance on minimum expected no-drilling buffer zones for particular site types to assist in development and access road planning. These buffers would be applied based on the results of the preconstruction survey. The buffer sizes would vary based on site type and may be adjusted as necessary, based on site-specific conditions. Siting in the vicinity of cultural resources would still be subject to site-specific review and approval. Applying these additional conservation measures would have a beneficial impact on cultural resources by providing more predictable guidance and standards for siting facilities and avoiding impacts on cultural resources.

Indian Trust Assets

The potential for impacts would be similar to that described for Action Alternative 1. Additional RCMs would place more constraints on developing the mineral estate. However, these measures are designed to clarify compliance requirements with more predictable guidance and standards. This would assist the BIA in meeting its trust responsibilities for the benefit of the Osage.

4.9.6 Cumulative Impacts

The cumulative impact analysis area for historical, cultural, and archaeological resources is primarily the planning area. Consideration is also given to the following:

- Historic trails that pass through Osage County, when those trails have not been well documented as linear cultural resources
- Actions outside the planning area that may alter the visual, atmospheric, and aural setting of cultural resources, culturally significant landscapes, and traditional cultural properties

The cumulative impact analysis area for Indian trust assets is the planning area.

Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect historical, cultural, and archaeological resources and Indian trust assets are as follows:

- Oil and gas development
- Wind energy development
- Infrastructure development
- Commercial and residential development
- Agricultural and ranching uses
- Quarries and mineral materials leases

These actions and trends can impact historical, cultural, and archaeological resources through ground and physical disturbance, aural, atmospheric, or visual setting disturbance, natural processes, such as erosion and weathering, historic structure abandonment or alteration, and increased access, vandalism, and unauthorized collection.

Cumulative actions that are subject to further review under NEPA, the NHPA, and other laws, statutes, and regulations would require consideration of the effects on historical, cultural, and archaeological resources. Adverse effects would be resolved by modifying the undertaking to avoid, minimize, or mitigate the adverse effects on historical, cultural, or archaeological resources.

Impacts would be avoided or mitigated in many of the actions. Mitigation could provide additional information for scientific study but could preclude other desirable resource management options.

Cumulative effects on Indian trust assets would be from the continued beneficial use of the Osage mineral estate. Other surface land uses and development, market prices, renewable energy projects, and environmental protection measures may provide additional constraints to the development and use of the mineral estate, but constraints would not preclude lease development.

Alternatives Analysis

Under the No Action Alternative, current trends described in **Section 3.9.3**, Historical, Cultural, and Archaeological Resources, *Trends*, would continue. The beneficial effects on historical, cultural, and archaeological resources of providing additional cultural RCMs and county-wide standards would not be realized under the No Action Alternative. For Indian trust assets, constraints on leasing and developing the mineral estate due to conservation measures would continue.

The No Action Alternative would not provide a standard framework applicable to Osage County for tiering site-specific NEPA analysis. The beneficial effects of developing and using the Osage mineral estate through simplifying and standardizing compliance guidance would not be realized under the No Action Alternative.

The potential for cumulative impacts would be greatest under the No Action Alternative, but the contributions of oil and gas leasing is expected to be less than significant. This determination is made on the basis that the Section 106 process would continue to identify and avoid, minimize, or mitigate the adverse impact on eligible resources and that any remaining impacts would not be "significant" under NEPA. Cumulatively there is the potential for incremental loss of the regional resource base, inadvertent impacts from access and activities near cultural resources, vandalism, and actions not subject to Section 106 review.

Under the two action alternatives, potential adverse cumulative impacts on historical, cultural, and archaeological resources would be reduced by applying standard cultural RCMs to all oil and gas activities.

Action Alternative 2 would provide additional guidance on anticipated buffer sizes around resources, thus further reducing potential ground-disturbing impacts. Because conservation measures for cultural resources are stronger under Action Alternative 2, the potential for cumulative impacts would be most reduced under it. Cumulative impacts on historical, cultural, and archaeological resources are expected to be less than significant under both action alternatives.

For Indian trust assets, constraints on leasing and developing the mineral estate due to conservation measures would be consistently applied to all permitted oil and gas activities in the planning area. There would be additional constraints on developing the mineral estate, but having standardized measures that are applicable county-wide would assist in developing and using the Osage mineral estate. Constraints could be greater under Action Alternative 2, if similar measures were not applied on a site-specific basis under the other alternatives; however, certainty regarding compliance requirements would also be greatest.

4.10 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

4.10.1 Methods and Assumptions

Indicators: Socioeconomics

Indicators of impacts on socioeconomics are as follows:

- Local area employment levels
- County population
- Local government fiscal conditions
- Local area services
- Quality of life factors, including air, water quality, traffic, and social environment

Indicators: Environmental Justice

For the environmental justice analysis, US Census Bureau data is used to determine whether the populations residing in the study area constitute an "environmental justice population," in accordance with CEQ guidance, through meeting either of the following criteria:

- At least half of the population is of minority or low-income status
- The percentage of population that is of minority or low-income status is at least 10 percentage points higher than for the entire state of Oklahoma

CEQ guidance does not provide specific criteria for determining low-income populations, as it does for minority populations, so the criteria for minority populations, which are discussed above, were also used as the criteria for low-income populations. Additional measures were examined to provide more information on the poverty status of area populations, including median household income and the percent of individuals below two times the poverty level.

In addition to CEQ definitions of environmental justice populations, other additional components were examined for environmental justice consideration. As noted in the EPA's Environmental Justice guidance (EPA 2015g), such measures as educational attainment may also be useful for identifying, characterizing, and developing strategies for engaging populations. In addition, county and state level populations were examined for percentage of the population over 65 or under 5, as these some impacts may affect these groups differently.

Finally, as noted in CEQ guidance, some population groups may have differential patterns of consumption of natural resources, which could result in different degrees of impacts. "Differential patterns of consumption of natural resources" relates to subsistence and differential patterns of subsistence. It means differences in rates or patterns of fish, water, vegetation and wildlife consumption among minority populations, low-income populations, or Indian tribes, as compared to the general population. The potential for differential pattern of consumption was examined in the planning area.

If significant impacts were to occur in any resource area and these were to disproportionately affect minority or low-income populations, there could be an environmental justice impact.

Assumptions

- The analysis is based on the current rate of taxes, royalty charges, and distribution.
- The percent of workers in the oil and gas industry residing and working in Osage County is not known and likely differs by

operator. While information is provided for Osage County, total economic impacts, including direct and indirect employment, income, and total value added, likely extend beyond this geographic area.

- This analysis includes information on direct and indirect impacts on jobs and income in the oil and gas industry. Due to the level of uncertainty of impacts on production levels from proposed actions, no quantitative modeling of impacts was included. However, recent studies of economic impacts from the oil and gas industry in Oklahoma were used to provide estimates for economic multipliers (i.e., the factor by which the original jobs or spending in the oil and gas industry results in additional jobs gained or money spent in the economy).

  Economic multipliers vary, depending on such factors as the location of jobs and the technology used. Estimates from two recent studies in Oklahoma of indirect impacts on income and employment in the oil and gas industry include a range of multipliers, as shown in **Table 4-3**. A range of potential impacts is provided, based on these values, with the assumption that these studies provide a rough estimate for potential overall level of impacts.

Table 4-3
Economic Multipliers for the Oil and Gas Industry in Oklahoma

Resource	Snead and Barta	PWC
Total value added	1.75	1.45
Employment	3.22	2.68

Source: Snead and Barta 2008; PWC 2011

4.10.2 Impacts Common to All Alternatives

Socioeconomics

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Oil and gas production would be impacted by conditions outside the scope of the decisions to be made in this document, including geology, market price, and state and local regulations. As described in **Section 3.16.3**, Mineral Extraction, *Trends*, oil and gas activity in the planning area is expected to increase over the next 20 years, particularly in areas with high or moderate-to-high development potential.

Under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA and Section 106 of the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Complying with these regulations may result in site-specific restrictions on surface development and a subsequent reduction in oil and gas production.

Reduction in oil and gas production has potential economic impacts, including direct and indirect impacts on the level of employment, labor income, and total value added by the oil and gas industry. In addition, changes in the production level could change the level of headright royalties paid and taxes collected and distributed.

While implementing the alternatives may result in site-specific short- or long-term limitations on surface disturbance, under all alternatives, there is no change in the lands available or unavailable to leasing or development; therefore, the resultant changes in production levels and associated social and economic impacts, including employment and population level changes, would be minimized.

In addition, due to the minimal changes anticipated in employment levels and area population as a result of management decisions, demands on public services, including police services, local schools, and utilities in the planning area are not likely to be significantly impacted by proposed project activities.

Oil and gas development may conflict with other land uses, including agriculture, timber harvesting, and renewable wind development. The degree to which conflict may occur depends on the degree of surface disturbance, and it would vary by alternative.

Under all alternatives, the development of oil and gas may impact non-market values in the planning area. Non-market values are the benefits derived by society from the uses or experiences that are not dispensed through markets and do not require payment. Non-market values can be broken down into two categories: use and non-use values.

The use value of non-market goods is the value to society from the direct use of the asset through recreation, such as hiking and camping. The use of non-market goods often includes associated market goods, such as lodging and gas.

Non-use values of non-market goods reflect the value of an asset beyond its current use, due to willingness to preserve a resource for potential future use and for the benefit of preserving an asset for future generations to enjoy. This can include such values as scenic views and preservation of plant and animal habitat that are not currently providing economic benefits. Non-use values are typically measured in terms of an individual's willingness to pay to preserve a resource.

Undeveloped land in the planning area provides non-market function in the use category through area recreation. Undeveloped open space may also play a role in the non-use category by preserving the visual landscape, sensitive resources, and important cultural sites for future generations' enjoyment.

