

United States Department of the Interior
 Bureau of Land Management
 Northeastern States Field Office
 LLES003410

Environmental Assessment

NEPA #: DOI-BLM-ES-030-2012-0005-EA

Expression of Interest #634

Date: September 2012

Type of Action: Oil and Gas Leasing

Serial Number: DOI-BLM-ES-0030-2012-0005-EA

Location: Michigan Meridian
 Allegan County, (Bloomingdale, Fennville, Millgrove and Pullman Quadrangles)
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 sec. 33, NW $\frac{1}{4}$.

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sec. 26, E $\frac{1}{2}$ NW $\frac{1}{4}$, N 60 AC W $\frac{1}{2}$ NE $\frac{1}{4}$.

Project Acreage: 6,470 acres

Proponent Address: Proprietary

Bureau of Land Management
Northeastern States Field Office
626 E. Wisconsin Ave., Suite 200
Milwaukee, WI 53202
414-297-4400 (phone)
414-297-4409 (fax)

MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

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CHAPTER 1 – PURPOSE OF AND NEED FOR ACTION

Purpose of the Proposed Action

The purpose is to consider opportunities for private individuals or companies to explore for and develop Federal oil and gas resources through a competitive leasing process. A Federal oil and gas lease is a legal contract that grants exclusive rights to the lessee to develop Federally-owned oil and gas resources, but does not authorize surface-disturbing activities or obligate the company to drill a well on the lease.

Need for the Proposed Action

The tracts considered for lease in this analysis were nominated by Expressions of Interest (EOIs) from private industry. The oil and gas leasing program managed by the Bureau of Land Management (BLM) encourages private exploration and development of domestic oil and gas reserves, the reduction of U.S. dependence on foreign sources of energy and is essential to meeting the nation's future needs for energy. The BLM's oil and gas leasing programs are codified under the authority of the Mineral Leasing Act of 1920, as amended; the Mineral Leasing Act for Acquired Lands of 1947, as amended; the Federal Land Policy and Management Act (FLPMA) of 1976; and the Energy Policy Act of 2005.

On June 30, 2008 (EOI #634), the BLM Northeastern States Field Office (NSFO) received a request from the BLM Eastern States Office for a National Environmental Policy Act (NEPA) analysis report on 8,400 acres of land in Allegan County, composed of State-owned lands within the Allegan State Game Area (ASGA). The NSFO verified Federal mineral ownership (FMO) on 6,470 acres with the following legal descriptions (see Appendix A, Figure 1):

Michigan Meridian

Allegan County, (Bloomingdale, Fennville, Millgrove and Pullman Quadrangles)

T. 1 N., R. 15 W., sec. 1, N $\frac{1}{2}$ SE $\frac{1}{4}$, SW $\frac{1}{4}$ SE $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$.

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sec. 26, SE $\frac{1}{4}$ (fractional), SW $\frac{1}{4}$;
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sec. 26, E $\frac{1}{2}$ NW $\frac{1}{4}$, N 60 AC W $\frac{1}{2}$ NE $\frac{1}{4}$.

This nomination is located on State-owned land.

Management Objectives of the Action

Since the BLM does not manage the surface, the BLM's sole management objective is to make Federal minerals available for economically feasible development in an environmentally sound manner.

Conformance with BLM Land Use Plan(s)

The proposed action and the no-action alternative described in Chapter 2 of this Environmental Assessment (EA) are in conformance with the existing Michigan Resource Management Plan (RMP), available at the NSFO. This plan provides the basis for considering the proposed action and alternatives (43 CFR 1610.8). The Michigan RMP was developed with public participation and governmental coordination, and this EA provides the site-specific environmental analysis required by the Michigan RMP (Page 4, Section B.2.c).

Relationship to Statutes, Regulations and Other Plans

This EA was prepared in accordance with the National Environmental Protection Act (NEPA) of 1969 and in compliance with all applicable regulations and laws passed subsequently, including Council on Environmental Quality (CEQ) regulations (40 C.F.R., Parts 1500-1508), U.S. Department of the Interior (USDI) requirements (Department Manual 516, Environmental Quality), the National Historic Preservation Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, E.O. 13007 (Indian Sacred Sites), guidelines listed in BLM's NEPA Handbook, H-1790-1 (BLM 2008a), and/or other Federal statutes and executive orders.

Additionally, any purchaser of a Federal oil and gas lease is required to comply with all applicable Federal, State, and local laws and regulations including obtaining all necessary permits required prior to the commencement of project activities.

Decision(s) To Be Made

The decision to be made is whether to offer the federal oil and gas mineral estate for competitive leasing. The BLM's policy is to promote oil and gas development if it meets the guidelines and regulations set forth by the National Environmental Policy Act of 1969 and other subsequent laws and policies passed by the U.S. Congress.

Scoping and Issues

Rationale for conducting external scoping

The BLM elected to conduct external scoping due to the heavy concentration of recreational use and managed wildlife habitat present on the ASGA. The ASGA supports many different types of recreational use, and the BLM recognizes that the proposed action likely presents different issues for different types of recreational uses. The BLM has limited knowledge of the seasonal variations, relative intensities, and needs of the various types of recreational use. The managers of the ASGA have a thorough understanding of the issues and can direct the BLM to other parties that may be able to identify additional issues or provide valuable information on those issues.

Process for conducting external scoping

The BLM shared maps of the EOI with staff from the Michigan Department of Natural Resources and Environment (MDNRE). The MDNRE provided the BLM with GIS data showing the locations of trails, state natural areas, campgrounds, and waterways. The BLM and the MDNRE held a conference call on Wednesday, October 12, 2011, to identify and discuss issues pertaining to the proposed leasing action.

Issues identified through internal and external scoping

Here are issues that the BLM anticipates the MDNRE and the Allegan County Parks and Recreation Commission identifying:

1. Noise from construction activities will detract from recreational opportunities that require quiet environments.

2. Construction of roads and additional traffic by large vehicles will degrade wildlife habitat by spreading invasive species, including both species that are new to the area and species that have already been identified in the ASGA.
3. Various construction-related activities could have adverse impacts on trout streams and designated Natural Rivers.
4. The Decision Area has many sensitive wetland and grassland habitats that harbor several Federally-listed and State-listed species.

CHAPTER 2 – ALTERNATIVES INCLUDING THE PROPOSED ACTION

Introduction

Tracts of land have been nominated for a federal oil and gas lease in Allegan County, Michigan. This competitive lease provides the lessee exclusive rights to explore and develop Federal oil and gas minerals that may exist on split estate property, but does not authorize surface-disturbing activities or obligate the company to drill a well on the lease.

Location

The site, shown in Appendix A, Figure 1, is located on State-owned land in the western portion of Michigan's Lower Peninsula. A legal description of the requested parcel is found in **Chapter 1 – Need for the Proposed Action** above.

Proposed Action

The proposed action is to lease the nominated parcels. If approved, a lease or leases would be offered for competitive sale with stipulations and notices generated through this process and other consultations. Such a competitive lease provides exclusive rights to develop the federal oil and gas resources but does not obligate the company to drill a well on the federal mineral estate. The lease can be used to consolidate acreage to meet well spacing requirements, or the mineral estate may be acquired for speculative value. The BLM will require applicants to adhere to lease stipulations (Appendix B), which have been formulated while conducting this environmental assessment and are made part of the proposed action.

Connected Action – Drilling and Production

Site-Specific Applications for Permit to Drill (APDs)

The proposed nominations, if approved, would be offered for competitive sale with stipulations and notices generated through this process and other consultations. Once a lease is awarded, the successful bidder is required to submit an Application for Permit to Drill (APD) to the BLM before any ground disturbance is authorized. In the APD, the applicant identifies a proposed drill site and provides the BLM with specific details on how and when the applicant proposes to drill the well within the constraints of the lease document. Upon receipt of an APD, the BLM conducts an onsite inspection with the applicant and, if possible, the private landowner or surface-managing agency. The NEPA and the Endangered Species Act (ESA) requirements must also be met at the APD stage, and in cases with potential to affect

Federally or State-listed species, a site-specific biological assessment is written, including the results of any required biological surveys. This is submitted to U.S. Fish and Wildlife Service and/or the state wildlife agency for consultation. The lessee is required, as per lease stipulation, to comply with the recommendations of these consultations.

The most likely targeted formation in this area is the Trenton-Black River formation, and Pinnacle Reef and Traverse are likely secondary targets that would be considered in any seismic exploration. Most of the previous developments in the area were drilled to the Traverse formation and were vertical, dry holes, now plugged and abandoned, and no seismic data are available to enable the BLM to determine the likely locations of geologic features that may produce marketable quantities of oil. If a well were to produce a marketable quantity of oil or gas, then the BLM would expect to receive further APDs.

The State of Michigan has stipulated well spacing by target formations. Spacing in Allegan County for most formations, including the Trenton-Black River formation, is 40 acres. Glenwood and deeper formations are spaced at 80 acres. However, development targeting the Trenton-Black River formation at this time would be exploratory, since there have been no recent permits for that formation, and the industry spacing standard for exploratory drilling is 640 acres. With this spacing, a maximum of 13 exploratory wells could be drilled. This EA will analyze impacts to natural resources based on three scenarios:

- Low-intensity, in the event of unsuccessful exploration – 10 dry holes,
- Medium-intensity, in the event of moderate production – 16 oil and gas wells,
- High-intensity, in the event of high production – 24 oil and gas wells.

These estimates are based upon a map analysis of the numbers of wells in existing, typical fields in the vicinity of the EOI being evaluated. *These scenarios are provided strictly for the purpose of analysis and do not represent the BLM's decision or prediction as to a number of wells that may be permitted under the proposed lease.* Directional drilling, combining wells on pads, and other factors may affect the number of wells proposed by an operator. The entire Allegan State Game Area is classified as non-development, meaning that surface occupancy is not permitted.

Hydrocarbon Drilling Methods

Oil and gas (hydrocarbon) wells are built in two phases – drilling the borehole and completing the well. Wells may be drilled vertically if the end of the well, or *bottom hole location*, is directly below the well pad, or directionally, if the well pad is not directly above the bottom hole location. For example, federal minerals under a state park, where drilling is not permitted, can be accessed by directional drilling. The same method may be used to drill horizontally, with a wellbore extending for up to several thousand feet through the hydrocarbon-producing rock formation. In this case, the purpose of non-vertical drilling is not necessarily to provide access to the hydrocarbons but to increase the well's production. Horizontal drilling differs dramatically from vertical or directional drilling primarily in the size of a well pad, the number of wells per pad, and the amount of water that is used to complete the well.

