

United States Department of the Interior

Bureau of Land Management

Northeastern States Field Office

LLES003420

Environmental Assessment

NEPA #: DOI-BLM-ES-0030-2013-0002-EA

**Environmental Assessment for
Expressions of Interest 1662, 1664, 1665,
1666, 1667, 1668, 1669, 1670, and 1673**

Date: March 2013

Type of Action: Oil and Gas

Serial Number: MI12415 (EOI-1662), MI12416 (EOI-1664), MI12417 (EOI-1665)
MI12418 (EOI-1666), MI12419 (EOI-1667), MI12420 (EOI-1668)
MI12421 (EOI-1669), MI12422 (EOI-1670), MI12423 (EOI-1673)

Location: Michigan Meridian, Allegan County, (Bloomingdale, Fennville, Millgrove and Pullman
Quadrangles)

EOI-1662

T. 1 N., R. 14 W., sec. 1, N $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$;
sec. 3, E $\frac{1}{2}$ NW $\frac{1}{4}$.

EOI-1664

T. 1 N., R. 15 W., sec. 2, S $\frac{1}{2}$ NE $\frac{1}{4}$ exc. S. 300 ft. of E. 1452 ft.; E $\frac{1}{2}$ SW $\frac{1}{4}$; E $\frac{1}{2}$ SE $\frac{1}{4}$;
sec. 4, N. 10 acres of E $\frac{1}{2}$ NE $\frac{1}{4}$; W $\frac{1}{2}$ NE $\frac{1}{4}$; E $\frac{1}{2}$ SW $\frac{1}{4}$; SE $\frac{1}{4}$ NW $\frac{1}{4}$;
sec. 11, NE $\frac{1}{4}$; SE $\frac{1}{4}$ NW $\frac{1}{4}$; E. 45 acres of the N $\frac{1}{2}$ SE $\frac{1}{4}$; S $\frac{1}{2}$ SE $\frac{1}{4}$;
sec. 12, NW $\frac{1}{4}$.



EOI-1665

- T. 2 N., R. 14 W.,
- sec. 3, S. 12 acres of NE $\frac{1}{4}$ NE $\frac{1}{4}$; NW $\frac{1}{4}$ NE $\frac{1}{4}$; S $\frac{1}{2}$ NE $\frac{1}{4}$; NW $\frac{1}{4}$; N $\frac{1}{2}$ SW $\frac{1}{4}$; W $\frac{1}{2}$ SE $\frac{1}{4}$;
 - sec. 4, NE $\frac{1}{4}$ NE $\frac{1}{4}$; SW $\frac{1}{4}$ NE $\frac{1}{4}$; W $\frac{1}{2}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$; NW $\frac{1}{4}$; Lot 4; Lot 5; SW $\frac{1}{4}$ SW $\frac{1}{4}$; E $\frac{1}{2}$ SE $\frac{1}{4}$;
 - sec. 5, Entire sec.;
 - sec. 6, W $\frac{1}{2}$ W $\frac{1}{2}$ NE $\frac{1}{4}$; NW $\frac{1}{4}$, exc. parcel 208.71 ft. sq. in SW cor.; SW $\frac{1}{4}$, exc. parcel 208.71 ft. sq. in NW cor.; W $\frac{1}{2}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$; S $\frac{1}{2}$ SE $\frac{1}{4}$;
 - sec. 7, SE $\frac{1}{4}$ NE $\frac{1}{4}$; W. 35 acres of NE $\frac{1}{4}$ SW $\frac{1}{4}$; E. 3 acres of W. 1/8 of SE $\frac{1}{4}$ SW $\frac{1}{4}$;
E. 2.5 acres of W $\frac{1}{2}$ E $\frac{1}{2}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$; W. 1/3 of E. 3/8 of SE $\frac{1}{4}$ SW $\frac{1}{4}$; E $\frac{1}{2}$ W $\frac{1}{2}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$;
That part of SE Qtr. desc. as follows:
Com. 2145 ft. W. of SE cor. of Sec. 7, th. N. 1320 ft., th. E. 165 ft., th.
N. 1320 ft., th. W. 330 ft., th. S. 1320 ft., th. W. 330 ft., th. S. 1320 ft.,
th. E. 495 ft. to beg.;
 - E. 10 acres of W. 50 acres of SE Qtr.;
 - E. 20 acres of W $\frac{1}{2}$ SE $\frac{1}{4}$;
 - sec. 8, N $\frac{1}{2}$; W $\frac{1}{2}$ SW $\frac{1}{4}$; SE $\frac{1}{4}$ SW $\frac{1}{4}$; W $\frac{1}{2}$ SE $\frac{1}{4}$; That part of E $\frac{1}{2}$ SE $\frac{1}{4}$ lying N'yly of Swan Creek;
That part of E $\frac{1}{2}$ SE $\frac{1}{4}$ lying S. and E. of Swan Creek;
 - sec. 9, Those parts of SW $\frac{1}{4}$, SW $\frac{1}{4}$ NW $\frac{1}{4}$, and Gov't Lot 1 and Lot 2 lying S. and E. of Swan Creek;
NE $\frac{1}{4}$ NE $\frac{1}{4}$; That part of Gov't Lots 1 and 2 and W $\frac{1}{2}$ lying NW of Swan Creek; Part of Gov't Lot 5 and
SW $\frac{1}{4}$ SE $\frac{1}{4}$ com. 2000.8 ft. W. of SE cor. of Sec., th. W. 92.1 ft., N. 18° E. to Kalamazoo River, SE along
river to pt. 2352.9 ft. N. 18° E. from beg., and S. 18° W. 2352.9 ft. to beg.
Lots 5 and 7 and SW $\frac{1}{4}$ SE $\frac{1}{4}$, subject to ease. for R.O.W. in Francis J. Koopman and his heirs and
assigns, exc. six parcels desc. as follows:

Com. 121.26 rds. (2000.8 ft.) W. of SE cor. of Sec. 9,
th. W. 92.10 ft., th. N. 18° E. 156.78 rds. (2586.9 ft.)
to Kalamazoo River, th. SE along Kalamazoo River to pt. 142.6 rds.
(2352.9 ft.) N. 18° E. of pt. of beg., th. S. 18° W.
142.6 rds. (2352.9 ft.) to place of beg., being 5.70 acres, more or less;

 - Com. 101.27 rds. N. of SE cor. of Sec. 9, th. W. 7.3 rds., th.
N. 18° E. 120.6 rds. to Kalamazoo River, th. SE along Kalamazoo River
12.36 rds. to pt. 108 rds. N. 18° E. of place of beg., th. S.
18° W., 108 rds. to place of beg., being 5.1 acres, more or less;

 - Com. 86.57 rds. (1428.41 ft.) W. of SE cor. of Sec. 9, th. W.
2.18 rds., th. N. 18° E. 80 rds. to Kalamazoo River, th. SE along
Kalamazoo River to pt. 75.14 rds. N. 18° E. of place of beg.,
Th. S. 18° W. 75.14 rds. to place of beg., being 1.06 acres,
more or less;

 - Com. 71.08 rds. W. of SE cor. of Sec. 9, th. W. 15.49 rds. to
Margaret F. Heiden land, th. W. 18° E. 75.14 rds. to Kalamazoo
River, th. along Kalamazoo River to pt. N. 18° E. from place of
beg., th. S. 18° W. 58 rds. to place of beg., being 6.1
acres, more or less;

 - Com. at SE cor. of Sec. 9, th. W. 54.99 rds. to SE cor. of
land heretofore sold to Charles Faulman, th. N. 18° E. 47 rds. to
Kalamazoo River, th. along river to E. sec. line of Sec. 9, th. S. along
sec. line to place of beg., being 15.9 acres, more or less;

 - Com. 54.99 rds. W. of SE cor., Sec. 9, th. W. 16.09 rds., th. N. 18° E. 58
rds. to Kalamazoo River, th. SE along river 16.6 rds. to pt. 47 rds. N. 18°
E. to place of beg., th. S. 18° W. 47 rds. to place of beg., being 5.0 acres,
more or less;
- sec. 10, W. 30.65 acres of SW $\frac{1}{4}$ NW $\frac{1}{4}$; N $\frac{1}{2}$ NE $\frac{1}{4}$; NW $\frac{1}{4}$ NW $\frac{1}{4}$; S $\frac{1}{2}$ N $\frac{1}{2}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$; That part of
Gov't Lot 1, com. 330 ft. S. of NE cor. of said Lot, th. W. 660 ft., th. S. to