Some of the value of undeveloped areas can also be determined by examining ecosystem services, including clean air and water. Ecosystem goods and services include a range of human benefits resulting from appropriate ecosystem structure and function, such as flood control from intact wetlands and carbon sequestration from healthy forests. Some involve commodities sold in markets, such as natural gas. Others, such as wetlands protection and carbon sequestration, do not commonly involve markets and thus reflect non-market values.

Environmental Justice

Environmental justice was analyzed at the county level, using the most currently available data from the US Census Bureau. Data for identifying low income is from the US Census Bureau, Small Area Income and Poverty Estimates. This program produces yearly single year poverty estimates for states, counties, and school districts and is considered the most accurate for these geographic scales, especially for areas with populations of 65,000 or less.

Minority populations are identified using the US Census Bureau American Community Survey, which provides estimates for the resident population by age, sex, race, and Hispanic origin at the national, state, and county scales, based on surveys collected for from 2009 to 2013.

As shown in **Table 3-34** in the previous chapter, 34.3 percent of the population in Osage County identified as minority, belonging to one or more racial or ethnic minority group (i.e., a group other than white of non-Hispanic origin), as compared to 26.5 percent for the state of Oklahoma. The Native American population in Osage County was 14.7 percent, as compared to 7 percent for the state of Oklahoma. In addition, as shown in **Table 3-35**, the poverty level of individuals in Osage County was below the state level (14.0 percent compared to 16.7 percent). Osage County therefore does not contain low-income or minority populations for environmental justice analysis, based on CEQ criteria specified in **Section 4.10.1**, Methods and Assumptions.

Other components of poverty examined confirm that Osage County residents are similar to the state population as an average. For example, median family income was similar for Osage County ($55,339) and Oklahoma ($56,464). The percent of those approximately two times the poverty level was also the same for both Osage County and the State of Oklahoma, at 21 percent of families below $50,000 (Headwater Economics 2015).

As discussed in **Section 4.10.1**, Methods and Assumptions, additional measures were examined to support environmental justice analysis. Education level in

Osage County was compared to the state level. As shown in **Table 3-22,** Education Level for Population 25 and Over, the percentage of those with a high school degree in Osage County is higher than that of the state level (87.6 percent versus 86.4 percent). In contrast, the percentage of Osage County residents with a bachelor's degree was lower compared to the state average (16.1 percent versus 23.5 percent). While still within ten percentage points of the state average, this differential may impact the jobs available to Osage county residents and the level at which job creation presents opportunities.

Although Osage County does not meet the standard CEQ definition for low-income or minority populations, other groups in the area may represent those at differential risk for impacts. The planning area represents the cultural seat of the Osage tribe, so any activities have the potential to impact this tribe.

Native Americans in the planning area may also have differential patterns of consumption of natural resources, as compared to the general population. For example, collecting native plants for traditional tribal practices may represent a differential pattern of consumption that may be impacted by proposed activities. For detailed analysis of Indian Trust Assets, see **Section 4.9**, Historic, Cultural and Archaeological Resources.

Population age was also examined, and Osage County contained a slightly higher level of those over the age of 65 than the state average (18.5 percent versus 14.5 percent) and a lower level of those under the age of 5 (5.2 percent versus 6.8 percent). As a result, actions that impact social services for the older population could have a slightly higher degree of impacts in the planning area. Under all alternatives, proposed project activities are anticipated to result in only minimal change to area population, so social services for all groups are not likely to be impacted.

Low-income or minority populations or important sites for Native Americans may be present at the census tract level; additional site-specific analysis would be required for APDs, in order to analyze potential environmental justice impacts.

4.10.3 No Action Alternative

Socioeconomics

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). As discussed in **Section 4.10.2**, any RCMs may represent site-specific restrictions and additional costs and time for development, which could subsequently reduce oil and gas production. This could have direct and indirect impacts on the level of employment, labor income, and total value added by the oil and gas industry. In addition, changes in the production level could change the level of headright royalties paid and taxes collected and distributed. However, reduction in production levels is expected to be minimal.

Application of these measures could also minimize impacts from workover operations on quality of life factors for area residents by reducing the likelihood of erosion and water contamination, requiring site reclamation, and minimizing noise and dust from operations (see also analysis in **Sections 4.3**, Water Resources, **4.4**, Air Quality and Climate, **4.11**, Public Health and Safety, and **4.13**, Noise).

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix I, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they could result in site-specific limitations in production. However, they could also help reduce impacts on other quality of life from new oil and gas leases in a manner similar to that described for activities within the scope of the Workover PEA.

Reducing disturbance from new leases could also minimize impacts on other land uses (i.e., agriculture, see **Section 4.8**, Agriculture) and their economic contributions. Minimizing impacts on sensitive resources from new leases could also help preserve these resources, thus minimizing impacts on non-market values, as discussed in **Section 4.10.2**.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. As described in **Section 4.10.2**, these RCMs would ensure compliance with applicable laws and regulations and could result in site-specific restrictions on surface development and a subsequent reduction in oil and gas production and related economic contributions. However, reduction in production levels is expected to be minimal, and the full extent of impacts cannot be known until a site-specific NEPA analysis is conducted.

The No Action Alternative would not provide a county-wide framework that site-specific NEPA analyses could be tiered to. Compliance with applicable laws and regulations, such as the ESA, the MBTA, and the NHPA, would be ensured on a case-by-case basis during the site-specific permitting process. Separate site-specific consultation could be required to ensure compliance with these regulations.

Ongoing threats to sensitive resources, including sensitive species and water, would continue to be present, and oil and gas development could impact the non-market value of these resources. The lack of a consistent approach also could result in an inconsistent mitigation of impacts on traffic, water quality, and noise, which could impact the quality of life for area residents.

Under the No Action Alternative, lessees would also continue to face uncertainty and delays associated with determining the RCMs that would be applied to a given permit. This could reduce overall the production levels and related economic impacts, including potentially reducing headright royalties.

Based on 2013 estimates for direct employment and industry income (see **Table 3-24**, Employment by Industry, 2001-2013), direct employment in the mining industry was 2,143 employees, including oil and gas employees. Using the economic multipliers discussed in **Section 4.10.1**, Methods and Assumptions, total direct, indirect, and induced employment by the oil and gas industry was between 6,900 and 9,043. Because the exact level of production changes would vary on a site-specific level, the quantitative impacts on direct and indirect employment or income cannot be determined in this document.

As discussed under **Section 4.10.2**, the level of production would also be impacted by such factors as market conditions, which is outside the scope of decisions to be made in this document, and not all of these jobs would be in Osage County.

In addition, uncertainty could impact the degree to which other land uses may occur in areas with the potential for oil and gas development. This could have impacts on jobs and income from these land uses.

The level of impacts on social and economic conditions from individual oil and gas development activities under the No Action Alternative would vary on a site-specific basis and would be determined by future site-specific NEPA analyses.

Environmental Justice

The continued development of oil and gas resources could benefit all populations, including low-income, minority, and tribal populations, by creating job opportunities and stimulating local economic growth. However, noise, dust, visual impacts, and habitat destruction could have an adverse effect on specific traditional tribal lifeways and religious and cultural sites. Development could also impact the use of sites for traditional tribal activities, such as collecting native plants for traditional tribal practices. Impacts on cultural sites would be minimized by RCMs applied through the leasing PEA or on a case-by-case basis.

Due to the lack of a low-income or minority population based on CEQ standards, project activities are not anticipated to result in disproportionate adverse impacts. Additional site-specific analysis when a lessee applies for a permit to drill would be required to identify any impacts on environmental justice.

4.10.4 Action Alternative 1

Impacts under Action Alternative 1 would be similar to those under the No Action Alternative, except that the BIA would apply additional standardized

RCMs to all oil and gas activities. This would include non-permitted lease activities, workover activities, and APDs and other permitted activities.

As under the No Action Alterative, measures to protect sensitive resources may result in site-specific limitations on surface disturbance and drilling. This could increase costs of development and reduce production and profits. However, standard RCMs may reduce the uncertainty for developers and could decrease the time required to obtain permits for leasing. This could support continued oil and gas operations and related economic benefits for the local economy, including continued headright payments.

In addition, the standard application of RCMs may help preserve resources, such as surface water and groundwater quantity and quality, air quality, and special status species. Therefore, these measures may enhance non-market values, such as preserving species and maintaining air and water quality for future generations.

Measures to preserve viewsheds, restrict noise, confine vehicles to existing and new roads, and minimize spills would more consistently preserve or enhance the quality of life for residents.

Consistent measures for oil and gas development may also decrease the impacts on other land uses, such as agriculture and timber harvest, thus allowing for potential economic gains for the local economy in these industries.

Environmental Justice

As discussed under the No Action Alternative, mineral development could provide economic opportunities for all populations, including low-income, minority, and tribal populations. Mineral development could result in site-specific impacts on important tribal or cultural sites. Standard RCMs may result in more reliable economic opportunities and may decrease the impacts on other resources, including important tribal or cultural sites.

Due to the lack of a low-income or minority population based on CEQ standards, project activities are not anticipated to result in disproportionate adverse impacts. Additional analysis when a lessee applies for a permit to drill would be required to identify any site-specific impacts on environmental justice.

4.10.5 Action Alternative 2

Impacts under Action Alternative 2 would be similar to those described under Action Alternative 1. The BIA would require additional RCMs to minimize impacts on sensitive resources, including a no-drilling buffer around culturally sensitive resources and measures to protect other resources, such as special status species and water resources. If similar restrictions were not applied on a site-specific basis under the other alternatives, their application under this alternative could reduce oil and gas profits. This could change employment levels and the total value added by the oil and gas industry and could reduce royalties, taxes distributed, and headright payments.

Profits from oil and gas development would be lowest under Action Alternative 2 if similar restrictions were not applied on a site-specific basis under the other alternatives. However, standard RCMs may reduce the uncertainty for developers and could decrease the time required to obtain permits for leasing. This could support continued oil and gas operations and related economic benefits for the local economy and for headright owners. The exact level of impacts would depend on market conditions, the technology used, and site-specific restrictions implemented.