Typically, after approval of an APD, the petroleum industry follows a general plan and process for all proposed drill sites, as follows:

Vertical Drilling

Preparation for the drilling process includes construction of a road, drilling pad, and reserve pit. Constructed access roads normally have a running surface width of 25-30 feet. Road length depends on the well site locations in relation to existing roads. The average length of road construction will be between 0.25-0.5 miles. Therefore, between one and two acres would be affected by road construction. Typically 2.5 acres are cleared and graded level for the construction of the drilling pad for a well. If the well is productive, another estimated one-half acre may be affected by pipeline construction. These approximations yield a total disturbed area of five acres for drilling a productive well. The excavation reserve pit is usually about 5-10 feet deep and is lined with bentonite clay to retain drilling fluids, circulated mud, and cuttings. Liners meeting state standards for thickness and quality are used on occasions when soils are determined incapable of holding pit fluids.

Drilling operations continue around the clock. Wells in this area are usually drilled in 30 days. Once drilling is completed, excess fluids are pumped out of the pit and disposed of in a state-authorized disposal site and the cuttings buried. Wells are drilled by rotary drilling, using mud as the circulating medium. Mud pumps are used to force mud down a drillpipe, forcing the rock cuttings out the wellbore. Water can be provided by a well drilled on-site, although water could be pumped to the site from a local pond, stream, or lake through a pipe laid on the surface. Approximately 1,500 barrels of drilling mud would be typically kept on the location.

Horizontal Drilling

Horizontal drilling is unlikely to be used to access minerals in Allegan County because the likely target formations are not shale gas formations. However, horizontal drilling methods may be considered in the future if technological advances allow for development of gas in marketable quantities in this geographical area.

Wells drilled horizontally with multiple-stage hydrofracture operations require somewhat larger well pads and reserve pits than conventional vertical or directional wells. A typical 3-4-acre well pad in the eastern Ohio Utica shale play is designed to accommodate one to three horizontal wells; similar pad sizes are likely in Michigan. The larger pads are required to store the larger amounts of equipment and supplies used in drilling horizontal wells.

Horizontal wells also require far more water for completion than conventional vertical wells. Conventional vertical wells are drilled to and slightly below the depth of the target formation(s), but a horizontal well is drilled to and then into the target formation, with the length of the horizontal portion of the well, known as a lateral, often exceeding the vertical depth of the well. Lateral lengths exceeding one mile can occur, and the number of fracture stages used to complete a horizontal well are far greater than the number used for a conventional vertical well. A horizontal shale well typically requires several million gallons of water, and some require more than 5 million gallons. The first Collingwood (Utica) shale well drilled horizontally in Michigan, the State Pioneer 1-3 HD1, conducted 15 staged fractures, had a lateral length of 6,351 feet, and used almost 6 million gallons of water for completion.

The State of Michigan regulates and monitors all proposed water usage. Typically, a water well is drilled within the well pad to provide water for drilling and completion. In some areas, surface water may be

used depending on state requirements. Water users must apply for state approval for use of any water sources. When a well is completed, the produced water, including both the hydrofracture fluids and formation fluids, must be collected in tanks for injection into state-approved disposal wells.

Well Completion

Hydraulic fracturing (hydrofracture or “fracking”) has been widely used in the oil and gas industry since the late 1940s. The process has allowed oil and gas (hydrocarbon) production from tight sandstones, shales and carbonates. Fracturing is not used in all well completions. The use of hydrofracture is dependent on the type of reservoir rock encountered in the subsurface.

When the wellbore reaches the hydrocarbon reservoir, various methods may be used to finish the well. Among these methods is hydraulic fracturing of the reservoir rock. In this process, water, sand and small amounts of chemical additives are pumped down the wellbore. Holes in the production tubing direct the mixture to the reservoir rock under high pressure, breaking the rock. The water-induced fractures allow the oil and gas to flow into the wellbore. Additives may be added based upon the type of reservoir rock and fluids encountered at depth to help maintain the fractures. Most conventional vertical wells require less than 500,000 gallons of water for completion.

The subsurface pressure forces the hydrocarbons, reservoir fluids and used fracture fluids to the surface. The hydrocarbons naturally separate from the other fluids. The used fracture and reservoir fluids are stored in large tanks for disposal in deep injection wells or other approved disposal methods. In areas where large quantities of water are needed to fracture the rocks, the fluids are recycled and used in other fracking operations.

Production, Abandonment, and Site Reclamation

Formation water production, along with the oil and/or gas, will be expected during the life of each well, and separation, dehydration and other production processing may be necessary. Construction of temporary on-site and additional off-site facilities may be needed to handle this processing.

During well pad construction, the topsoil is stockpiled to be used during restoration activities. If the well is successful, the drill pad would be reduced to about 100 feet square with the remaining surface area, including the reserve pit, re-graded and restored per BLM and surface owner requirements. A lease notice in these proposed leases encourages the use of non-invasive cover plants during all restoration and stabilization activities. Final seed mixtures and plantings are determined with recommendations from BLM with approval of the land owner. The remaining pad is maintained for the life of the well. The life of a productive well may be 25 years. Following abandonment, the pad is subject to the same restoration parameters.

No-Action Alternative

Under the No-Action Alternative, the request to offer the proposed tract for oil and gas lease would be denied.

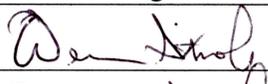
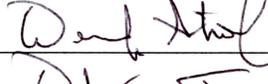
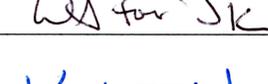
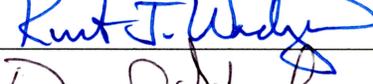
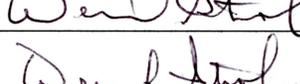
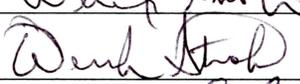
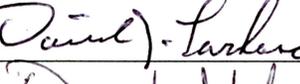
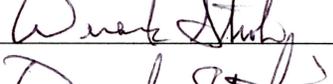
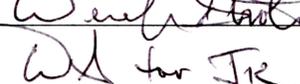
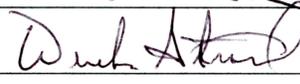
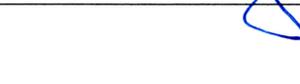
CHAPTER 3 – DESCRIPTION OF THE AFFECTED ENVIRONMENT

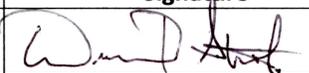
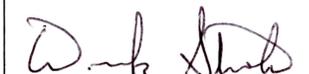
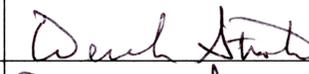
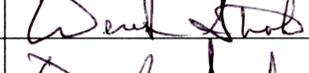
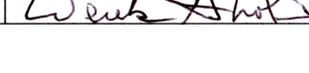
Introduction

The Decision Area (Figure 1, Appendix A), a total area of 30,500 acres, consists of the EOI boundary and a one-mile buffer, which is the typical maximum distance that directional drilling is economically feasible. The Decision Area is within the Southern Michigan/Northern Indiana Drift Plains level III ecoregion. The Decision Area straddles the boundary between two 8-digit HUC watersheds, with 10,200 acres of the Decision Area within the Black River watershed (HUC#04050002) and 20,300 acres in the Kalamazoo River watershed (HUC#04050003). The Decision Area overlaps the Allegan State Game Area, a 50,000-acre complex owned by the MDNRE that includes wetlands, forests, wildlife refuges, recreational trails, campgrounds, and public hunting areas. The Decision Area is readily accessible via a grid of paved roads, forestry roads, and recreational trails.

Because the MDNRE will not permit well development within the ASGA, the area that could be developed pursuant to leasing would include only the non-state-owned lands within about one mile of the EOI. This potentially developable area, referred to throughout the analysis as the Development Area, is 11,900 acres.

Table 1. Technical Review.

X	Program	Reviewer	Signature	Date
X	Air Quality	Derek Strohl Natural Resources Specialist		9/25/12
X	Climate Change	Derek Strohl Natural Resources Specialist		9/25/12
X	Cultural/Paleontology	Jarrold Kellogg Archeologist		9/25/12
X	Environmental Justice	Kurt Wadzinski Planning & Environmental Coordinator		9/25/12
X	Farmlands (Prime & Unique)	Derek Strohl Natural Resources Specialist		9/25/12
X	Fish and Wildlife	Derek Strohl Natural Resources Specialist		9/25/12
X	Floodplains	Derek Strohl Natural Resources Specialist		9/25/12
X	Geology/Mineral Resources/Energy Production	Dave Lachance Geologist		9/25/12
X	Hazardous Wastes	Derek Strohl Natural Resources Specialist		9/25/12
X	Invasive Species/Noxious Weeds	Derek Strohl Natural Resources Specialist		9/25/12
X	Native American Religious Concerns	Jarrold Kellogg Archeologist		9/25/12
X	Recreation	Derek Strohl Natural Resources Specialist		9/25/12
X	Socioeconomics	Kurt Wadzinski Planning & Environmental Coordinator		9/25/12

X	Program	Reviewer	Signature	Date
X	Soils	Derek Strohl Natural Resources Specialist		9/25/12
X	Threatened, Endangered or Candidate Animal Species/Migratory Birds	Derek Strohl Natural Resources Specialist		9/25/12
X	Vegetation	Derek Strohl Natural Resources Specialist		9/25/12
X	Visual Resources	Derek Strohl Natural Resources Specialist		9/25/12
X	Water Resources/Quality (Drinking, Surface & Ground)	Derek Strohl Natural Resources Specialist		9/25/12
X	Wetlands/Riparian Zones	Derek Strohl Natural Resources Specialist		9/25/12
X	Wild & Scenic Rivers	Derek Strohl Natural Resources Specialist		9/25/12
X	Wilderness	Derek Strohl Natural Resources Specialist		9/25/12

Based on a review of the resources listed above on the NSFO Technical Review Form and in consideration of the Purpose and Need statement prepared for this EA, the following resources will be addressed in this EA: Air Quality; Climate Change; Cultural/Paleontology; Environmental Justice; Prime and Unique Farmlands; Fish and Wildlife; Floodplains; Geology/Mineral Resources/Energy Production; Hazardous Wastes; Invasive Species/Noxious Weeds; Native American Religious Concerns; Recreation; Socioeconomics; Soils; Threatened, Endangered, or Candidate Animal Species/Migratory Birds; Vegetation, Visual Resources; Water Resources/Quality (Drinking/Surface/Ground); Wetland/Riparian Zones; Wild and Scenic Rivers; and Wilderness.