- Kalamazoo River, th. SE'ly along said River to S. line of said lot, th. E. to E. line of said Lot, thence N. to pt. of beg.; NE¼SE¼; W¼SE¼; Gov't Lot 2 exc. N. 7 acres; E. 25 acres of S½NE¼; W. 26.5 acres of SE¼NW¼, exc. parcel of land 8 rds. E. and W. by 20 rds. N. and S. in SW cor. thereof; E. 9.35 acres of the SW¼NW¼;
- sec. 15, All that part of W½NE¼ lying N. of Kalamazoo River and above contour line at elevation 618 six according to U.S.G.S. datum; That part of Lot 1 lying N. of Hwy.; That part of SW¼, lying above contour line at elevation 618 according to U.S.G.S. datum;
- sec. 16, N½NE¼ exc. that part lying below contour 618 ft. U.S.G.S. datum; W¼NW¼; S½SW¼ exc. S. 5 acres of SW¼SW¼; NE¼SE¼, exc. N. 532.1 ft. of E. 532.1 ft., also exc. that part of balance lying below contour 618 ft., U.S.G.S. datum;
- sec. 17, E½NE¼; NW¼, exc. S. 244.66 ft. of W. 222.75 ft.; NE¼SW¼; W¼SW¼; S½SE¼SW¼; E½SE¼, exc. strip of land 50 ft. on each side of a cent. line beg. at pt. 33.39 ft. S. 89° W. of S. 1/8 cor. common to Secs. 16 and 17, th. 760 ft., S. 69° 56' W., containing 1.745 acres, more or less; SW¼SE¼;
- sec. 18, NE¼; N½NW¼; SW¼NW¼; W¼SE¼, SE¼SE¼; Lots 5 and 6, Round Lake Resort Subdivision; NE¼SW¼;
Part of SE¼SW¼ and W¼SW¼ desc. as that tract of land lying E. and N. of Round Lake Resort, desc. as beg. at SE cor. of said SE¼SW¼, th. W. along S. line of said Sec. 18, 519.5 ft. to E. bdy. of said Round Lake Resort, th. N. along said bdy. 889 ft. to N. line of Cottage Grove Avenue, th. along N. line N. 76° 15' W. 837 ft. to pt. on W. line of said SE¼SW¼, th. S. along W. line 291 ft. to N. shore line of Round Lake, th. in NW'ly direction along said N. shore line to pt. 271.25 ft. due W. of said W. line of SE¼SW¼, th. N. to S. line of Cottage Grove Avenue, th. along S. line N. 76° 15' W. to pt. 371.25 ft. due W. of said W. line of SE¼SW¼, th. N. to pt. 330 three hundred ft. due S. of N. line of said NW¼SW¼, th. E. 371.25 ft. to E. line of said NW¼SW¼, th. S. to SE cor. of NW¼SW¼, th. E. to NE cor. of SE¼SW¼, th. S. to pt. of beg.;
S½SE¼; NW¼SE¼;