Additional protections for water quality and proactive closures of areas for sensitive species may improve the long-term preservation of these resources for future generations, thereby enhancing non-market values. Additional restrictions on noise levels and traffic may reduce quality of life impacts on people who live next to drilling facilities.

Environmental Justice

Impacts under Alternative 2 would be similar to those described under Alternative 1. Additional RCMs could reduce production and economic opportunities for all populations, including low-income, minority, and tribal populations. However, additional protections could also help reduce impacts on any important tribal uses or cultural sites.

Due to the lack of a low-income or minority population based on CEQ standards, project activities are not anticipated to result in disproportionate adverse impacts. Additional site specific analysis when a lessee applies for a permit to drill would be required to identify any site specific impacts on environmental justice.

4.10.6 Cumulative Impacts

The cumulative impact analysis area for socioeconomics and environmental justice is the planning area. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect socioeconomics and environmental justice are similar to those described under current conditions.

Oil and gas operations in the county will continue to provide employment and income, supported by existing pipelines. Recently completed PEAs for workover operations and leasing, as well as the USFWS ABB Industry Construction Plan, could limit oil and gas development, which may impact the level of production and subsequent economic contributions from this industry.

The construction industry will continue to represent another important source of jobs and employment in the planning area; based on 2013 data (see **Table 3-24**), the construction field represents over 10 percent of area employment.

Ongoing construction of the Osage Wind Project is a current source of employment in the county.

Proposed projects (see **Table 4-1**), including the Pawhuska Casino, Bartlesville Casino, and Mustang Ranch Wind Project, as well as the residential land use plan and tribal transportation improvement plan, all represent potential sources of construction employment. The level of impacts on area housing or public services would depend on the timing of construction and employment needs.

Other current land uses in the area that support employment could continue to conflict with oil and gas development. Most of Osage County is rural, and agriculture represents a major land use and approximately 7 percent of employment in the area (see **Table 3-24**). Agriculture may not be compatible with oil and gas development if water is limited or if land disturbance impacts agricultural land use.

Area tourism, including the heritage scenic byway, where tourism stops are under construction, could also be impacted by oil and gas development if tourists are looking for rural undeveloped landscapes. In addition, as discussed under **Section 4.10.2**, Impacts Common to All Alternatives, oil and gas development has the potential to impact quality of life for area residents.

Alternatives Analysis

Under the No Action Alternative, contributions to cumulative impacts include continued employment and income in the oil and gas industry. Site-specific variability in regulations may continue to impact the level of cumulative contributions. For this and all alternatives, the exact level of employment and total cumulative number of workers needed at a given time would vary, depending on market conditions for the oil and gas industry and timing and employment needs for other construction activities listed in **Table 4-1**. As a result, quantitative estimates for level of employees and any related impacts on population, housing, and public services cannot be predicted here.

Minimal changes are expected in employment levels and area population as a result of management decisions; therefore, cumulative contributions to population change or strain on public services and housing are likely minimal. Under all alternatives, due to the lack of significant impacts on low-income or minority populations, the cumulative contribution to environmental justice from proposed management would be negligible at the county level.

Under Action Alternative 1, standardized resource conservation for oil and gas activities could result in site-specific limitations; however, it may also limit uncertainty, supporting continued cumulative economic contributions from the oil and gas industry. Standard application of RCMs may help reduce cumulative contributions from disturbance and development, including impacts on quality of life and non-market values of clean air and water and visual landscape preservation. Consistent measures for oil and gas development may also decrease the cumulative contribution to impacts on other land uses, such as agriculture.

The contribution to cumulative impacts from Action Alternative 2 would be similar to that described under Action Alternative 1. The potential contributions to cumulative impacts from development on the quality of life, non-market values, and land uses would be lowest under Alternative 2. The exact level of impact would depend on market conditions, the technology used, and site-specific restrictions implemented.

4.11 PUBLIC HEALTH AND SAFETY

4.11.1 Methods and Assumptions

Indicators
Indicators of impacts on public health and safety are as follows:

- A substantial hazard to people or the environment through the routine transport, use, or disposal of hazardous materials or as a result of an accidental release of hazardous materials
- Hazardous emissions from or handling of hazardous or acutely hazardous materials, substances, or waste
- Exposure of people or structures to a risk of loss, injury, or death involving wildland fires

Assumption
Adhering to applicable laws and regulations would reduce the risk of hydrogen sulfide gas exposure under all alternatives.

4.11.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. This would result in continued exposure to and risk associated with public health and safety issues addressed in **Section 3.11**.

Under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA and Section 106 of the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs would indirectly reduce impacts on public health and safety. For example, they would help ensure that water quality standards are met.

Adhering to the rules in 25 CFR, Part 226, would also reduce risks to public health and safety. For example, lessees would be required to exercise due diligence in controlling and removing pollutants and extinguishing fires. This would reduce the potential for hazardous material spills and wildfires.

4.11.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). Implementing these measures would reduce public health and safety risks associated with leasing and workover activities by helping prevent spills and requiring removal of unused equipment.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would help reduce impacts on public health and safety from new oil and gas leases in a manner similar to that described for activities within the scope of the Workover PEA. It would not affect APDs and other permit applications outside the scope of the Workover PEA. For these applications, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis.

As described in **Section 4.11.2**, these RCMs would ensure compliance with applicable laws and regulations and would indirectly reduce impacts on public health and safety (e.g., via adherence to 25 CFR, Part 226). However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level. The No Action Alternative would not provide a county-wide framework that site-specific NEPA analyses could be tiered to. This could result in fragmented decision-making, which may increase impacts on public health and safety.

4.11.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. This would minimize impacts on public health and safety from oil and gas development across the planning area. For example, requiring specific plans and training for workers would reduce the risk of hazardous material exposure and injury.

Spill prevention measures would reduce the potential for hazardous material exposure. Improved signage and site security practices would likewise minimize risks to workers and the general public. Controlling noise near private landowners or neighbors would reduce noise exposure to sensitive receptors in those areas. (Impacts from noise are described in detail in **Section 4.13**.) Fire risk would be reduced via measures that control vegetation, promote safe storage and use of flammable materials, and educate workers on the risk of accidental ignitions resulting from vehicle use, cigarette smoking, and other practices.

Prohibiting gas venting or flaring without prior written approval from the BIA Osage Agency Superintendent would reduce the risk of exposure to hydrogen sulfide gas and other stack emissions. Overall, impacts of oil and gas activities on public health and safety under Action Alternative 1 would be reduced, compared to the No Action Alternative, if similar protective measures were not applied on a site-specific basis under the No Action Alternative.

4.11.5 Action Alternative 2

Impacts under Action Alternative 2 would be similar to those under Action Alternative 1, with additional measures to reduce adverse impacts on public health and safety. Additional groundwater sampling requirements could better protect drinking water by detecting contaminants that pose a threat to public health. This protection would occur only where drinking water is obtained from groundwater resources, such as wells.

Additional restrictions on noise levels would protect public health by reducing exposure to increased noise levels, including limiting construction within half a mile of a residence or campground to weekdays from 7:00 a.m. to 7:00 p.m. (Impacts from noise are described in detail in **Section 4.13**.)

4.11.6 Cumulative Impacts

The cumulative impact analysis area for public health and safety is the planning area. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect public health and safety are those projects and activities that result in exposure to hazards or hazardous materials.

Alternatives Analysis

The incremental impact of implementing any of the alternatives would be a reduction in adverse impacts on public health and safety because of the conservation measures applied under each alternative. This reduction would be greatest under Action Alternative 2 because it has the most measures to protect public health and safety. Implementing any of the alternatives would have no effect on risks or exposure associated with other activities, such as transportation, new development, or quarrying. Implementing Action Alternative 1 or Action Alternative 2 would reduce risks from wildfire, as described in Action Alternative 1, above. This may assist with achieving goals and objectives in the BIA Eastern Oklahoma Region Fire Plan.

4.12 Visual Resources

4.12.1 Methods and Assumptions

The temporary direct effects on visual resources described in **Section 4.12.2**, below, would last only during construction; then all equipment would be removed, and staging, storage, and construction areas would be reclaimed to a pre-disturbance condition. Therefore, the impacts on visual resources described for each alternative in the following sections focus on the permanent or long-term effects of implementing certain RCMs.

Indicator

The indicator of impacts on visual resources is changes in the characteristic landscape (e.g., form, line, color, and texture) compared to current conditions.

Assumption

The severity of a visual effect depends on a variety of factors, including the size of a project (i.e., area disturbed and physical size of structures), the location and design of access roads, the overall visibility of disturbed areas, and the proximity to the viewer.

4.12.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Temporary direct effects on visual resources would occur from construction and ground disturbance at well pads, access roads, and pipelines. The effects would occur for a short period, such as weeks or months. Construction would disturb the ground surface and remove vegetation. This would affect visual resources by denuding the land. Also, ground disturbances would affect visual resources by creating exposed soil with a different texture and color than undisturbed soil. Depending on growing conditions, trees and shrubs may not regenerate quickly, which would affect the timeline for reclaiming disturbed areas.

Disturbing the ground would also generate dust from vehicles and excavation being blown across exposed soil. Fugitive dust would affect visual resources by diminishing atmospheric clarity. This effect would persist until the dust settles or is blown elsewhere.

Construction lighting would reduce nighttime darkness which would affect nighttime activities, such as stargazing. Reflective surfaces on construction equipment and vehicles create glare. The intensity and amount of glare would vary, depending on the intensity of sunlight and the time of day. This would affect visual resources by adding artificial points of illumination not found naturally in the landscape.

During construction, views of a project's area would be cluttered with construction equipment and materials and temporary support infrastructure, such as pipes, pits, fences, flagging, and stream crossings. The color and geometric, boxy forms of construction materials and equipment would contrast with the rolling form of the terrain and the vegetation. The rigid vertical elements would create various focal points on a mostly open landscape and would not mimic other landscape elements, which are mostly vegetation and rolling hills. The color of construction equipment and vehicles would not resemble the muted tans and greens of the terrain and vegetation.