Air Quality

The Planning Area meets the National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), sulfur dioxide (SO₂), particulate matter (PM_{2.5} and PM₁₀), and lead (Pb). These are the primary pollutants that the USEPA tracks nationwide.

Climate Change

The primary indicators of interest regarding climate change are emissions of greenhouse gases (GHG), primarily water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and a few other gasses of lesser importance. These gasses tend to trap heat from the sun in the Earth's atmosphere, leading to global warming. The various GHGs trap different amounts of heat and persist in the atmosphere for different amounts of time. Therefore, the various GHGs have different levels of potency in causing global warming per unit volume in the atmosphere. These potencies are normalized with respect to the potency of CO₂ and expressed in terms of CO₂e (carbon dioxide equivalent). For example, one metric ton of methane, which is 21 times as potent as carbon dioxide, represents 21 metric tons of CO₂e. Carbon dioxide and CH₄ are the most abundant GHGs in terms of CO₂e.

Because these gases circulate freely throughout Earth's atmosphere, the Planning Area for this resource is the entire globe. The largest component of global anthropogenic greenhouse gas emissions is carbon dioxide. Global anthropogenic carbon emissions reached about 7,000,000,000 metric tons per year in 2000 and about 9,000,000,000 metric tons per year in 2004.¹ Oil and gas production is a major contributor of greenhouse gases. In 2006, natural gas production accounted for eight percent of global methane emissions, and oil production accounted for 0.5% of global methane emissions.² The impact of the proposed action on climate change will be discussed further in Chapter 4.

Cultural/Paleontology

Native Americans inhabited Allegan County prior to the arrival of European settlers, and several villages, burial grounds, mounds, and important trails, were located throughout the county. Reviews of State forest lands conducted by the MDNR³ state that there are no cultural or archeological resources present. The BLM would consider potential cultural resources with each APD that is submitted under any lease(s) that would be approved pursuant to this EOI. No further analysis is warranted at this time.

Environmental Justice

Executive Order 12898 (1994) formally requires federal agencies to incorporate environmental justice as part of their missions. Specifically, it directs agencies to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority or low-income populations.

The project area is located in rural townships, in a game area frequented by recreational users. There are no adverse human health and environmental effects anticipated from potential development on minority and low-income populations or individuals near the project area.

Prime and Unique Farmlands

There are 400 acres of prime farmland in the Development Area (see Figure 4, Appendix A). These occur mostly in the flat areas between the steep slopes (see *Soils*, below) in the southern portion of the northern block. Interspersed among these areas are 50 acres of soils classified as prime farmland if drained. Based on aerial photo interpretation, most of these prime farmlands are in some sort of agricultural production. There are also 2,260 acres of land in soil types characterized as farmland of local importance. These make up a large portion of the Development Area in the southern and eastern portions of the northern block and the southeastern and northwestern portions of the southern block.

¹ Marland, G., T.A. Boden, and R. J. Andres. 2007. Global, Regional, and National CO2 Emissions. Outside Trends: A Compendium of Data on Global Change.

² URS Corporation. 2010. Climate Change Supplementary Information Report, Montana, North Dakota and South Dakota Bureau of Land Management.

³ Available online at http://www.michigan.gov/dnr/0,1607,7-153-30301_30505---,00.html and at the Northeastern States Field Office.

Fish and Wildlife

As described above, the ASGA encompasses 50,000 acres. The Decision Area overlaps 18,870 acres, or 38%, of the ASGA. This overlap includes all of the 600-acre Bravo Unit Refuge, which has no visitor access. More than 100,000 Canada geese stage in the ASGA before their fall migration, and the game area supports deer and many other kinds of game and nongame wildlife.

Floodplains, Wetlands, and Riparian Zones

Wetlands (Figure 2, Appendix A) comprise 10,874 acres, or 36%, of the Decision Area. These include lowland hardwood forests, floodplain forests, wet meadows, fens, relict Atlantic coastal plains marshes, and other types. The Kalamazoo River comprises 550 acres of Michigan Natural River area, a designation that establishes heightened development restrictions along a river's banks.

Geology/Mineral Resources/Energy Production

Michigan's Southern Peninsula is entirely underlain by the Michigan Basin, a structural depression within the Earth's crust that is filled with sedimentary rocks of various ages. The exploration and development of oil and gas resources within the Michigan Basin has occurred continuously since 1925. Production was first established in Allegan County in 1937.

The majority of oil and gas exploration and development centers around the exploration and development of oil and gas "plays," i.e., the systematic exploration and development of undiscovered and discovered oil and gas fields that are assumed to have similar structural and stratigraphic features found in known oil and gas fields.

The current list of recognized oil and gas plays within the Michigan Basin consists of Mid-Michigan Rift-Related Structures, Mid-Michigan Rift Reactivation-Related Structures, Niagaran Pinnacle Reefs, Shallow Salt-Related Structures, the Antrim Shale and the Collingwood Shale.

BLM has not identified specific exploration targets underlying the lands being evaluated in this EA. However, based upon currently available data and exploration and development activity, Mid-Michigan Rift Reactivation-Related Structures would be the most likely to attract exploration and development on the lands being evaluated in this EA.

Exploration and development of these structures would probably center on production from the Trenton-Black River formations.

A secondary target within the general area of the lands being evaluated in this EA would be Shallow-Salt Related Structures. Production from these features could be expected to be found in the Berea, the Traverse Limestone and the Detroit River Formation.

It is also feasible that the Niagaran Pinnacle Reef Trend could attract exploration and development on some of the lands within the two northernmost townships being evaluated in this EA.

Production associated with Niagaran reefs can be expected to be found both within the reefs themselves, and in overlying formations which are "draped" over the reefs such as the A-1 Carbonate

and the Richfield Formation. Pinnacle reefs are typically identified through the acquisition of seismic data and interpretation of this data in light of data available from wells which have been drilled in an area of interest.

Although development of the Utica – Collingwood shale zones in northern Michigan is currently taking place, it is unlikely that the shale zones would be development targets in Allegan County due to lack of sufficient thickness and total organic content (TOC). However, horizontal drilling methods may be considered in the future if technological advances allow for development of gas in marketable quantities in this geographical area.

Any exploration and development within this area is likely to be preceded by the acquisition of seismic, magnetic and gravity data and existing well data.

Hazardous Wastes

The Decision Area contains two closed leaking underground storage tanks and one closed (non-leaking) underground storage tanks according to the Michigan Department of Environmental Quality's online Environmental Mapper⁴. These are all in the southern block of the Decision Area. Most of the Decision Area has been used historically for forestry and agriculture.

Invasive Species/Noxious Weeds

Several roadsides throughout the Decision Area are infested with non-native, invasive shrub species, including exotic honeysuckle species (*Lonicera* spp.) and autumn and/or Russian olive (*Eleagnus umbellata* and *E. angustifolia*). These species form dense thickets in disturbed areas such as roadsides and in recently cutover areas, and they suppress regeneration of native woodland plant species. Reed canary grass (*Phalaris arundinacea*) is also present in the Decision Area. This species aggressively colonizes open and partially-shaded wetlands across a broad hydrologic gradient and reduces the habitat complexity and microtopography of the habitats it invades. Given the prevalence of wetlands in the Decision Area, this species is likely present in many parts of the Decision Area. There are likely many other non-native, invasive species present in the Decision Area.

Native American Religious Concerns

Federally recognized Native American tribes have been contacted about this proposed undertaking (Chapter 5). Human remains and associated funerary objects of Native American ancestry have been discovered within the Development Area. There are no additional identified sacred sites or traditional cultural properties within the Development Area. If any additional sites are identified, access would be granted by agreement between the landowner and the Native Americans. The BLM has no authority over access to these tracts. The BLM's responsibility is limited to the area of surface disturbance if or when a proposal for development is submitted.

⁴ <http://www.mcgi.state.mi.us/environmentalmapper/>

Recreation

The Allegan State Game Area is a regionally popular recreation area. Eight miles of the lower Kalamazoo River and its tributary Swan Creek within the Decision Area are state-designated Natural Rivers⁵. Table 2 lists the amounts of selected recreational resources within the ASGA or Allegan County and the proportions of those resources that fall within the Decision Area.

Table 2. Selected types of recreational resources in the surrounding area and relative proportions within the Decision Area.

Type	Total	Location/Distribution	Proportion within Decision Area
Hiking trail	22 mi	All in ASGA	13 mi (60%)
Equestrian trail	50 mi	Throughout Allegan County	1.8 mi (4%)
Biking/skiing trail	20 mi	All in ASGA	8 mi (40%)
Snowmobile trail	24 mi	All in ASGA	10 mi (42%)
Campsites	109	Two campgrounds in ASGA	48 (44%)
Non-motorized lakes	7 lakes, 237 acres	All in ASGA	7 lakes, 237 acres (100%)

Socioeconomics⁶

Allegan County is located in the southwestern part of Lower Michigan, its western border on Lake Michigan, and is 825.32 square miles, with a population density of approximately 135 persons per square mile. Its population as of the 2010 U.S. Census was 111,408, a 5.4% increase from the 2000 census. The county seat is located in the city of Allegan, in the south-central part of the county. The project area encompasses 8,400 scattered acres within the Townships of Cheshire, Lee, Valley, Clyde, Monterey, and Heath in the west-central part of the county and falls within the Allegan State Game Area.

The distribution of population in Allegan County is 92.9% White, 6.7% Hispanic or Latino, 1.9% Two or More Races, 1.2% African American, 0.6% Native American or Alaska Native, and 0.6% Asian. 73.8% of Allegan County residents are 18 years of age or older, with 13% aged 65 years or older; the State of Michigan has a population 18 years of age and older of 76.3%, with 13.8% aged 65 or older.