- sec. 19, W¼E½E½E½SW¼; W. 10 acres of E½SW¼; NW¼NE¼, exc. 1 acre in sq. form in NE corner thereof; NW¼NE¼; E. 10 acres of NW¼NW¼, exc. R.O.W. for hwy. outstanding of record, containing .08963 of an acre; S½NE¼; N½SW¼NW¼; SE¼NW¼; N. 10 acres of W¼SW¼; S. 10 acres of W¼NW¼; S½NW¼SW¼; S½SW¼SW¼; E. 30 acres of W¼E½SW¼; E. 10 acres of W. 20 acres of E¼SW¼; SE¼;
- sec. 20, E½NW¼; NW¼NW¼; S½SW¼; SE¼;
- sec. 21, SW¼; W¼SE¼;
- sec. 22, A parcel in NW¼NW¼ com. at NW corner, th. S. 16 rds., th. E.50 rds., th. N. 16 rds., th. W. 50 rds., to place of beg.; W. 15 acres of E½NE¼SW¼, exc. a strip of land 12 ft. wide off W. side containing .36 acres; W¼E½SW¼; W¼W½S¼; E. 100 acres of SE¼;
- sec. 23, That part of S½NE¼ lying N. of State Trunk Highway M-89, exc. W. 1994.35 ft., also exc. that part lying below contour 618' of U.S.G.S. datum; S. 10 acres of NE¼NW¼; E. 5 acres of S½SE¼NW¼; NE¼SW¼; W¼NW¼SW¼; S½SE¼; SW¼SE¼;
- sec. 24, That part of Gov't Lot 3, Gov't Lot 4 and E. 660 ft. of SE¼NW¼ lying above contour 618, also W. 660 ft. of SE¼NW¼ lying S. of cent. line of State Trunk Hwy. M-89; W¼ lying S'ly of State Trunk Hwy. M-89 exc. N. 208.7 ft. of E. 211.36 ft.; also exc. parcel com. at int. of W. sec. line of Sec. 24 and cent. line of State Trunk Hwy. M-89, th. S. along the W. sec. line 858 ft., th. E. 198 ft., th. N. 891 ft. to cent. line of hwy. known as M-89, th. SW'ly along said cent. line to beg.; E½SW¼; W¼SE¼;
- sec. 25, W¼E½W¼E½SW¼; SE¼NE¼; W¼NE¼; E½NW¼; E. 10 acres of W¼NW¼; W. 10 acres of the E. 20 acres of W¼NW¼; E. 10 acres of W. 15 acres of E½W¼NW¼; W. 5 acres of E. 40 acres of W¼NW¼; W. 15 acres of NW¼; W¼E½W¼W¼SW¼; W. 10 acres of the E. 30 acres of W¼SW¼; W. 10 acres of E. 20 acres of W¼SW¼; W. 5 acres of E. 20 acres of W¼SE¼; W. 10 acres of SE¼; E. 5 acres of SW¼; W. 10 acres of E. 40 acres of SW¼;
- sec. 26, E. 10 acres of NE¼; W. 10 acres of E. 20 acres of NE¼; W. 15 acres of E. 35 acres of NE¼; W. 30 acres of E½NE¼; NW¼NW¼; S½NW¼; E½E½SW¼; NE¼SE¼; W. 30 acres of SE¼;
- sec. 27, SE¼NW¼; NE¼; W¼W½; NE¼SE¼; S½SE¼; NE¼NW¼; W¼NW¼;
- sec. 28, N½; SW¼; NE¼SE¼;
- sec. 29, NE¼; E½NW¼; SW¼; N½SE¼;
- sec. 33, N½;
- sec. 34, N½N½NE¼; S½NE¼; NE¼NW¼; W¼SE¼NW¼; NW¼SW¼; NW¼NW¼; W¼E½SE¼;
- sec. 36, N½, exc. E½E½NE¼; N. 30 acres of E½SW¼; W¼SW¼, exc. S. 726 ft. of E. 600 ft.; E½SE¼; N. 70 acres of W¼SE¼.