Long-term effects are those associated with the operation of oil and gas lease sites. Long-term direct effects on visual resources would occur from operating and maintaining sites and facilities. The effects on visual resources would remain through the life of the operations, until a site is abandoned and reclaimed. The visibility of the features described below would vary, depending on viewer distance and location, topography, color and composition of facilities, and screening vegetation.

New roads would add artificial elements to undeveloped areas. Improving roads typically enhances the contrast of the road with the adjacent landscape. Roads lack vegetation and create an abrupt vegetation edge along the roadside. Smooth roads would stand out against the moderately coarse texture of the terrain. This would affect visual resources by dividing the landscape with areas that lack vegetation and by altering the natural topography and the texture and color of the land surface.

New pipelines and electrical lines would add artificial elements to undeveloped areas. The form, line, and texture of these structures would not resemble nearby structures, unless they were collocated with similar structures. In particular, pipelines would divide the landscape with strips of land lacking vegetation, and electrical lines would introduce prominent vertical elements.

Well pads and facilities, such as flowback pits and compressor stations, would add artificial elements to undeveloped areas. These areas would be cleared of vegetation, thereby leaving a clearing that contrasts with the surrounding landscape. The form, line, color, and texture of these facilities would not resemble nearby structures, unless they were collocated with similar existing industrial facilities. Also, the well pads and facilities would be sources of activity and commotion that are not typically found in undeveloped areas.

Lights may be installed for safety and to illuminate work areas, such as drilling rigs, at night. This would reduce nighttime darkness by adding light to areas lacking artificial light. As a result, this would diminish opportunities for viewing visual resources between dusk and dawn, particularly stargazing opportunities.

Under all alternatives, the BIA would apply RCMs to oil and gas permits to ensure compliance with applicable laws and regulations and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs could incidentally reduce impacts on visual resources if they reduce ground disturbance or result in placement of facilities in less visually intrusive locations.

4.12.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover

PEA for a list of activities within its scope). Several of these measures would incidentally minimize or exaggerate impacts on visual resources.

Visual impacts of workovers would continue to be limited by the limitations on siting and disturbance, such as the following:

- Preventing stream channel and wetlands modifications
- Restricting vehicles to existing roads, where possible
- Limiting disturbance to the historic footprint of well pads
- Requiring prompt reclamation of sites

Measures requiring enclosures, such as fences, would exaggerate long-term visual impacts on landscapes that do not have similar features in terms of form, line, color, and texture.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would impact visual resources in a manner similar to that described for the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. As described in **Section 4.12.2**, these RCMs would ensure compliance with applicable laws and regulations and could reduce impacts on visual resources if they were to reduce ground disturbance or result in placement of facilities in less visually intrusive locations. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.

The No Action Alternative would not provide a county-wide framework that site-specific NEPA analysis could be tiered to. This could result in fragmented decision-making, which may increase impacts on these resources.

4.12.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. The RCMs described under the No Action Alternative as applicable for workovers would be applied to all oil and gas activities.

Temporary and long-term visual impacts would be further reduced, compared with the No Action Alternative, because lessees proposing activities that would cause new visual impacts would be required to consult with surface owners to mitigate those impacts. Additional measures would minimize long-term impacts by requiring reclamation and remediation to restore natural conditions, return a disturbed area to its original contour, and remove visual clutter, such as equipment and infrastructure.

RCMs applied under Action Alternative 1 would also have indirect impacts on visual resources. For example, burying power lines where feasible and appropriate, given other resource protection needs, would reduce the visibility of these large, highly visible linear features on the landscape. However, requiring signage and additional drainage systems and stockpiling topsoil would indirectly impact visual resources by adding features to the visual landscape, increasing disturbance footprints, and modifying the landscape to be a different color, texture, and form.

The impacts of stockpiling topsoil would be short term, but impacts of signage and drainage systems would be long term. Overall, impacts of oil and gas activities on visual resources under Action Alternative 1 would be reduced, compared to the No Action Alternative, if similar RCMs were not applied on a site-specific basis under the No Action Alternative.

4.12.5 Action Alternative 2

Impacts on visual resources under Action Alternative 2 would be similar to those under Action Alternative 1; however, additional RCMs would apply under Action Alternative 2 that would further minimize impacts of oil and gas activities on visual resources.

The more specific consultation requirement under Action Alternative 2 may reduce long-term visual impacts of oil and gas activities. Additionally, measures applied for minimizing impacts on other resource areas under Action Alternative 2 would have incidental impacts by reducing impacts on visual resources. The following measures would all reduce impacts of oil and gas activities on visual resources:

- Reduce habitat fragmentation
- Maintain natural landscapes
- Reduce surface disturbance
- Avoid placing structures on hilltops or ridges
- Protect cultural resources

4.12.6 Cumulative Impacts

The cumulative impact analysis area for visual resources is the planning area. Past, present, and reasonably foreseeable future actions and conditions within the cumulative impact analysis area that have affected and will likely continue to affect visual resources are those that have caused, are now causing, or would later cause surface disturbance or create large human-made modifications on the landscape.

Past and present oil and gas development and mineral leasing have disturbed the surface, thereby altering the natural visual conditions of the area. Large human-made modifications, such as those from infrastructure projects, could alter the visual resources in the planning area by creating linear disturbances in the landscape. The proposed projects that would affect the visual landscape in this way are wind farms, a water tower, transportation routes, and buildings.

These actions, in addition to the continued oil and gas development proposed under all alternatives, would cumulatively exaggerate impacts on visual resources in the planning area.

Alternatives Analysis
Under the No Action Alternative, trends for visual resources, as described in **Section 3.12.3**, are likely to continue, as no additional RCMs or other restrictions on oil and gas activities would be implemented. The cumulative visual impacts of oil and gas development, in combination other infrastructure projects described in **Table 4-1**, would be greatest under this alternative.

Under the action alternatives, applying standardized RCMs would reduce impacts on visual resources, compared to the No Action Alternative if it did not require similar site-specific measures. However, the impacts from infrastructure projects described in **Table 4-1**, which are outside of the scope of this EIS, would be the same. Cumulative effects would likely be least under Action Alternative 2. This is because it would implement the most restrictive RCMs to minimize impacts on visual resources from oil and gas development across the planning area.

4.13 NOISE

4.13.1 Methods and Assumptions
Noise from developing and operating gas wells and constructing associated infrastructure could impact sensitive land uses and users in the planning area.

Indicator
The indicator of impacts on noise is the level of noise generated by oil and gas activities

Assumptions
- Actual noise levels at sensitive receptor locations would depend on the exact locations of wells and related infrastructure, the level of development activity, and the local topography.

- The duration of noise impacts is based on the following average drilling times:[4]
  - A 4,500-foot horizontal well (the average size for Osage County) in the tight Mississippi Chat would take 14 to 21 days drilling time.
  - A 4,200-foot vertical well drilled to the granite layer in the western side of the county (the deepest part of Osage County) would take 10 to 14 days.
  - Most disposal wells are drilled to a formation slightly above the granite layer and so would take 10 to 14 days to drill.
  - A vertical well in the eastern part of the county (the shallowest part of Osage County) can be drilled in a week or less.
  - Well drilling and completion would take at most 60 hours (5 days), plus time for mobilization and demobilization.

4.13.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Noise resulting from oil and gas production could affect sensitive receptors in the planning area, including residents, recreationists, and wildlife (the potential noise impacts on wildlife are addressed separately in **Section 4.5**, Fish and Wildlife). The magnitude of the effect would depend on the distance between the receptor and the noise source, the duration and frequency of the noise, and the time of the noise (noise is viewed as more disruptive at night). In addition, individuals react differently to changes in ambient noise levels and to various types of sound; therefore, the perceived level of impact may vary by receptor.

Noise under all alternatives would occur from construction and operations. Construction would increase short-term, localized, and intermittent ambient noise levels, while operations may increase long-term ambient noise levels over the life of the project.

Sources of noise are construction (earth-moving equipment for well drilling, roads, well pads, compressor stations, electrical lines, and pipelines), vehicle traffic, and operation (production); see **Table 4-4**.

Construction activities would require the use of earth-moving equipment (e.g., bulldozers, graders, and backhoes), heavy trucks (e.g., dump trucks and water trucks), generators, and air compressors at the construction site. Noise from

[4]Galen Crum, Osage Minerals Council, e-mail to Katie Patterson, EMPSi, and Jeannine Hale, BIA Osage Agency, on June 16, 2015.

Table 4-4
Noise Levels for Oil and Gas Activities

Noise Source	Noise Level
Typical compressor station	50 dBA (375 feet from property boundary)
Pumping units	50 dBA (325 feet from well pad)
Fuel and water trucks	68 dBA (500 feet from source)
Crane for hoisting rigs	68 dBA (500 feet from source)
Concrete pump used during drilling	62 dBA (500 feet from source)
Average well construction site	65 dBA (500 feet from source)

Source: Earthworks 2015

construction is assumed to be short term but would be loud and constant. In addition, heavy truck and personal vehicle traffic would increase along area roadways to bring personnel and supplies to the staging and construction sites. Noise from these activities would be short term and intermittent. For access roads, electrical lines, and pipelines, the construction equipment would not remain in one location for a long period, given the linear nature of this type of development. These facilities would be constructed during working hours, which would not affect nighttime ambient noise levels.

The primary noise sources associated with drilling are large diesel engines that power the rotary rig and pumps and the large diesel-driven air compressors. In addition, heavy truck and personal vehicle traffic would increase along area roadways to bring personnel and supplies to the well site.

The primary sources of noise during operation are natural gas or electric pumps at each well, natural gas-fired internal combustion engines to power the compressors at each compressor station, and intermittent traffic related to operations and maintenance. In addition, periodic workovers would be needed to correct problems with producing wells, and road maintenance would occur to replace surface materials and apply dust abatement.