⁵ Michigan Department of Natural Resources, Fisheries Division. Lower Kalamazoo Natural River Plan. 1981, revised 2002.

⁶ Much of the information in this section is taken from the 2010 United States Census Quickfacts website available on-line at <http://quickfacts.census.gov/qfd/states/26/26005.html>

In 2010, there were 49,426 housing units in the county with a homeownership rate from 2005-2009 of 83.6%, which is 9% higher than the state as a whole. The median value of these owner-occupied homes was \$149,600 for the period 2005-2009, slightly higher than that of the state.

Median household income in 2009 was \$50,487 for Allegan County, over \$5,000 higher than for the state. Approximately 11.5% of persons lived below the poverty level, much below the 16.1% statewide that live below the poverty level. 87.4% of the county population 25 years of age and over graduated from high school, the same percentage as the state. 19.7% of county residents 25 years of age and older have a bachelor's degree compared to 24.5% for Michigan as a whole. About 6% of residents speak a foreign language in the home; in total, about 9% of Michigan residents speak a foreign language in the home.

Demographically, Allegan County is more affluent, slightly less educated, more homogenous and younger than most counties in the State of Michigan.

The unemployment rate for Allegan County was 7.2% in November 2011, a 0.4% decrease from the 7.6% rate in October 2011⁷, which is 2.6% lower than Michigan's unemployment rate of 9.8% for the same month. In 2009, the retail trade provided the greatest number of employers, followed by construction, other services (except public administration), and manufacturing. Manufacturing employs the most people in the county (12,048), followed by the retail trade (3,581), and health care and social assistance (3,432).⁸

Soils

Soils in the Decision Area are glacially-derived sandy loams with hydric soil types in the wetland areas. Most of the Decision Area is characterized by flat to gently rolling topography with occasional steep slopes. The Development Area has a total of 1060 acres of soils that are characterized by the U.S. Department of Agriculture as *highly erodible* and 540 acres characterized as *potentially high erodible*. These are mostly concentrated in the northern block of the Development Area, highly erodible types occurring on slopes between 12 and 45 degrees, and potentially highly erodible types on slopes between six and 12 degrees.

Bureau-Sensitive Species and Migratory Birds

Four species are listed on the Fish and Wildlife Service's list of endangered species known to occur in Allegan County, Michigan⁹, as of August 8, 2011. Of these, the one plant species, Pitcher's thistle (*Cirsium pitcheri*) is likely not present within the Planning Area because it dwells on dunes, which are not present in the Decision Area. The remaining species are all animals and are all listed in the State of Michigan as well. Two of them, Eastern massasauga and Karner blue butterfly, are known to occur in

⁷ Bureau of Labor Statistics. 2011. *Local area unemployment statistics*. Available on-line at <http://www.bls.gov/lau/>

⁸ United States Census Bureau. 2010. *2009 county business patterns (NAICS)*. Available on-line at <http://censtats.census.gov/cgi-bin/cbpnaic/cbpsect.pl>

⁹ Available on-line at <http://www.fws.gov/midwest/Endangered/lists/michigan-cty.html>

Allegan County. The table in Appendix C lists the federally-listed species that are known to occur in Allegan County and the state-listed species that the MDNR reported as likely being present in or near the Decision Area.

The Decision Area contains the 397-acre Crooked Lake Marsh State Natural Area (SNA). This SNA contains Crooked Lake Marsh, the largest of Michigan's coastal plain marshes.¹⁰ The SNA is known to harbor many rare species. The SNA includes an upland area and an access road.

Twenty-five of the 29 listed plant species are found in wetlands. The 19 animal species occupy a variety of habitats, including open areas and forests, wetlands and uplands, and many move between habitats over a year or throughout their life cycles.

Vegetation

Most of the Decision Area is wooded, and it contains abundant open wetland habitats, as described in ***Floodplains, Wetlands, and Riparian Zones***, above. The wooded cover types include lowland hardwoods, pine-oak forests, and oak-pine barrens. Private lands within the Development Area include a mix of forests and agricultural lands with small homesteads.

Visual Resources

Most of the Decision Area consists of undeveloped lands within a grid of paved roads along most section lines. Based on aerial photo interpretation, the Development Area's non-wetland areas are roughly evenly divided between forests and agricultural fields, with several small homesteads and a few scattered oil and gas wells.

Water Resources and Water Quality

The Decision Area contains 42 miles of streams, including 19 miles of trout streams (Figure 2, Appendix A). The Decision Area contains 550 acres within Michigan's Natural Rivers zoning area. Michigan's Natural River designation is a state analog to the national Wild & Scenic River designation, and there may be local restrictions on surface occupancy in the designated Natural River Zone.

The Decision Area includes at least 85 drinking water wells. Groundwater in the Decision Area flows toward the Kalamazoo River, which is in between the two blocks of the Decision Area, and there are more than 200 more drinking water wells in that valley.

Wild and Scenic Rivers and Wilderness

There are no designated Wild and Scenic Rivers or Wilderness within the Decision Area. No further analysis is warranted at this time.

¹⁰ Michigan Department of Natural Resources website, http://www.michigan.gov/dnr/0,4570,7-153-30301_31154_31260-54389--,00.html

CHAPTER 4 – ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

Introduction

This chapter assesses potential consequences associated with direct, indirect, and cumulative effects of the Proposed Action and alternatives. Since the BLM expects that leasing will be followed in due time by Applications for Permits to Drill (APDs), this section provides a primarily qualitative examination of potential impacts from drilling. This examination is used to develop lease stipulations and mitigation measures and to raise issues that will need to be addressed at the APD stage.

As stated in Chapter 2, this EA will consider the impacts associated with three development scenarios, which are based on the area's geology, well spacing stipulations and standard industry practices, and other factors:

- unsuccessful exploration – 10 dry holes, disturbing a total of approximately 45 acres,
- moderate production – 16 oil and gas wells, disturbing a total of approximately 80 acres, and
- high production – 24 oil and gas wells, disturbing a total of approximately 240 acres.

Climate Change

Many aspects of oil and gas production emit greenhouse gases (GHG). The primary aspects include the following:

- Fossil fuel combustion for construction and operation of oil and gas facilities – vehicles driving to and from production sites, engines that drive drill rigs, etc. These produce CO₂ in quantities that vary depending on the age, types, and conditions of the equipment as well as the targeted formation, locations of wells with respect to processing facilities and pipelines, and other site-specific factors.
- Fugitive methane – methane that escapes from wells (both gas and oil), oil storage, and various types of processing equipment. This is a major source of global methane emissions. These emissions have been estimated for various aspects of the energy sector, and producers are required under 40 CFR Part 98, starting in 2011, to estimate and report their methane emissions to the USEPA.¹¹
- Combustion of produced oil and gas – the expected result of the proposed action is applications for permits to drill, and it is expected that drilling will produce marketable quantities of oil and/or gas. Most of these products will be used for energy, and the combustion of the oil and/or gas would release CO₂ into the atmosphere. Fossil fuel combustion is the largest source of global CO₂.

In recent years, many states and other organizations have initiated GHG inventories, tallying GHG emissions by economic sector. Links to statewide GHG emissions inventories can be found

¹¹ More information on this requirement is available at <http://www.epa.gov/climatechange/emissions/subpart/w.html>.

at <http://www.epa.gov/statelocalclimate/state/state-examples/ghg-inventory.html>. Guidelines for estimating project-specific GHG emissions are available,¹² but some necessary data, such as quantities of oil produced and number of wells, are available for such an estimate for the proposed action. The uncertainties regarding numbers of wells and other factors make it very impractical to attempt to project amounts of GHG that the proposed action would emit.

Many oil and gas operators are already participating in Natural Gas STAR, a voluntary, USEPA program that identifies sources of fugitive methane sources and seeks to minimize fugitive methane through careful tuning of existing equipment and technology upgrades. The BLM would encourage operators to participate in this voluntary program.

Cultural/Paleontology

Little is known about the earliest Native American Inhabitants of Allegan County, although several Paleo-Indian sites have been found throughout Michigan's Lower Peninsula. Mounds from the Hopewell Culture and earlier can be found throughout southeastern Michigan in Southeastern Michigan. One of the most notable sites is the Norton Mound Group or Hopewell Indian Mounds Park, located 15 miles north of Allegan County in Grand Rapids, Michigan. Occupied from 400 BCE to 400 CE and listed on the National Register of Historic Places, the site contains several burials and at the time of listing was considered to contain the "most important and best-preserved Hopewell mounds in the western Great Lakes region." Similar sites should be expected in Allegan County. Several general interest websites state that the word "Allegan" comes from "Allegawi" or "Alleghan," which were once used to describe moundbuilders in the region.

The Mascouten Tribe, a semi-sedentary branch of the Algonquin Tribe, inhabited Allegan County during the early historic period, leaving the area by the early 1700s and merging with the Kickapoo after attacks by Iroquoian groups from Ohio. This coincided with the increased presence of French explorers and missionaries in the Upper Great Lakes region. While trade between Native Americans and the French, and later British, occurred in and around modern day Allegan County, most permanent European settlements were located in east Michigan. This began to change as American trappers and traders began to enter the area in the early 1800s.

Over 30 properties in Allegan County are listed in the National Register of Historic Places, and are all historic structures including churches, domiciles, and barns. There are no listed prehistoric properties in Allegan County.

No known deposits of vertebrate fossils have been found in Allegan County.

The BLM would consider potential cultural resources and paleontological resources, and any affect to historic properties, with each APD that is submitted under any lease(s) that would be approved pursuant to this EOI. This may include, but may not be limited to, archaeological surveys, archeological site and

¹² BLM. 2010. *Climate Change Supplementary Information Report, Montana, North Dakota and South Dakota Bureau of Land Management*, page 5-2, available at http://www.blm.gov/mt/st/en/prog/energy/oil_and_gas/leasing/leasingEAs.html.

survey record searches, consultation with the Michigan State Historic Preservation Office, and appropriate Native American Tribes. No further analysis is warranted at this stage.

Prime and Unique Farmlands

If we assume that half of the wells drilled under the scenarios set forth in Chapter 2 would be drilled in agricultural lands, then as much as 22.5, 40, or 60 acres of prime farmlands and farmlands of local importance may potentially be impacted. Impacted areas would be reclaimed at the end of the life of each well. Far less area would likely be impacted, though, since the numbers of wells described in Chapter 2 would need to be scattered across the Development Area in order for the operator to access the EOI and comply with spacing requirements, while the prime and locally important farmlands are concentrated in two portions of the Development Area. Since prime and locally important farmlands are designated according to remotely-mapped soil types, the BLM may conduct a soil survey of areas proposed for drilling in order to determine with more certainty whether these resources may be impacted.