EOI-1666

T. 2 N., R. 15 W.,

sec. 1, N. 40.2 acres of NE $\frac{1}{4}$; S. 50 acres of N $\frac{1}{2}$ NE $\frac{1}{4}$; N $\frac{1}{2}$ NW $\frac{1}{4}$; W $\frac{1}{2}$ SW $\frac{1}{4}$; S $\frac{1}{2}$ NE $\frac{1}{4}$; NE $\frac{1}{4}$ SE $\frac{1}{4}$ exc. S. 214.5 ft. of N. 561 ft. of E. 214.5 ft.;

sec. 2, E. 80 acres of NE $\frac{1}{4}$ exc. 10 sq. acres in SE cor.; W $\frac{1}{2}$ SW $\frac{1}{4}$; SE $\frac{1}{4}$ SW $\frac{1}{4}$; NW $\frac{1}{4}$ SE $\frac{1}{4}$; W $\frac{1}{2}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$;

sec. 3, SW $\frac{1}{4}$ SE $\frac{1}{4}$;

sec. 10, E. 51 acres of N. 100 acres of NE $\frac{1}{4}$, exc. 2.1 acres in NE corner, 22 rds., 8 ft. E. and W. by 15 rds., 4 ft. N. and S.; W. 49 acres of N. 100 acres of NE $\frac{1}{4}$; SE $\frac{1}{4}$, exc. S. 70 acres, also exc. N. 10 acres; N. 35 acres of S. 70 acres of SE $\frac{1}{4}$; S. 35 acres of S $\frac{1}{2}$ SE $\frac{1}{4}$;

sec. 11, E $\frac{1}{2}$ NE $\frac{1}{4}$; N. 10 acres of W. 15 acres of E $\frac{1}{2}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$; SW $\frac{1}{4}$ NE $\frac{1}{4}$; NW $\frac{1}{4}$; S $\frac{1}{2}$;

sec. 12, NE $\frac{1}{4}$ NE $\frac{1}{4}$; W $\frac{1}{2}$ NE $\frac{1}{4}$; S $\frac{1}{2}$ NW $\frac{1}{4}$; NW $\frac{1}{4}$ NW $\frac{1}{4}$; SW $\frac{1}{4}$; NW $\frac{1}{4}$ SE $\frac{1}{4}$; S $\frac{1}{2}$ SE $\frac{1}{4}$;

sec. 13, E. 100 acres of NE $\frac{1}{4}$; W $\frac{1}{2}$ E $\frac{1}{2}$ NW $\frac{1}{4}$; W $\frac{1}{2}$ NW $\frac{1}{4}$; N $\frac{1}{2}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$; SE $\frac{1}{4}$;

sec. 14, W $\frac{1}{2}$ E $\frac{1}{2}$ NE $\frac{1}{4}$; NW $\frac{1}{4}$ NW $\frac{1}{4}$; S $\frac{1}{2}$ NW $\frac{1}{4}$; E $\frac{1}{2}$ SE $\frac{1}{4}$; NW $\frac{1}{4}$ NE $\frac{1}{4}$;

sec. 15, E $\frac{1}{2}$;

sec. 21, S. 60 acres of W $\frac{1}{2}$ NE $\frac{1}{4}$, exc. S. 295.16 ft. of W. 295.16 ft.; E $\frac{1}{2}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$; E $\frac{1}{2}$ NW $\frac{1}{4}$, exc. that part com. at cent. of Sec. 21, th. N. along N. and S. one qtr. line 528 ft., W. 264 ft., S. 264 ft., E. 99 ft., S. 264 ft. to E. and W. one qtr. line, E. to beg.; SE $\frac{1}{4}$ SE $\frac{1}{4}$;

sec. 22, NE $\frac{1}{4}$ NE $\frac{1}{4}$; W $\frac{1}{2}$ NW $\frac{1}{4}$; W $\frac{1}{2}$ E $\frac{1}{2}$ SW $\frac{1}{4}$; W $\frac{1}{2}$ SW $\frac{1}{4}$; NE $\frac{1}{4}$ SE $\frac{1}{4}$; S $\frac{1}{2}$ SE $\frac{1}{4}$;

sec. 27, E $\frac{1}{2}$; E. 30 acres of SE $\frac{1}{4}$ NW $\frac{1}{4}$; E $\frac{1}{2}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$; NE $\frac{1}{4}$ SW $\frac{1}{4}$; S $\frac{1}{2}$ SW $\frac{1}{4}$;

sec. 28, SW $\frac{1}{4}$ NW $\frac{1}{4}$; SW $\frac{1}{4}$; S $\frac{1}{2}$ SE $\frac{1}{4}$;

sec. 33, NE $\frac{1}{4}$; NE $\frac{1}{4}$ NW $\frac{1}{4}$; SE $\frac{1}{4}$;

sec. 34, N $\frac{1}{2}$;

sec. 36, NE $\frac{1}{4}$ SW $\frac{1}{4}$; SE $\frac{1}{4}$; W $\frac{1}{2}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$; W $\frac{1}{2}$ SW $\frac{1}{4}$; N $\frac{1}{2}$ NE $\frac{1}{4}$ (Lot 1); N $\frac{1}{2}$ S $\frac{1}{2}$ NE $\frac{1}{4}$.