Table 4-4 shows typical noise levels associated with oil and gas activities. Actual noise levels at a given location depend on the topography, atmospheric conditions (temperature, wind speed and direction, and humidity), and the vegetation in the vicinity (which can absorb sound) and any structures between a noise source and a noise receptor.

Under all alternatives, the BIA would apply RCMs to oil and gas permits to ensure compliance with applicable laws and regulations, such as the ESA and Section 106 of the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs could incidentally reduce impacts on noise resources if they were to reduce vehicle traffic or relocate noise sources away from sensitive receptors.

4.13.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). Some of these measures would incidentally reduce noise impacts. For example, confining vehicles and equipment to existing roads where possible would reduce noise impacts of workovers because impacts would be concentrated to these areas. Avoiding areas with NRHP-eligible or unevaluated cultural resources would reduce noise impacts because these areas would be avoided altogether.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would impact visual resources in a manner similar to that described for the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. As described in **Section 4.13.2**, these RCMs would ensure compliance with applicable laws and regulations and could reduce noise impacts if they were to reduce vehicle traffic or relocate noise sources away from sensitive receptors. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level. The No Action Alternative would not provide a county-wide framework that site-specific NEPA analysis could be tiered to. This could result in fragmented decision-making, which may result in increased impacts on these resources.

4.13.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. In addition, RCMs requiring noise control, noise buffers, noise mufflers, and submersible pumping units would be applied to reduce long-term noise impacts. Overall, noise impacts of oil and gas activities under Action Alternative 1 would be reduced, compared to the No Action Alternative, if similar RCMs were not applied on a site-specific basis under the No Action Alternative.

4.13.5 Action Alternative 2

Impacts from noise under Action Alternative 2 would be similar to those under Action Alternative 1; however, additional RCMs would apply under Action Alternative 2 that would further reduce long-term noise impacts. For example, lessees would be required to take affirmative steps to reduce sound levels in situations where noise could disturb wildlife and other sensitive receptors to mitigate noise impacts of oil and gas activities. Noise reduction measures would be required if a proposed activity's noise is above a certain level. Limiting construction to daytime hours would minimize temporary noise impacts on sensitive receptors.

Other RCMs would indirectly reduce noise impacts on sensitive receptors. For example, the measure to restrict vehicle traffic to protect breeding prairie chickens would minimize temporary and long-term impacts. This is because vehicle noise would be limited during certain times.

4.13.6 Cumulative Impacts

The cumulative impact analysis area for noise is the planning area. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area are those that have increased, are now increasing, or would later increase short-term noise from construction activities. This also includes increased long-term noise from infrastructure with noise-emitting sources.

The construction of proposed wind farms, a water tower, transportation routes, and buildings would have short-term but loud and constant noise impacts on the planning area. Proposed actions to create new transportation routes would have long-term impacts on the planning area by expanding the area for noise-emitting vehicles. These actions, in addition to the continued oil and gas development proposed under all alternatives, would cumulatively exaggerate noise impacts in the planning area.

Alternatives Analysis

Under the No Action Alternative, noise trends described in **Section 3.13.3** are likely to continue. This is because no additional RCMs or other restrictions on oil and gas activities would be implemented. The cumulative impacts of oil and gas development, in combination with construction and infrastructure projects described in **Table 4-1**, would be greatest under this alterative.

Under the action alternatives, standardized conservation measures would reduce noise impacts, compared to the No Action Alternative if it did not require similar site-specific measures. However, the impacts from implementing construction and infrastructure projects in **Table 4-1**, which are outside of the scope of this EIS, would be the same. Cumulative effects would be least under Action Alternative 2, which would implement the most restrictive RCMs to minimize noise impacts from oil and gas development across the planning area.

4.14 Land Use Plans, Utilities, and Timber Harvesting

4.14.1 Methods and Assumptions

Indicators

Indicators of impacts on land use plans, utilities, and timber harvesting are as follows:

- Actions that influence the ability to carry out land use planning described in existing land use plans
- Actions that increase, reduce, or eliminate the demand for new utilities (e.g., from oil and gas development)
- Actions that increase, reduce, or eliminate opportunities for timber harvesting

Assumptions

- Land use planning authority on tribal trust lands resides with the Osage Nation; Osage County maintains authority on non-tribal lands.
- All future utility development on non-tribal lands will be consistent with existing state and local plans, such as the 2030 Osage County Comprehensive Plan.
- The demand for new utilities, especially underground pipeline infrastructure, will increase over time as new oil and gas production wells are developed.
- The demand for new electrical transmission infrastructure will increase in response to new wind energy development in and next to the planning area.
- Residential and commercial development will continue to be rural, with the exception of the far southeastern portion of the planning area. The demand for new utility development in this area will be greater compared to the remainder of the planning area.
- The availability of and demand for timber for harvesting will remain steady or will gradually decline over time.

4.14.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Osage County would retain land use planning authority for non-tribal lands in the planning area, while the Osage would retain such authority on tribal lands. Within its jurisdiction, the BIA would continue to oversee the administration of land entitlements.

Under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA and Section 106 of the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected.

Utility development would continue to be allowed according to the existing land use plans under all alternatives. Direct impacts on timber harvesting for all alternatives would include the following:

- Removing wood, plants, and seeds
- Creating roads or trails for equipment
- Increasing traffic on roads from transporting products, potentially introducing invasive or noxious weeds
- Spreading invasive or noxious weeds by equipment or foot traffic
- Trampling understory vegetation
- Compacting soil

Indirect effects would be increasing the spread of invasive or noxious weeds (colonization of bare mineral soil), reducing regeneration rates where seed material has been removed, and increasing the abundance and vigor of native understory vegetation.

4.14.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope).

Existing and proposed oil and gas and wind energy development would continue to increase the need for new or expanded utilities, such as pipelines and electrical distribution and transmission lines. RCMs, such as filling and leveling temporary pits immediately on completion of the activity, would continue to be implemented. This would ensure that lands are reclaimed for other land uses and developments in a timely manner. Other RCMs, such as avoiding or minimizing soil and vegetation disturbance, could limit development of facilities or transmission lines in certain areas.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would impact land use plans, utilities, and timber harvest in a manner similar to that described for the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. As described in **Section 4.14.2**, these RCMs would ensure compliance with applicable laws and regulations and could reduce conflict with timber harvesting where development occurs in or near the area of harvestable timber. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level. The No Action Alternative would not provide a county-wide framework that site-specific NEPA analyses could be tiered to. This could result in fragmented decision-making, which may result in increased impacts on these resources.

4.14.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. Management actions proposed under Action Alternative 1 would result in additional restrictions on oil and gas development, such as siting and timing limitations to protect sensitive wildlife or additional requirements for erosion prevention. Limitations on these activities could result in changed siting, compared to the No Action Alternative. Changes in the location of oil and gas facilities could reduce the demand for new utilities, such as pipelines, compared to the No Action Alternative. Requiring lessees to identify existing surface and underground utilities and avoid accidental damage would reduce conflicts with or damage to these utilities.

Compared to the No Action Alternative, additional restrictions on oil and gas development under Action Alternative 1 would reduce the potential for conflict with timber harvesting and wind energy development. This would happen if similar RCMs were not applied on a site-specific basis under the No Action Alternative.

4.14.5 Action Alternative 2

Impacts on utilities and timber harvesting under Action Alternative 2 would be similar to those under Action Alternative 1; however, additional restrictions on oil and gas development, such as additional siting limitations in important grassland habitat, could result in a slightly lower demand for new utilities and a slightly lower potential for conflict with timber harvesting and wind energy development.

4.14.6 Cumulative Impacts

The cumulative impact analysis area for land use plans, utilities, and timber harvesting is the planning area. Cumulative impacts are past, present, and reasonably foreseeable future actions that increase or decrease the demand for land use authorizations and timber harvesting or prompt the need for new or revised land use plans. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect land use plans, utilities, and timber harvesting are oil and gas and renewable energy development. These actions have placed and will continue to place demands on the BIA realty program through right-of-way applications for transmission lines, roads, and pipelines.

There are currently 1,000 miles of pipelines used predominately for crude oil and natural gas transportation in the planning area (NPMS GIS 2015). Oil and gas production in the planning area is expected to increase in the next 20 years, resulting in the need for additional land use authorizations, and potentially new or revised local land use planning documents, to support that development.

Alternatives Analysis

All alternatives would include RCMs to protect soils, vegetation, visual resources, cultural resources, and special status species. Some measures would limit the locations where new authorizations could be approved, while others would ensure that lands are reclaimed for other land uses and development in a timely manner. The cumulative impacts of oil and gas development on land use plans, utilities, and timber harvest would be reduced under the action alternatives, which would impose siting requirements that would limit conflicts between oil and gas activities and other land uses.

4.15 TRAFFIC AND TRANSPORTATION

4.15.1 Methods and Assumptions

Indicators

Indicators of impacts on traffic and transportation are as follows:

- Unsafe conditions on public roadways, such as limited access, inadequate parking, poor design, reduced sight distance, slow vehicles, and damaged public roads
- Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation, including mass transit and nonmotorized travel, and relevant components of the circulation system, including intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit

Assumption

Implementing RCMs would not affect the eligibility of roads for inclusion in the Tribal Transportation Program.

4.15.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Effects on traffic and transportation may occur from physical changes to roads (such as deterioration from overuse), leasing and development, additional traffic on local roads, or changes in traffic volumes. Changes in road condition and traffic can increase the risk of vehicle collisions. Under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA and Section 106 of the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs could reduce impacts on traffic and transportation if they were to improve road maintenance and safety.