Fish and Wildlife

The proposed action would likely result in the conversion of no more than 45, 80, or 120 acres of wildlife habitat, based on the low-, medium-, and high-intensity scenarios described in Chapter 2. Impacted areas would be reclaimed at the end of their use as well pads or construction areas.

A cursory review of aerial photographs of the area, combined with wetland overlays, reveals that a large proportion of the forested areas within the Decision Area are identified as wetlands. Since a BLM stipulation will prohibit disturbance in wetlands, it is more likely that wells would be located in the non-forested, agricultural areas within the Decision Area. These areas do not provide the high habitat diversity of the forests and harbor primarily species that fare well in landscapes that are heavily modified by human development, such as white-tailed deer, raccoon, wild turkey, and coyote.

Floodplains, Wetlands, and Riparian Zones

Lease stipulations (see Appendix B) will prohibit surface occupancy in and around wetlands. These will prevent direct filling of wetlands as well as polluted runoff directly entering wetlands. Because wells could potentially be directionally drilled from outside the EOI, prohibiting surface occupancy in wetlands would not necessarily prevent accessing the minerals under the wetlands. Beyond the BLM's stipulated protection of wetlands, the State of Michigan protects the Natural River area associated with the Kalamazoo River, further removing the potential for direct impacts to riparian areas.

Geology/Mineral Resources/Energy Production

Whether or not commercial quantities of oil and gas are present beneath the lands that are being evaluated in this EA cannot be known without further exploration. However, it is certain that any oil and gas produced from these lands is a nonrenewable resource that will not be available in the future.

Hazardous Wastes

Drilling introduces various chemicals into the environment that become waste products after use. These include drilling and completion fluids, which may contain heavy metals, hydrochloric acid,

hydrocarbons, and brine. These materials are typically stored temporarily on-site. Michigan regulations require that field fluid wastes be injected into underground formations that are isolated from freshwater by impervious strata. These wastes are exempt from the federal definition of hazardous waste and are referred to as *special wastes* by the USEPA. Under certain circumstances, wastes may be disposed of in the annular spaces between strings of casing. Also, brines that are rich in calcium and that contain minimal concentrations of hydrogen sulfide and a few aromatic hydrocarbons may be used for ice and dust control and road stabilization¹³. Environmental impacts to the Decision Area may occur under several circumstances. Chemicals may be spilled or leaked from a temporary storage facility or container used for transportation. Chemicals may contaminate groundwater resources in the event of improper design, construction, or use of an injection well intended for disposal of wastes. Surface introduction of restricted amounts of hydrogen sulfide and hydrocarbons may occur in the event that the State of Michigan permits the surface spreading of brines, as provided for in the State of Michigan's regulations.

Invasive Species/Noxious Weeds

Construction of roads, well pads, pipelines, and other structures associated with oil and gas development can be expected to spread invasive species and/or noxious weeds in two general ways. First, increased vehicle traffic may carry seeds, plant parts, or other live organisms that may become established within the Decision Area. This could introduce new species from outside the Decision Area or from one part of the Decision Area to another. The risk of such propagation may be estimated in terms of the area disturbed, calculated in Chapter 2 at five acres per productive well, the volume of vehicle traffic, and the presence of invasive species in locations along the routes that traffic uses on the way to and within the Decision Area. While the last two variables would be unreasonable to attempt to quantify without site-specific analysis, we may consider various scenarios of infestation. The land areas described in the low-, medium-, and high-intensity development scenarios in Chapter 2 (45, 80, and 240 acres) would be susceptible to direct infestation by non-native, invasive plant species that thrive in disturbed conditions. However, many of these species are able to propagate into undisturbed areas, and large areas of otherwise intact habitat could be infested by plant parts that are imported into the Decision Area on equipment and vehicles. Therefore, it is possible that far more than the directly-disturbed area of land could be infested in non-native, invasive plant species as a result of the disturbance.

The second way that oil and gas development may result in the propagation of invasive species is by creating open corridors and forest edges that are highly susceptible to invasive by edge-loving species. Where the forest canopy is broken, invasive species that thrive in sunny conditions may proliferate.

The Wisconsin Council on Forestry has developed a set of best management practices (BMPs) designed to prevent the spread of invasive species in forests due to urban and production forestry practices,

¹³ Michigan's Oil and Gas Regulations, available on-line at http://michigan.gov/deq/0,1607,7-135-3311_4111_4231-9245--,00.html.

transportation and utility rights-of-way, and recreation¹⁴. Several of the BMPs are directly applicable to the proposed lease, since it would incorporate rights-of-way and vegetation management on dedicated forest land. The BLM would incorporate appropriate BMPs as conditions of approval into permits to drill in order to prevent the introduction of spread of invasive species into affected areas.

Native American Religious Concerns

There is potential for the discovery of additional Native American burial sites within the Decision Area. Further consultation with appropriate Native American tribes will be conducted with each APD to determine if such additional sites are located within individual APEs and the larger Decision Area. No further analysis is warranted at this time.

Recreation

Well construction, operation, and, eventually, abandonment would be expected to create noise and change views in ways that will make the area less attractive to people who desire solitude and natural surroundings. Also, the noise from construction will drive away the animals that hunters seek. Visual impacts will be considered in the **Visual Resources** section, below.

There are several factors to consider in quantifying auditory and visual impacts, and this analysis will begin with auditory impacts. Noise that is generated by construction or operation is naturally damped as it travels through an environment, and the nature of the environment through which it travels, such as open air, buildings, or woods, determines the rate at which noise is damped. Finally, the time of the disturbance affects the value of the impact, since hunters and wildlife are present and/or active at some times of the year more than at others.

Construction equipment generates between 70 and 115 decibels (dB),¹⁵ and a forest may damp (reduce) noise by five to 20 dB per 100 feet. Assuming that the maximum noise level that hunters, game animals, and trail users are likely to tolerate is 40 dB, the affected radius with respect to hunting around construction operation would range from 150 feet to 1,500 feet (0.28 mile). A total of 13 miles of equestrian trail, 5 miles of hiking trail, 1.6 miles of ski/bike trail, and 5 miles of snowmobile trail are within 1,500 feet of the Development Area (Figure 3, Appendix A). The length of trails that would be impacted by noise during well construction would be expected to fall well below these figures for two reasons. First, these figures assume the lowest damping effect of the woods, and, second, multiple wells would have to be constructed in a tight cluster in order to impact the cluster of trails that are within 1,500 feet of the Development Area. It is more likely that wells would be scattered throughout the Development Area.

The damping effect of the woods would be at its highest during summer, when leaves aid in damping the sound, although a thick snow cover is also an effective sound damper. The areas to be affected by these minimum and maximum radii are, respectively, 1.6 acres and 160 acres per point source of the described construction noises. Since the public recreation land of the ASGA will be off limits to drilling,

¹⁴ These are available at <http://council.wisconsinforestry.org/invasives/>.

¹⁵ U.S. Department of the Interior, Bureau of Land Management, Eastern States Milwaukee Field Office, "Mosquito Creek Lake Draft Planning Analysis/Environmental Assessment," April 1998, available for review at the NSFO.

it is possible that noise would have little to no impact on game and hunting in the ASGA. Drilling a well close to the ASGA boundary would impact between 0.8 acre and 80 acres.

These noises are expected to continue non-stop for 30 days for each well that is constructed. The time of year of construction has a critical effect on the value of the disruption. For example, noise created at the height of a hunting season may render one area unsuitable for hunting for the duration of the noise or for an entire hunting season. It may also force animals to move to other nearby areas, making them easier for hunters to target and improving hunting success. If the noise were created outside of a hunting season, the animals may reacclimate to the site and behave naturally by the time hunting begins, and hunters may not even be aware of the disturbance if they do not see the well(s).

This analysis does not consider the recreational values of private lands. Private lands indeed provide recreational opportunities, and sometimes these opportunities may be available to the public, since some state-sponsored land management programs require participants to permit public use of their lands. Recreational values of private lands would be considered in an EA evaluating an APD, since it would be more reasonable to assess such values on a site-specific basis.

Socioeconomics

The proposed action would likely bring revenues to the region in the form of wages and salaries to employees and contractors who are employed in drilling wells and sales to area hotels, restaurants, and other businesses that serve drillers for the duration of drilling and similar construction-related benefits later as wells are removed and sites restored. During production, producers would be earning income from the produced oil and/or gas, some of which would provide salaries and wages to maintenance staff and contractors.

Soils

In order to comply with well spacing requirements and access the entire EOI, wells would likely be scattered across the entire Development Area, and one or two wells may be expected to be built on highly erodible or potentially highly erodible soils. Since grading a steep slope poses an additional cost to an operator, it is likely that operators will prefer to locate on level ground in other portions of the Development Area.

Due to the presence of potentially highly erodible soils in the Decision Area, the BLM would incorporate soil-conserving BMPs into permits to drill. The Michigan DNR has compiled a guide to using BMPs to prevent erosion.¹⁶ The Michigan water quality BMPs address several activities that are common in oil and gas drilling, such as building temporary roads and clearing land. The BLM would require the use of appropriate BMPs, through consultation with the MDNR, as conditions of approval for APDs.

¹⁶ *Sustainable Soil and Water Quality Practices on Forest Land* is available at http://michigan.gov/dnr/0,1607,7-153-30301_31154_31261---.00.html.

Bureau-Sensitive Species and Migratory Birds

The stipulations prohibiting surface occupancy in wetlands will prevent direct impacts to the endangered and threatened plant species and most of the animal species that occur in wetlands. For example, animals that are restricted to wetlands or waterways, such as fish and mussels, will not be directly impacted, while turtles, which may use adjacent upland habitats, may be killed if they are present during construction. Stipulations requiring protective buffers adjacent to wetlands and waterways will prevent indirect impacts to aquatic species due to sediment runoff into aquatic habitats. Applicants will be required to perform surveys of sites proposed for development in APDs, further preventing direct impacts to listed species. Applicants will be required to implement the recommendations of the Fish and Wildlife Service with respect to species that are likely to be impacted by proposed wells.