4.15.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). Applying these RCMs would reduce impacts on traffic and transportation by requiring lessees to maintain and upgrade roads as needed. Maintaining and upgrading new roads according to BIA direction and agreements between the lessee and surface owners would ensure an adequate level of standard to facilitate current and anticipated traffic levels and to reduce damage to public roads.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would help reduce impacts on traffic and transportation from new oil and gas leases in a manner similar to that described for activities within the scope of the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. As described in **Section 4.15.2**, these RCMs would ensure compliance with applicable laws and regulations and could reduce impacts on traffic and transportation. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.

The No Action Alternative would not provide a county-wide framework that site-specific NEPA analyses could be tiered to. This could result in fragmented decision-making, which may result in increased impacts on these resources. For example, where RCMs are not applied, the potential exists for unrepaired damage to public roads and increased risk of vehicle collisions due to inadequate signage.

4.15.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities, including non-permitted lease activities, workover activities, and APDs and other permitted activities. This would reduce impacts on traffic and transportation if similar RCMs were not applied on a site-specific basis under the No Action Alternative.

Several RCMs applied under Action Alternative 1 would affect traffic and transportation. Placing warning signs at turnoffs from high traffic areas and along roads close to schools would reduce the potential for vehicle collisions. Incorporating adequate drainage systems for new roads would prevent rutting and reduce damage to public roads.

Implementing Action Alternative 1 is not expected to measurably increase traffic levels on roads in Osage County. This is because this alternative does not make additional lands available or unavailable to leasing or development.

Compatibility with applicable traffic and transportation plans, ordinances, and policies would be determined on a case-by-case basis. Implementing the RCMs proposed under Action Alternative 1 would not conflict with plans, ordinances, and policies.

4.15.5 Action Alternative 2

Impacts under Action Alternative 2 would be similar to those under Action Alternative 1, except there would be an RCM restricting vehicle traffic in the vicinity of prairie chicken booming grounds (leks). Prohibiting vehicle traffic on r

oads within 1,640 feet of booming grounds from two hours before sunrise until three hours following sunrise, from March 1 to May 31, would shift traffic patterns during that part of the year. Vehicles would be shifted onto roads away from booming grounds.

Traffic levels may also increase, starting three hours after sunrise. As a result, congestion may occur on those roads that provide a detour around booming grounds during the hours nearest sunrise. More congestion than usual may also occur later in the morning if traffic were to be shifted to the period after the closure is lifted. Congestion would be limited between March 1 and May 31 because there would be no restrictions during other times of the year. Whether affected vehicle operators detour around the booming ground buffer or delay their travel until later in the morning when the restriction is lifted depends on such factors as the exact location of booming grounds and whether there are adequate detours.

Prairie chicken concentrations are highest in northwest Osage County, so impacts on traffic and transportation would be greater in this area. Roads that may be impacted by the booming grounds restriction are US Highway 60 and State Highways 11 and 18 in northwest Osage County. Public access would not be affected, but oil and gas-related vehicle operators would need to avoid these and other roads if they are shown to be within 1,640 feet of a booming ground.

Impacts on traffic levels and conflicts with applicable plans, ordinances, and policies would be the same as under Action Alternative 1.

4.15.6 Cumulative Impacts

The cumulative impact analysis area used to analyze cumulative impacts on traffic and transportation is the planning area. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect traffic and transportation are transportation plans and projects and other activities that introduce additional traffic on roads in the county.

Alternatives Analysis

Implementing any of the alternatives would not change the level of traffic in the county. RCMs would shift the traffic patterns of oil and gas-related vehicles and may improve driver safety due to improved signage. Along with road repair and maintenance and planned new road construction, this may help the county achieve transportation planning goals.

4.16 MINERAL EXTRACTION

4.16.1 Methods and Assumptions

Indicators

Indicators of impacts on mineral extraction are as follows:

- Prohibiting drilling in sensitive areas to protect other resources
- Applying RCMs that restrict the timing, location, or methods of oil and gas development

Assumptions

- Management actions proposed under the alternatives would apply to oil and gas activity wherever the BIA administers the subsurface mineral estate, regardless of who owns the surface.
- RCMs applied to permits would not eliminate all reasonable opportunity to develop a lease.
- Because the actions under all alternatives apply only to oil and gas development, solid mineral extraction in the planning area would not be impacted by the actions analyzed in this EIS. Therefore, only impacts on oil and gas development are discussed in this section.
- As described in **Section 3.16.3**, Mineral Extraction, *Trends*, oil and gas activity in the planning area is expected to increase over the next 20 years, particularly in areas with high or moderate-to-high development potential.

4.16.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing and development would continue to occur in the planning area. However, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA and Section 106 of the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs could limit the siting, design, or timing of oil and gas extraction in the planning area. However, the amount of oil and gas development in the planning area is not likely to change, based on the alternative selected. The action alternatives would streamline the permitting process but are unlikely to impact the level of leasing or development in the planning area.

4.16.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). Applying these RCMs would restrict operations and siting for these activities. However, these measures would not reduce the overall number of workover operations in the planning area.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would restrict operations and siting for activity on new oil and gas leases.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. As described in **Section 4.16.2**, these RCMs would ensure compliance with applicable laws and regulations and could limit the siting, design, and timing of oil and gas extraction activities in the planning area. However, because measures would be applied on a site-specific basis, lessees would continue to face uncertainty regarding the requirements for their operations.

The permitting process for activities outside the scope of the Leasing PEA and the Workover PEA would remain extended. This would be due to the need to fully evaluate site conditions and to identify RCMs to be applied. This could cause delays for oil and gas development in the planning area.

4.16.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities. While these measures could restrict oil and gas development in a manner similar to the RCMs applied under the No Action Alternative, identifying the measures to be applied up front would provide additional certainty to lessees. Lessees would know the requirements for permits in advance of permit application and would be better able to plan the timing of development and allocation of resources.

Exceptions would be granted where an RCM is not applicable or where the lessee proposes an alternative action that better meets the intent of the RCM. These exceptions would mitigate impacts on oil and gas activities from RCMs where they are not best suited to site-specific circumstances. Additionally, individual permitting processes would be streamlined because less site-specific analysis and identification of RCMs would be required at the permitting phase.

4.16.5 Action Alternative 2

Similar to Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities; however, it would apply additional RCMs to areas with known sensitive resources. These measures would provide the most certainty to lessees and would result in the most streamlined permitting process of all the alternatives.

The requirement for baseline and follow-up sampling of drinking water wells near proposed oil and gas wells could also protect lessees from liability for groundwater contamination, if the contamination were shown to predate the well. However, management under this alternative may also be the most restrictive for oil and gas development if site-specific measures applied under the other alternatives did not apply similar restrictions. While this management could increase costs and alter siting, design, and timing of development, it would not decrease the level of oil and gas development in the planning area.

4.16.6 Cumulative Impacts

The cumulative impact analysis area used to analyze cumulative impacts on mineral extraction is the planning area. Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect oil and gas activities are other planned land use projects, such as wind farm or casino construction, that may conflict with oil and gas development.

Alternatives Analysis

Under the No Action Alternative, current trends for oil and gas activities in the planning area would continue. Because the planned projects listed in **Table 4-1** are already permitted or pending, they are unlikely to conflict with planned oil and gas development no matter what alternative is selected. Therefore, management of oil and gas development under the alternatives is not expected to have cumulative impacts beyond the direct impacts described under each alternative in this section.

4.17 Recreation and Special Use Areas

4.17.1 Methods and Assumptions

Indicators

Indicators of impacts on recreation and special use areas are as follows:

- Short- or long-term elimination or reduction of recreation opportunities, activities, or experiences throughout the planning area
- Inability of special use areas (e.g., state parks and wildlife management areas) to provide desired recreation activities and opportunities

Assumption

Recreation in the planning area will continue as populations grow, with an anticipated increase in motorized recreation, wildlife viewing, hiking, and camping.

4.17.2 Impacts Common to All Alternatives

Under all alternatives, oil and gas leasing would occur, which would lead to oil and gas production. Continued and increased oil and gas production would include increasing developments and infrastructure that could conflict with desired recreation activities and experiences, thereby reducing opportunities for recreation.

Under all alternatives, the BIA would apply RCMs to oil and gas activities to ensure compliance with applicable laws and regulations, such as the ESA and Section 106 of the National Historic Preservation Act, and to prevent environmental degradation. These measures may be applied on a case-by-case basis or up front, or a combination of both, depending on the alternative selected. Applying these RCMs could reduce impacts on recreation and special use areas if it were to relocate surface disturbance away from these areas.

4.17.3 No Action Alternative

Under the No Action Alternative, the BIA would apply the BMPs listed in Section 5.1 of the Workover PEA as mandatory RCMs for all activities within the scope of the Workover PEA (BIA 2015a; see Section 1.2 of the Workover PEA for a list of activities within its scope). These RCMs would ensure compliance with applicable laws and regulations and could reduce impacts on recreation and special use areas. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.

For new oil and gas leases, the BIA may choose to apply appropriate BMPs listed in Appendix 1, Section 7.13, of the 2014 Leasing PEA as mandatory RCMs (BIA 2014). If the BIA were to apply these measures, they would impact recreation and special use areas in a manner similar to that described for the Workover PEA.

For APDs and other permit applications outside the scope of the Leasing and Workover PEAs, the BIA would continue to issue permits based on site-specific NEPA analysis and would apply RCMs on a case-by-case basis. As described in **Section 4.17.2**, these RCMs would ensure compliance with applicable laws and regulations and could reduce impacts on recreation and special use areas. However, the extent of reduction in impacts cannot be known until a site-specific NEPA analysis is conducted on the specific measures to be applied at the project level.

The No Action Alternative would not provide a county-wide framework to which site-specific NEPA analyses could be tiered. This could result in fragmented decision-making, which may result in increased impacts on these resources. The lack of requirements to consistently apply RCMs would result in the continued risk of conflict with recreation activities and opportunities, particularly when leasing and development occurs near special use areas or other important recreation areas.

4.17.4 Action Alternative 1

Under Action Alternative 1, the BIA would apply standardized RCMs to all oil and gas activities. RCMs applied under this alternative would provide more indirect benefits to recreation than the No Action Alternative if similar requirements were not applied on a site-specific basis under the No Action Alternative.

Minimizing the use of virgin surface water and groundwater needed for drilling and hydraulic fracturing of wells would indirectly benefit recreation by ensuring water levels in lakes, rivers, and reservoirs are adequate for water recreation, such as boating and jet skiing. Requiring reclamation of wells no longer in production no later than 90 days after rig removal would benefit recreation by ensuring areas are available for recreation as soon as possible. Limiting noise that could disturb wildlife, livestock, and private landowners or neighbors would enhance recreation by reducing human noises that could interfere with recreation, such as wildlife viewing.

4.17.5 Action Alternative 2

Impacts under Action Alternative 2 would be the same as those described under Action Alternative 1. Although more specific RCMs would be added under Action Alternative 2, none of these measures would be specific to recreation, so any additional beneficial impacts on recreation would be indirect and minimal.

4.17.6 Cumulative Impacts

The cumulative impact analysis area for recreation and special use areas is the planning area and all wildlife management areas that intersect it. The cumulative effects analysis area also extends along major roads, trails, and rivers where management inside the planning area could impact use outside the planning area boundary.

Past, present, and reasonably foreseeable future actions and conditions in the cumulative impact analysis area that have affected and will likely continue to affect recreation and special use areas are construction of infrastructure for oil and gas and other energy development, such as transmission lines, pipelines, and wind farms. These activities have the potential to affect game populations, which in turn would impact potential recreation benefits (e.g., wildlife viewing and hunting) because of the loss or gain of the number of animals.

Alternatives Analysis

Management of vegetation, wildlife, and wild horses and burros that implements strategies to protect or rehabilitate areas would serve to maintain recreation experiences but could also restrict recreation access. Cumulative impacts would vary by the degree of protective management and use restrictions under the RCMs proposed by each alternative. In general, cumulative impacts of oil and gas development on recreation and special use areas overlapping the planning area would be the lowest under the action alternatives. This would be due to the application of RCMs that would reduce conflicts with recreation and enhance recreation experiences.

4.18 Unavoidable Adverse Impacts

Section 102(2)(C) of NEPA requires disclosure of any adverse environmental effects that cannot be avoided should the proposal be implemented. Unavoidable adverse impacts are those that remain following the implementation of mitigation measures or impacts for which there are no mitigation measures. Some unavoidable adverse impacts occur as a result of implementing the EIS. This section summarizes major unavoidable impacts; discussions of the impacts of each management action (in the discussion of environmental consequences) provides greater information on specific unavoidable impacts.

Surface-disturbing activities would result in unavoidable adverse impacts. Although these impacts would be mitigated to the extent possible with the implementation of RCMs, unavoidable damage would be inevitable. Long-term conversion of areas to oil and gas development uses would increase erosion and change the relative abundance of species within plant communities, the relative distribution of plant communities, and the relative occurrence of seral stages of those communities. Oil and gas development would also introduce surface structures, which could affect the visual landscape in the long term.

Unavoidable damage to cultural and paleontological resources from permitted activities could occur if resources undetected during surveys were damaged or destroyed during ground-disturbing activities. In these instances, further activities would be required to cease, and the resource would be mitigated to minimize data loss. Unavoidable loss of cultural and paleontological resources due to lack of knowledge, lack of information and documentation, erosion, casual collection, and inadvertent destruction or use would also occur. Unavoidable damage to buried cultural resources could occur, particularly during construction.

4.19 Irreversible and Irretrievable Commitment of Resources

Section 102(2)(C) of NEPA requires a discussion of any irreversible or irretrievable commitments of resources that are involved in the proposal should it be implemented. An irretrievable commitment of a resource is one in which the resource or its use is lost for a period of time, such as extraction of any locatable mineral ore or oil and gas. An irreversible commitment of a resource is one that cannot be reversed, such as the extinction of a species or disturbance to protected cultural resources.

Oil and gas extraction eliminates a nonrenewable resource, thereby resulting in irreversible and irretrievable commitment of the resource. Surface disturbance associated with energy development is reclaimed after the resource is removed. However, surface disturbances from gas storage and road rights-of-way is a long-term encumbrance of the land. Although new soil can develop, it is a slow process in many parts of the planning area.

Soil erosion or the loss of productivity and soil structure may be considered irreversible commitments to resources. Surface-disturbing activities, therefore, would remove vegetation and accelerate erosion that would contribute to irreversible soil loss; however, RCMs are intended to reduce the magnitude of these impacts and restore some of the soil and vegetation lost. Laws protecting cultural and paleontological resources would provide for mitigation of irreversible and irretrievable impacts on these resources.

4.20 Relationship Between Local Short-term Uses and Long-term Productivity

Section 102(2)(C) of NEPA requires a discussion of the relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity of resources. As described in the introduction to this chapter, "short-term" is defined as anticipated to occur within one to five years of the activity's implementation; "long-term" is defined as following the first five years of implementation but within the life of the EIS (projected to be 20 years).

Across all alternatives, oil and gas activities would result in various short-term effects, such as increased localized soil erosion, fugitive dust emission, vegetation loss or damage, wildlife disturbance, and decreased visual resource quality. Surface-disturbing activities, such as well pad, road, and pipeline development, would result in the greatest potential for impacts on long-term productivity. RCMs are intended to minimize the effect of short-term commitments and reverse change over the long term.

Short-term use of an area to foster oil and gas activities would result in long-term loss of soil productivity and vegetation diversity. Impacts would persist as long as the surface disturbance and vegetation loss continue. In general, the loss of soil productivity would be directly at the point of disturbance, although long-term vegetation diversity and habitat value could be reduced due to fragmentation and the increased potential for invasive species to spread from the developments or disturbances.

The No Action Alternative would have the greatest potential for short-term loss of productivity and diversity because fewer measures to conserve resources would be applied up front. Action Alternative 1 and Action Alternative 2 would provide greater long-term productivity by implementing more RCMs to proactively protect resources, with Action Alternative 2 providing the greatest protection.

CHAPTER 5
CONSULTATION AND COORDINATION

5.1 INTRODUCTION

In accordance with requirements set forth in the National Environmental Policy Act of 1969 (NEPA), Title 40 Code of Federal Regulations (CFR), Part 1506.3(c) and the Council on Environmental Quality, the US Department of the Interior, Bureau of Indian Affairs (BIA) conducted consultation and coordination when preparing this environmental impact statement (EIS). This was done to ensure that appropriate members of the public, Indian tribes, and federal, state, and local agencies were contacted, consulted, and given an adequate opportunity to be involved in the environmental analysis and EIS process. This chapter describes the internal and public scoping process, tribal consultation, cooperating agency involvement, and additional consultations and public involvement activities.

5.2 PUBLIC SCOPING

The BIA held a formal scoping period to involve the public in identifying significant issues related to the agency's potential land use management actions. The public scoping period was completed as part of the Oklahoma, Kansas, Texas (OKT) Joint EIS/US Department of the Interior, Bureau of Land Management (BLM) Resource Management Plan (RMP) and BIA Integrated RMP scoping period. The scoping period began on July 26, 2013, with the publication of a notice of intent in the *Federal Register* and concluded on January 31, 2014.

Osage County is in the planning area for the OKT Joint EIS/BLM RMP and BIA Integrated RMP. The subject of the Osage County Oil and Gas EIS—oil and gas development in Osage County—was part of the OKT Joint EIS/BLM RMP and BIA Integrated RMP scoping.

The scoping period provided an opportunity for individuals from federal, state, and local agencies, tribes, interest groups, and the general public to express their comments and to provide meaningful input via e-mail, letters, and participation in 17 public scoping meetings. As part of the scoping period, the BIA held a public meeting in Pawhuska, Oklahoma, on January 15, 2014. Six people attended. Meeting materials and the final scoping report are available at the public website for the OKT Joint EIS/BLM RMP and BIA Integrated RMP (http://www.blm.gov/nm/oktrmp). The BIA used the information collected during this scoping period to formulate the alternatives for this EIS.

During the public scoping period, the BLM and BIA received 143 unique written submissions and 2 different form letters, which included 683 unique comments. A breakdown is as follows:

- Members of the general public provided 118 written submissions (82.5 percent)
- Organizations or nonprofit groups submitted 10 comments (7.0 percent)
- Businesses submitted 10 comments (7.0 percent)
- A federal agency provided one written submission (0.7 percent), state agencies provided two written submissions (1.4 percent), and an elected official provided one written submission (0.7 percent). These represent a total of 2.8 percent of the submissions.
- One anonymous comment was received (0.7 percent).

No written submissions were received from tribal governments, educational organizations, or local governments.

To ensure that public comments were properly registered and that none were overlooked, the BLM and BIA used a multiphase management and tracking system. First, written submissions were logged and numbered. Once all comments were received and documented, the BLM and BIA assigned a planning classification to each issue. These classifications detail which issues raised will be resolved through the planning effort. Planning classifications are as follows:

1. Issues that will be resolved in the Joint EIS/BLM RMP and BIA Integrated RMP
2. Issues that will be addressed through BLM or BIA policy or administrative action
3. Issues that are beyond the scope of the Joint EIS/BLM RMP and BIA Integrated RMP that will be considered but not addressed
4. Issues about the Oklahoma/Texas boundary

To assist with the analysis, the BLM and BIA entered comments into a public input and comment tracking database. Staff then organized comments by planning issue categories and commenter affiliation. Finally, these identifiers were queried and tallied to provide information on planning and other issue categories. The BLM and BIA published a scoping report with the results of the comment analysis in June 2014 (available at http://www.blm.gov/nm/oktrmp). Issues relevant to the Osage County Oil and Gas EIS are presented in **Section 1.7**, Issues.