Vegetation

Construction activities following APDs would result in the clearing of vegetation approaching the areas of disturbance calculated in Chapter 2. As described in the *Fish and Wildlife* section in this chapter, the predominance of wetlands in forested parts of the Decision Area makes it unlikely that most wells would be located in forested areas. There are cost factors that decrease the likelihood that forested areas will be cleared for a large number of wells. First, forested lands likely cost more to clear, both in terms of the actual work of clearing and compensation to owners. Second, cleared, agricultural areas have more roads than forested areas, making them less expensive to access. If we assume that more than half of the wells to be constructed would be located in open areas, then the low-, medium-, and high-intensity scenarios would yield a maximum of 22.5, 40, and 120 acres, respectively, of forest vegetation being cleared. Open vegetation types, including agricultural crops, would be cleared at rates of 22.5-45 acres, 40-80 acres, and 120-240 acres, respectively, based on the three development scenarios. These clearings would persist for the duration of construction, in the case of temporary workspace, or for the life of each well, and vegetation would be restored according to plans that are approved by the BLM and the surface owners.

Visual Resources

The proposed action would likely result in the construction of wells in agricultural areas or forested areas. Wells in agricultural areas would be visible from throughout the fields in which they are constructed, resulting in an industrial element being present in an otherwise agricultural setting. If we assume that half of wells in the scenarios presented in Chapter 2 would be constructed in agricultural areas and that a typical agricultural field in this area is 40 acres in size, then the low-, medium-, and high-intensity scenarios would result in 200, 320, and 480 acres in which wells would be visible.

Wells constructed in forested areas would be visible from only a short distance due to the forest cover. If we assume that the 2.5-acre well pad construction site is roughly circular and that the well pad will be visible from up to 100 feet into the forest, then each well pad construction site in a forest will convert six acres of forest to an industrial appearance, totaling 30, 48, 72 acres, for the duration of exploration. In the medium- and high-intensity scenarios, the productive well pads would then be reduced to 10,000 square feet. During the time that it takes for trees and shrubs to mature to the point of obscuring the

view of the well pad, the visually impacted area per well pad would dwindle to less than two acres, totaling 14 and 21 acres, respectively, for the medium- and high-intensity scenarios.

Water Resources and Water Quality

As described in Chapter 2, drilling and completion consume water, on the order of a half a million gallons, and this water would likely be obtained from a well drilled for this purpose. The volume of water required would depend on the depth of the oil/gas well, and the impacts of using a certain volume of water would depend upon the aquifer characteristics and the aquifer's proximity to surface water resources. Because of these complexities, anyone wishing to withdraw water at a rate of more than 70 gallons per minute must use the online Water Withdrawal Assessment Tool (<http://www.miwwat.org/>) and obtain a registration for the withdrawal.

Stipulations protecting surface water resources reduce the likelihood of contamination of surface water resources. Contamination of groundwater resources may occur through state-permitted waste disposal on the surface or in injection wells, as described in **Hazardous Wastes**, above. Groundwater contamination may occur as the result of flaws in well design or construction, especially casing and cementing, and produced water that is spilled at the surface may introduce contaminants into the soil, surface water, or groundwater. Through the application of Best Management Practices and adherence to state regulations for drilling, produced water treatment, and fluids storage and disposal, it is expected that drilling and production will not result in measurable contamination impacting nearby drinking water wells.

PERSONS, GROUPS, AND AGENCIES CONSULTED

Consultation and Coordination

List of Persons, Agencies and Organizations Consulted

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
Maria Albright, Wildlife Technician, Allegan State Game Area, Michigan Department of Natural Resources	General information regarding the ASGA	The ASGA and all wildlife areas are off-limits to surface development.
Brian D. Conway, State Historic Preservation Officer	Antiquities Act, Section 106	Letter received from Michigan SHPO dated May 15, 2012 concurring with BLM's consultation requirement conditions prior to drilling activities.
Consulted via website	U.S. Fish and Wildlife Service	Compiled list of Endangered, Threatened, and Candidate species recorded in Allegan County.
Kurt Perron, Chairman Bay Mills Indian Community 12140 West Lakeshore Drive Brimley, MI 49715	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Alan Shively, Chairman Lac Vieux Desert Band of Lake Superior Chippewa Indians P.O. Box 249 Watersmeet, MI 49969	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Joseph Eitrem, Chairman Sault Ste. Marie Tribe of Chippewa Indians 523 Ashmun St. Sault Ste. Marie, MI 49783	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves	No response, assumes no concerns or issues at this time.

	Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	
Dexter McNamara, Chairman Little Traverse Bay Bands of Odawa Indians 7500 Odawa Circle Harbor Springs, MI 49740	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Derek Bailey, Chairman Grand Traverse Band of Ottawa & Chippewa Indians 2605 N. West Bay Shore Dr. Peshawbestown, MI 49682-9275	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Kenneth Meshigaud, Chairman Hannahville Indian Community N14911 Hannahville B-1 Rd. Wilson, MI 49896	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Homer Mandoka, Tribal Council Chairperson Nottawaseppi Huron Band of Potawatomi 2221 1-½ Mile Road Fulton, MI 49052	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
David Sprague, Chairman Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians PO Box 218 Dorr, MI 49323	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Matthew Wesaw, Mekko Pokagon Band of Potawatomi	The National Historic	Response received by email from Michael Zimmerman, Jr. dated May 14,

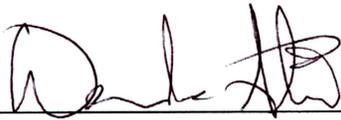
Indians 58620 Sink Road, Box 180 Dowagiac, MI 49047	Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	2012 detailing one area within the decision area where there is a pre-contact burial site. Potential for other burial sites in nearby area.
Warren Swartz, Jr., President Keweenaw Bay Indian Community 16429 Beartown Rd. Baraga, MI 49908	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Julius Peters, Chief Saginaw Chippewa Indian Tribe 7070 East Broadway Road Mt. Pleasant, MI 48858	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.
Larry Romanelli, Tribal Ogema Little River Band of Ottawa Indians 375 River Street Manistee, MI 49660	The National Historic Preservation Act, The American Indian Religious Freedom Act, The Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response, assumes no concerns or issues at this time.

List of Preparers

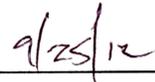
BLM Preparers

Name	Title	Responsible for the Following Section(s) of this Document
Derek Strohl	Natural Resources Specialist	Air Quality, Climate Change, Prime and Unique Farmlands, Fish and Wildlife, Floodplains, Hazardous Wastes, Invasive Species/Noxious Weeds, Recreation, Soils, Threatened, Endangered, or Candidate Animal Species/Migratory Birds, Vegetation, Visual Resources, Water Resources/Quality (Drinking/Surface/Ground), Wetland/Riparian Zones, Wild and Scenic Rivers, and Wilderness
Kurt Wadzinski	Planning and	Environmental Justice, Socioeconomics

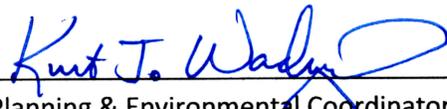
	Environmental Coordinator	
Jarrold Kellogg	Cultural Resources Specialist	Cultural Resources, Native American Religious Concerns
Dave Lachance	Geologist	Geology/Mineral Resources/Energy Production



 Preparer



 Date



 Planning & Environmental Coordinator



 Date



 Assistant Field Manager, Natural Resources



 Date

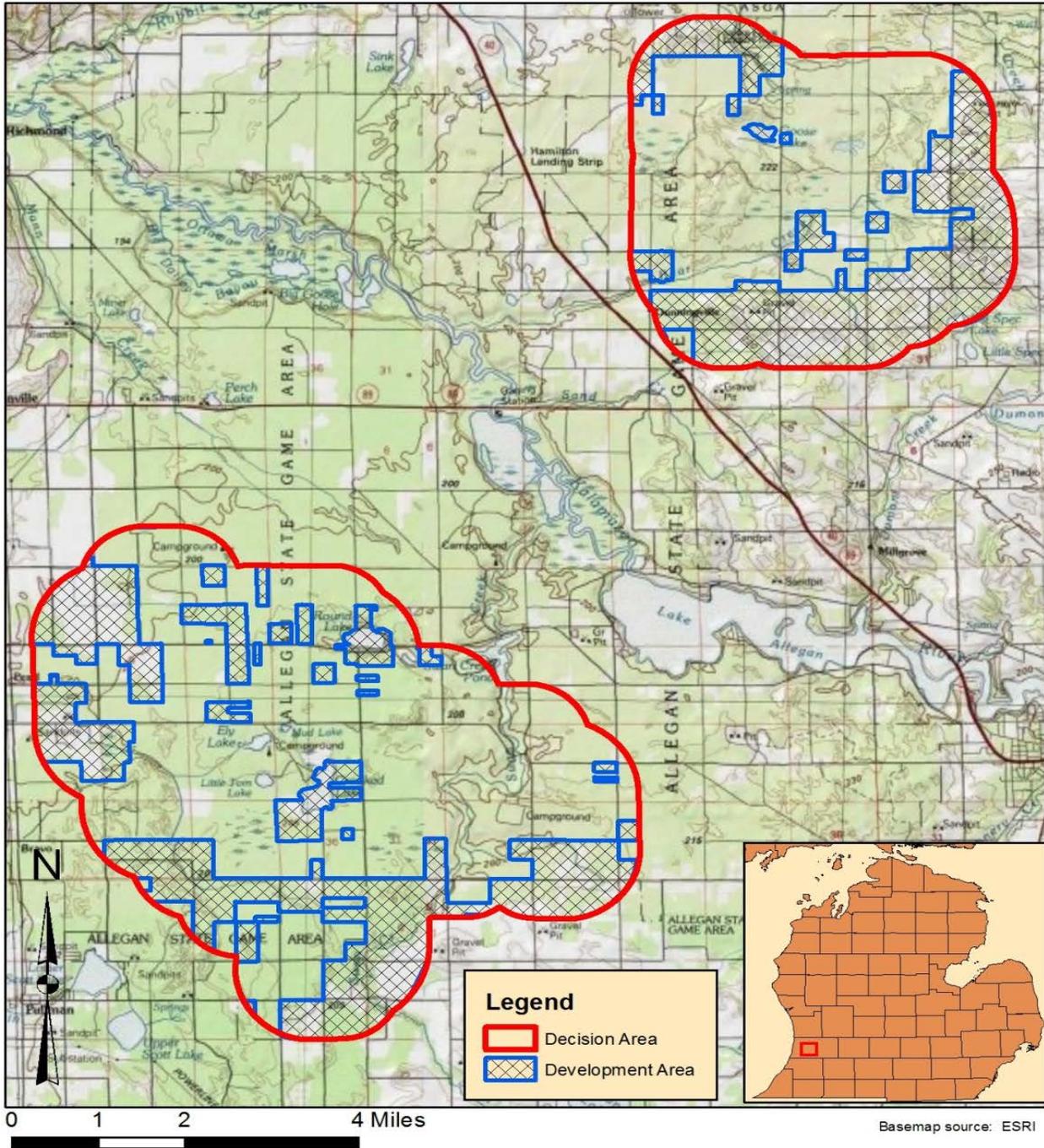
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APPENDIX A – Figures