5.3 COLLABORATION

Federal laws require the BIA to consult with certain federal and state agencies and entities and Native American tribes (40 CFR, Subpart 1502.25) during the NEPA decision-making process. The BIA is also directed to integrate NEPA requirements with other environmental review and consultation requirements to reduce paperwork and delays (40 CFR, Subpart 1500.4-5).

In addition to formal scoping, the BIA conducted additional outreach, which included an alternatives listening session, a project website, and maintaining a project mailing list. The BIA will also hold a draft EIS workshop with the public and cooperating agencies. The BIA will continue to meet with interested agencies and organizations throughout the planning process, as appropriate, and will continue coordinating closely with cooperating agencies.

5.3.1 Tribal Consultation

The BIA sent the Osage Nation a written invitation on January 2, 2015, to participate in the EIS on a government-to-government basis. They were invited to participate on a variety of issues related to the EIS, including mineral development and cultural concerns. The BIA attended the following meetings with the Osage Nation and Osage Minerals Council in the spirit of government-to-government consultation:

- November 18, 2014 with the Osage Nation and Osage Minerals Council (introductory consultation meeting for the project)
- November 19, 2014 with the Osage Minerals Council (introduction to project)
- May 5, 2015 with the Osage Minerals Council (discussion of Preliminary Draft Chapter 2, Alternatives)
- May 12, 2015 with the Osage Minerals Council (government-to-government consultation)

The Osage Nation and Osage Minerals Council were also invited to attend all public meetings, as described in **Section 5.4.1**.

5.3.2 Cooperating Agency Involvement

In March 2014, the BLM and BIA wrote to all appropriate local, state, federal, and tribal representatives, inviting them to participate as cooperating agencies and entities for the OKT Joint EIS/BLM RMP and BIA Integrated RMP. At the time these invitations were sent, oil and gas leasing and development in Osage

County was within the scope of the OKT Joint EIS/BLM RMP and BIA Integrated RMP.

After deciding to separate and accelerate the Osage County Oil and Gas EIS, the BIA sent separate written invitations to seven eligible federal agencies, state and local governments, the Osage Nation, and the Osage Minerals Council to participate as cooperating agencies and entities during the development of the EIS. These invitations were sent on January 2, 2015. Those who accepted cooperating agency or entity status for this EIS are the following:

- Environmental Protection Agency Region 6
- The Osage Nation

Cooperating agencies and entities are engaged throughout the planning process, including participating in alternatives development and reviewing and commenting on draft sections of this draft EIS.

The BIA is engaging in formal government-to-government consultation with the Osage Nation. It also is conducting formal Endangered Species Act Section 7 consultation with the US Fish and Wildlife Service and National Historic Preservation Act Section 106 consultation with the State Historic Preservation Officer (SHPO) and the Osage Nation Tribal Historic Preservation Officer (THPO).

5.3.3 National Historic Preservation Act Section 106 Consultation

On January 15, 2015, the BIA notified by mail the Osage Nation THPO, Deputy State Historic Preservation Officer (at the SHPO), and the State Archaeologist (at the Oklahoma Archaeology Survey) of the EIS. This letter invited comment on the potential for historic properties and sensitive cultural properties that may be affected by planning decisions considered in the EIS.

In addition, on March 9, 2015, and at the suggestion of the SHPO, the BIA contacted Preservation Oklahoma, Inc., and the Osage County Historical Museum to notify them of the EIS and request information.

Consultation continued and information was requested throughout the development of the draft EIS, including input on planning actions and alternatives and assessment of the potential effects. The BIA will continue consultation as needed through the completion of the EIS. In accordance with the National Historic Preservation Act, the BIA will make a determination of effect for the planning actions considered in the EIS and will notify the SHPO and Osage Nation THPO for review.

5.3.4 Endangered Species Act Section 7 Consultation

To comply with Section 7(c) of the Endangered Species Act of 1973, the BIA is consulting with the US Fish and Wildlife Service through the development of a biological assessment, prepared concurrently with the draft EIS.

5.4 ADDITIONAL PUBLIC INVOLVEMENT AND SCOPING

5.4.1 Public Meetings

In addition to the scoping meetings described in **Section 5.2**, the BIA hosted additional public meetings to offer the public the opportunity to provide input throughout the EIS process.

The BIA hosted a public listening session on Monday, March 9, 2015, from 4:00 to 6:00 p.m. at the Wah-Zha-Zhi Cultural Center (1449 W. Main, Pawhuska, Oklahoma). The listening session began with a short presentation providing background information on the EIS process and additional detail on the measures that would be included in each alternative. Following the presentation, the BIA invited written comment and verbal input on the draft alternatives from members of the public.

The BIA will also host a public meeting following publication of the draft EIS to provide information on the EIS, to collect written comments, and to answer questions about the process.

5.4.2 Project Website and Email Address

The BIA maintains an interactive website to provide the public with the latest information about the EIS process. The website (http://www.bia.gov/WhoWeAre/RegionalOffices/EasternOklahoma/WeAre/Osage/OSAGEOilGasEIS/) provides background information about the project, a public comment card, information on involvement opportunities, and copies of public information documents, such as the notice of intent and newsletter.

The BIA also created a project e-mail address (osagecountyoilgaseis@bia.gov) for the public to use to offer comments and subscribe to the project mailing list.

5.4.3 Mailing List

The BIA is compiling a mailing list that includes individuals who attend public meetings, those who request to be on the mailing list, and relevant agencies and organizations, including those that were contacted for possible cooperating agency status. Requests to be added to or to remain on the mailing list will continue to be accepted throughout the EIS process.

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CHAPTER 6
LIST OF PREPARERS

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Jenna Jonker	GIS/eGIS Lead
Kate Krebs	Visual Resources
Molly McCarter	Visual Resources; Noise
Katie Patterson	Project Manager; Water Resources; Minerals
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Morgan Trieger	Vegetation, Wetlands, and Noxious Weeds
Drew Vankat	Public Health and Safety; Traffic and Transportation; Recreation, and Special Use Areas
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CHAPTER 7
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CHAPTER 8
ACRONYMS AND GLOSSARY

8.1 ACRONYMS

Acronyms and Abbreviations	Full Phrase
°C	degrees Celsius
°F	degrees Fahrenheit
μg/m³	micrograms per cubic meter
AADT	annual average daily traffic
ABB	American burying beetle
ACS	American Community Survey
AD	Anno Domini
APD	application for permit to drill
APLIC	Avian Power Line Interaction Committee
ARPA	Archaeological Resources Protection Act
BEA	US Department of Commerce, Bureau of Economics
BIA	US Department of the Interior, Bureau of Indian Affairs
BLM	US Department of the Interior, Bureau of Land Management
BMP	best management practice
bpd	barrels per day
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPTS	Cimarron Public Transit System
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibels
DIR	dividends, interest, and rent
DOI	US Department of the Interior

Acronyms and Abbreviations	Full Phrase
EIS	environmental impact statement
EO	executive order
EPA	US Environmental Protection Agency
ESA	Environmental Species Act
FEMA	Federal Emergency Management Agency
FMP	fire management plan
GHG	greenhouse gas
GIS	geographic information system
H_2S	hydrogen sulfide
INCOG	Indian Nations Council of Governments
IPCC	Intergovernmental Panel on Climate Change
IRMP	Integrated Resource Management Plan
m^3/hr	cubic meters per hour
Ma	millions of years ago
MBTA	Migratory Bird Treaty Act
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOA	notice of availability
NOI	notice of intent
NPMS	National Pipeline Mapping System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTL	notice to lessees
OAS	Oklahoma Archeological Survey
ODM	Oklahoma Department of Mines
ODOT	Oklahoma Department of Transportation
ODWC	Oklahoma Department of Wildlife Conservation
OGS	Oklahoma Geological Survey
OkIPC	Oklahoma Invasive Plant Council
OKT	Oklahoma, Kansas, and Texas
ONENRD	Osage Nation Forest Management Plan
PBA	programmatic biological assessment
PEA	programmatic environmental assessment
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
ppb	parts per billion
ppm	parts per million
PVC	polyvinyl chloride

Acronyms and Abbreviations	Full Phrase
RCM	resource conservation measure
RCRA	Resource Conservation and Recovery Act
RMP	resource management plan
SHPO	State Historic Preservation Officer
SO_2	sulfuric acid
SPCC	spill prevention and control and countermeasure
TDS	total dissolved solids
THPO	Tribal Historic Preservation Officer
TNC	The Nature Conservancy
TNT	trinitrotoluene
TTP	Tribal Transportation Program
USACE	US Army Corps of Engineers
USC	United States Code
USFWS	US Department of the Interior, Fish and Wildlife Service
USGS	US Department of the Interior, Geological Survey
WMA	Wildlife Management Area

8.2 GLOSSARY OF USEFUL TERMS

Crinoidal limestone: Limestone with a high fossil content of the marine animals that make up the class Crinoida of the echinoderms.

Cuesta: A hill or ridge with a gentle slope on one side and a steep slope on the other.

Headright: An equal payment share provided to allottees and their heirs.

Historic properties: Cultural resources that meet specific criteria for eligibility for listing on the NRHP.

National Register of Historic Places: The official list of the nation's historic places worthy of preservation, which is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archaeological resources.

Oil and gas field: A geographical area under which an oil or gas reservoir lies.

Oil and gas play: A set of known or postulated oil and or gas accumulations sharing similar geologic, geographic, and temporal properties, such as source rock, migration pathways, timing, trapping mechanism, and hydrocarbon type.

Pronotum: The plate covering all or part of the thorax of some insects.

Salt scarring: Bare soil with a reduced ability to support vegetation as a result of increased salinity, due to the release of brine or high salt concentrated water onto the landscape, generally from historic oil and gas exploration and production.

Section 106: A cultural resource compliance process under the National Historic Preservation Act that outlines the steps for identifying and evaluating historic properties, for assessing the effects of federal undertakings on historic properties, and for consulting to avoid, reduce, or minimize adverse effects.

Umbone: The highest point of a bivalve shell.

CHAPTER 9
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