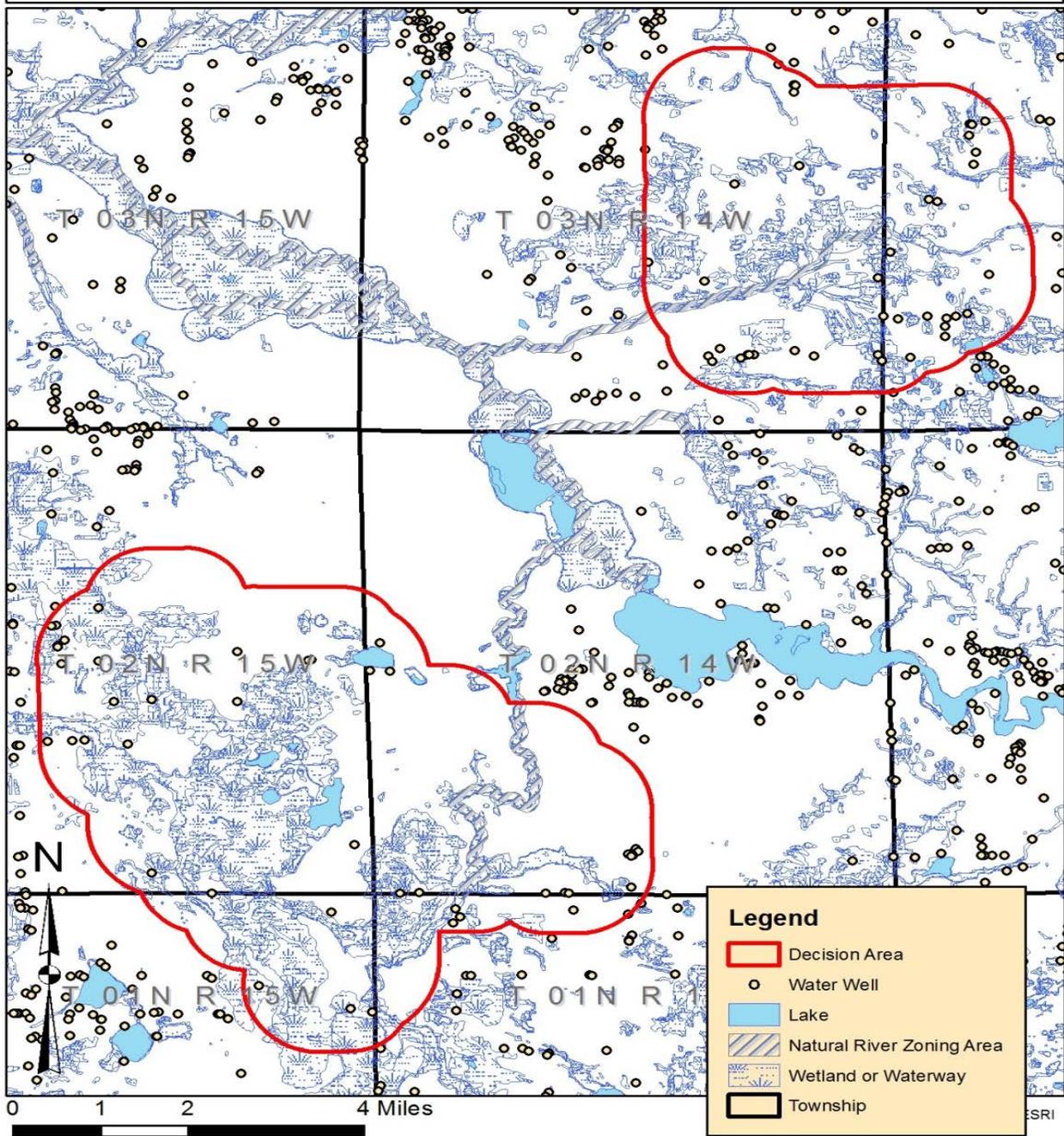
Figure 1. Proposed Lease Area, Decision Area, and Development Area



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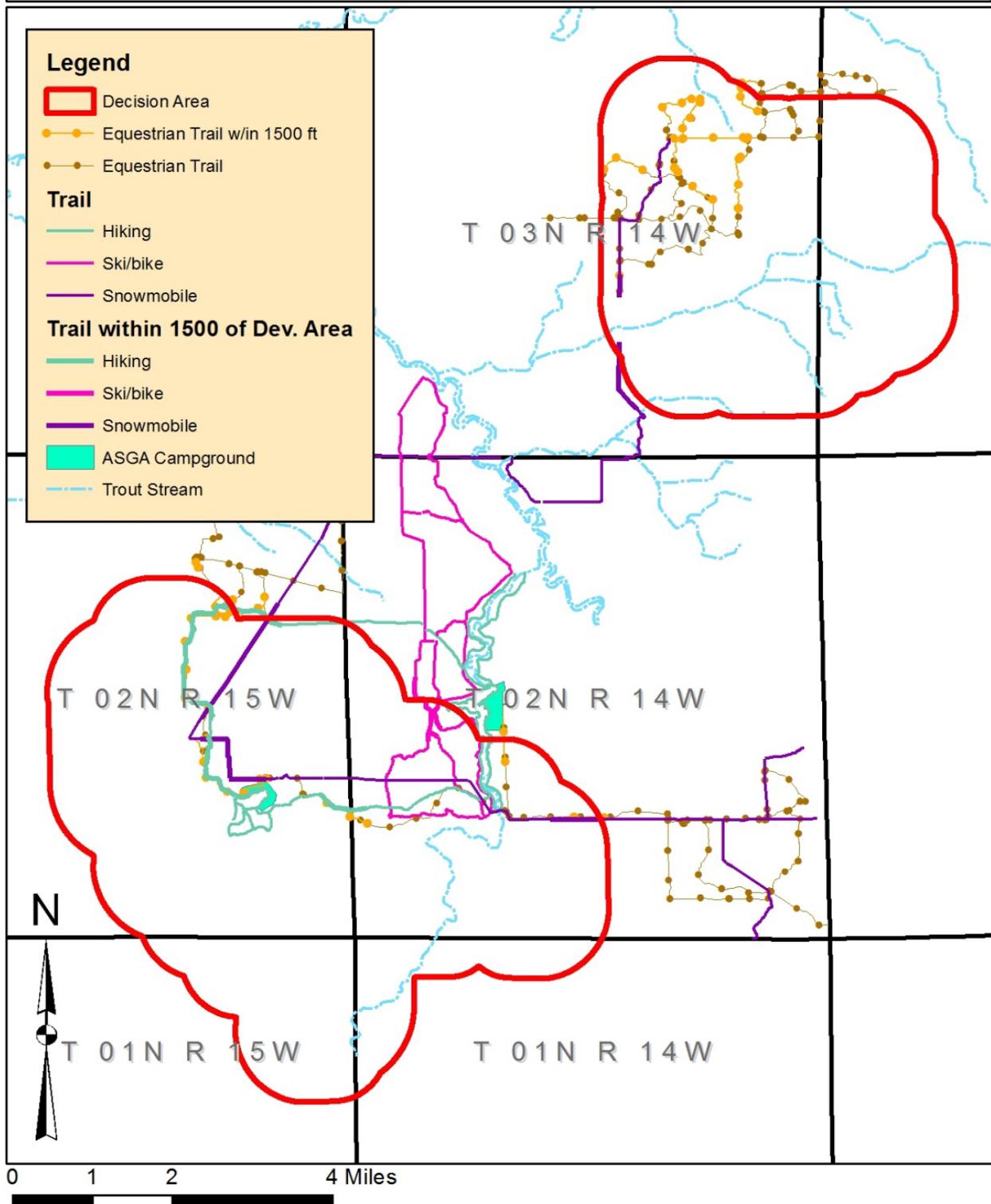
Figure 2. Hydrologic Setting



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.



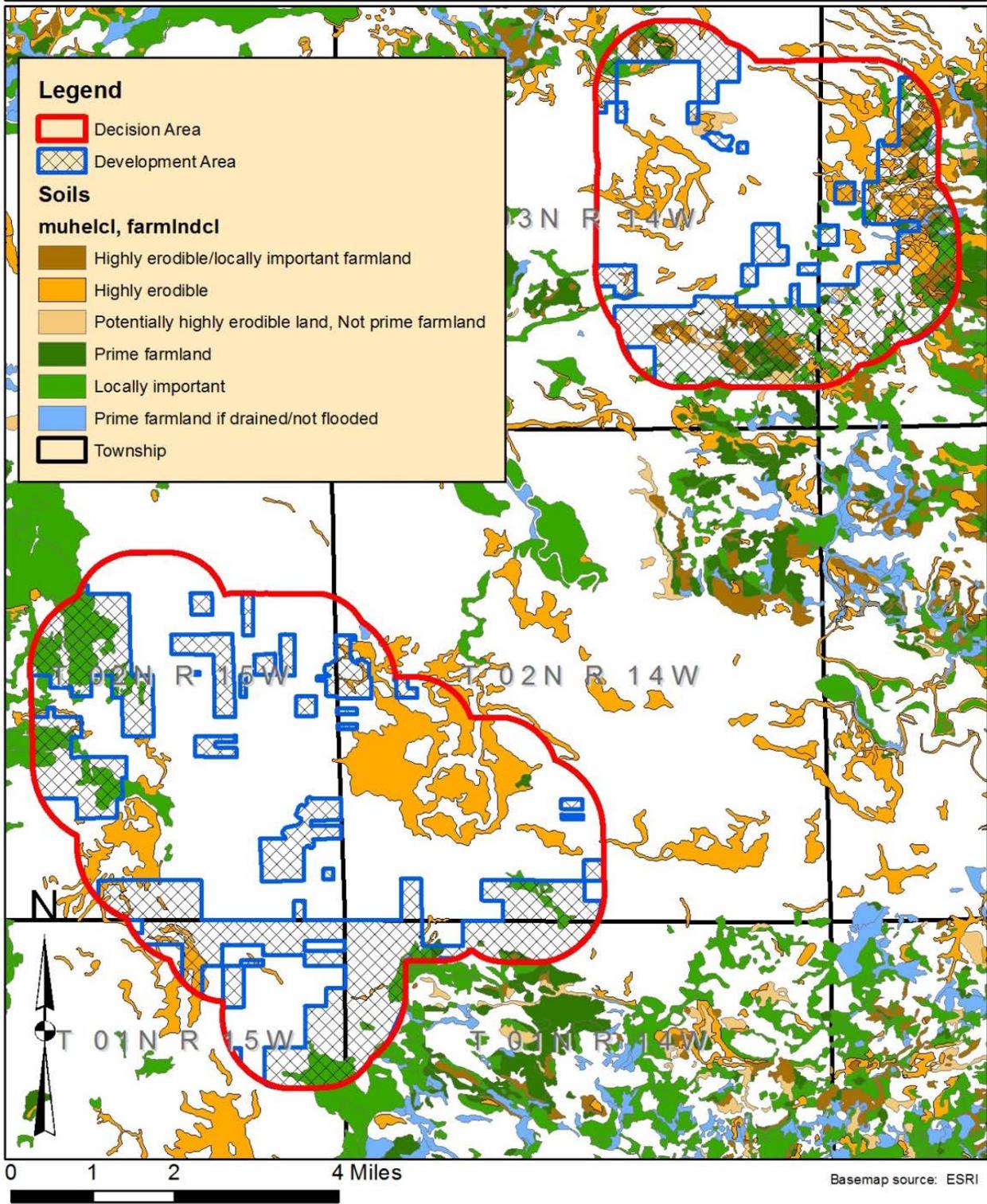
Figure 3. Selected Recreational Resources



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Figure 4. Highly Erodible Soils and Prime Farmlands



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APPENDIX B – Lease Stipulations

1. Well pad construction will not be permitted within 200 feet of a recreational trail, public campground, or park. Exceptions to this distance may be granted in writing by the BLM.
2. No surface occupancy will be permitted in wetlands. Exceptions to this stipulation may be granted in writing by the BLM and the MDNR.
3. No surface occupancy will be permitted within 200 feet from any navigable waterway or within the Natural River Zoning Area. Exceptions may be made in writing by the BLM for improvements made to existing stream crossings; exceptions made will incorporate best management practices to minimize impacts to water resources.

APPENDIX C – Special-Status Species

Threatened, endangered, and candidate species present in Allegan County, Michigan, in habitats that are present in the EOI.

Common name	Scientific name	Status	Habitat
Animals			
Blanchard's cricket frog	<i>Acris crepitans blanchardi</i>	Thr	Open edges of permanent bodies of water or wetlands with saturated soils, also using temporary bodies of water if near permanent water
Blazing star borer	<i>Papaipema beeriana</i>	SC	Prairies that contain blazing star (<i>Liatris</i> spp.), its host plant
Cerulean warbler	<i>Dendroica cerulea</i>	Thr	Canopy of large tracts of deciduous forest
Culver's root borer	<i>Papaimema sciata</i>	SC	Prairies containing Culver's root (<i>Veronicastrum virginicum</i>), the host plant
Eastern box turtle	<i>Terrapene carolina carolina</i>	SC	Forested habitats, and adjacent open habitats, with sandy soils and nearby water sources; nesting in sandy, open areas
Eastern massasauga	<i>Sistrurus catenatus catenatus</i>	CAN	Wetlands and adjacent upland areas
Frosted elfin	<i>Incisalia irus</i>	Thr	Barrens, openings and edges of forests, and shady deciduous forests
Gray ratsnake	<i>Pantherophis spiloides</i>	SC	Forests and adjacent open areas, also structures and dumped debris that mimic natural, large, woody debris
Hooded warbler	<i>Wilsonia citrina</i>	SC	Understory of mesic and wet broadleaved forests
Indiana bat	<i>Myotis sodalist</i>	END, End	River and stream corridors with well-developed riparian woods
Karner blue butterfly	<i>Lycaeides melissa samuelis</i>	END, Thr	Pine barrens and oak savannas on sandy soils and containing wild lupines (<i>Lupinus perennis</i>).
Least shrew	<i>Cryptotis parva</i>	Thr	Meadows, usually upland, with dense coverage of grasses and forbs
Louisiana waterthrush	<i>Seiurus motacilla</i>	Thr	Broad forested areas along clear streams
Maritime sunflower borer	<i>Papaimema maritima</i>	SC	Wet sites that contain tall sunflower (<i>Helianthus giganteus</i>), its host plant
Persius duskywing	<i>Erynnis persius persius</i>	Thr	Barrens, fields, and brushy areas near populations of wild lupine (<i>Lupinus perennis</i>), their sole host plant
Prairie warbler	<i>Dendroica discolor</i>	End	Variety of early successional shrubby/scrubby habitats including young pine plantations and clearcuts in oak forests
Red-shouldered hawk	<i>Buteo lineatus</i>	Thr	Various types of woodlands, especially mature forests in or adjacent to wet meadows and swamps
Spotted turtle	<i>Clemmys guttata</i>	Thr	Clean, shallow bodies of water with muddy or mucky bottoms and aquatic or emergent vegetation
Sprague's pygarcia	<i>Pygarcia spraguei</i>	SC	Openings of oak or oak-pine barrens and other habitats with flowering spurge (<i>Euphorbia corollata</i>)

Appendix C – Special-Status Species

Common name	Scientific name	Status	Habitat
Woodland vole	<i>Microtus pinetorum</i>	SC	Deciduous woodlands with loose, sandy soils, deep humus, and heavy leaf litter
Plants			
Atlantic blue-eyed grass	<i>Sisyrinchium atlanticum</i>	Thr	Coastal plain marshes
Bald-rush	<i>Rhynchospora scirpoides</i>	Thr	Coastal plain marshes
Black-fruited spike-rush	<i>Eleocharis melanocarpa</i>	SC	Coastal plain marshes
Carey's smartweed	<i>Polygonum careyi</i>	Thr	Exposed lakeshores, sandy marshes, and beaver ponds
Cross-leaved milkwort	<i>Polygala cruciata</i>	SC	Coastal plain marshes
Dwarf bulrush	<i>Hemicarpha micrantha</i>	SC	Coastal plain marshes
Dwarf burhead	<i>Echinodorus tenellus</i>	End	Coastal plain marshes
Engelmann's quillwort	<i>Isoetes engelmannii</i>	End	Emergent areas of shallow, acidic lakes
Engelmann's spike rush	<i>Eleocharis engelmannii</i>	SC	Coastal plain marshes
Fescue sedge	<i>Carex festucacea</i>	SC	Various wetland types, notably coastal plain marsh
Goldenseal	<i>Hydrastis canadensis</i>	Thr	Southern hardwood forests, as well as moist ravines and portions of riparian forests
Hall's bulrush	<i>Schoenoplectus hallii</i>	Thr	Coastal plain marshes
Maryland meadow beauty	<i>Rhexia mariana</i>	Thr	Coastal plain marshes
Meadow beauty	<i>Rhexia virginica</i>	SC	Coastal plain marshes
Netted nut rush	<i>Scleria reticularis</i>	Thr	Seasonally flooded wetlands formed in shallow depressions and potholes in glacial lakeplain landscapes
Orange- or yellow-fringed orchid	<i>Platanthera ciliaris</i>	End	Acidic swamps dominated by bog vegetation
Panic grass	<i>Panicum longifolium</i>	Thr	Seasonally flooded wetlands formed in shallow depressions and potholes in glacial lakeplain landscapes
Panicled screwstem	<i>Bartonia paniculata</i>	Thr	Associated with fen complexes, margins of shallow lakes/intermittent wetlands, along coastal plain marshes, and lakeplain wet-mesic prairies
Prairie dropseed	<i>Sporobolus heterolepis</i>	SC	Prairie fens
Scirpus-like rush	<i>Juncus scirpoides</i>	Thr	Coastal plain marshes
Short-beak beak-rush	<i>Rhynchospora nitens</i>	End	Coastal plain marsh
Small-fruited spike-rush	<i>Eleocharis microcarpa</i>	End	Intermittent, seasonal wetlands with a fluctuating water table and acidic sandy-peaty substrates

Appendix C – Special-Status Species

Common name	Scientific name	Status	Habitat
Tall beakrush	<i>Rhynchospora macrostachya</i>	SC	Various types of areas with fluctuating water table, including coastal plain marshes
Tall nut rush	<i>Scleria triglomerata</i>	SC	Dry or moist, sandy ground, in prairies, or on borders of marshes
Three-ribbed spike rush	<i>Eleocharis tricostata</i>	Thr	Coastal plain marshes
Torrey's bulrush	<i>Scirpus torreyi</i>	SC	Seasonally inundated wetlands
Waterthread pondweed	<i>Potamogeton bicupulatus</i>	Thr	Seasonally flooded wetlands formed in shallow depressions and potholes in glacial lakeplain landscapes
Whiskered sunflower	<i>Helianthus hirsutus</i>	SC	Apparently in disturbed openings and rights-of-way in former oak barrens and savanna regions, also limited occurrence in prairie fens adjacent to oak woodlands
Whorled mountain mint	<i>Pycnanthemum verticillatum</i>	SC	Seasonally flooded wetlands formed in shallow depressions and potholes in glacial lakeplain and outwash landscapes

Key: END – Federally endangered; THR – Federally threatened; CAN – Federal candidate; End – State endangered; Thr – State threatened; SC – State species concern; X – presumed extirpated (state)