EOI-1667

T. 3 N., R. 13 W.,

sec. 7, Entire sec., exc. N. 528 ft. of NW $\frac{1}{4}$ SW $\frac{1}{4}$;

sec. 8, N $\frac{1}{2}$ SW $\frac{1}{4}$;

sec. 18, NE $\frac{1}{4}$, exc. SE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$; E $\frac{1}{2}$ NW $\frac{1}{4}$; SW $\frac{1}{4}$; W $\frac{1}{2}$ SE $\frac{1}{4}$;

sec. 19, W $\frac{1}{2}$ NW $\frac{1}{4}$; E. 35 acres of SE $\frac{1}{4}$ SW $\frac{1}{4}$; S $\frac{1}{2}$ SE $\frac{1}{4}$;

sec. 20, N $\frac{1}{2}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$;

sec. 30, N $\frac{1}{2}$ NW $\frac{1}{4}$.

EOI-1668

T. 3 N., R. 14 W.,

sec. 33, S. 2145 ft. of W. 115.5 ft. of E $\frac{1}{2}$ NE $\frac{1}{4}$; N $\frac{1}{4}$ NW $\frac{1}{4}$; S $\frac{1}{2}$ NW $\frac{1}{4}$; SW $\frac{1}{4}$; W $\frac{1}{2}$ E $\frac{1}{2}$ SE $\frac{1}{4}$; W $\frac{1}{2}$ SE $\frac{1}{4}$;

sec. 34, That part of NE of Sec. 34, lying E. of Bee Line Road, so called, exc. 12 acres in NW desc. as 40 rds. N. and S. and running from N. and S. qtr. line to Pere Marquette R.R.; also except Pere Marquette R.R. R.O.W. desc. com. 639 ft. W. of E. qtr. post of said Sec. 34, th. N. 28° 30' W. to N. line of said sec., said above line being the cent. line of a strip of land 99 ft. in width; S. 577.5 ft. of the NE $\frac{1}{4}$ lying W'ly of State Trunk Line M-40; NW $\frac{1}{4}$, exc. that part lying NE'ly of State Trunk Line M-40; W $\frac{1}{2}$ SW $\frac{1}{4}$; That part of the N $\frac{1}{2}$ SE $\frac{1}{4}$ lying W'ly of Pere Marquette R.R. less that part lying E. of State Trunk Line M-40.

EOI-1669

T. 3 N., R. 14 W.,

sec. 11, NE $\frac{1}{4}$; E $\frac{1}{2}$ NW $\frac{1}{4}$; SW $\frac{1}{4}$; SE $\frac{1}{4}$ SE $\frac{1}{4}$;

sec. 12, S $\frac{1}{4}$ N $\frac{1}{2}$ NE $\frac{1}{4}$; S $\frac{1}{2}$ NE $\frac{1}{4}$; NW $\frac{1}{4}$; NE $\frac{1}{4}$ SW $\frac{1}{4}$; S. 32.5 acres of NW $\frac{1}{4}$ SW $\frac{1}{4}$; SE $\frac{1}{4}$ SW $\frac{1}{4}$; SE $\frac{1}{4}$;

sec. 14, NW $\frac{1}{4}$ NE $\frac{1}{4}$;

sec. 15, E. $\frac{3}{4}$ of N $\frac{1}{2}$ NE $\frac{1}{4}$; N $\frac{1}{2}$ S $\frac{1}{2}$ NE $\frac{1}{4}$; W $\frac{1}{2}$, exc. SW $\frac{1}{4}$ SW $\frac{1}{4}$ and NW $\frac{1}{4}$ NW $\frac{1}{4}$;

sec. 16, S $\frac{1}{2}$ SE $\frac{1}{4}$;

sec. 17, W $\frac{1}{2}$ SW $\frac{1}{4}$;

sec. 18, Entire sec., exc. E $\frac{1}{2}$ NE $\frac{1}{4}$;

sec. 19, E $\frac{1}{2}$; W $\frac{1}{2}$ NW $\frac{1}{4}$, exc. N. 255.62 ft. of W. 255.62 ft., also exc. S. 29 acres;

sec. 20, NW $\frac{1}{4}$ NE $\frac{1}{4}$; N $\frac{1}{2}$ NW $\frac{1}{4}$; SW $\frac{1}{4}$; W $\frac{1}{2}$ SE $\frac{1}{4}$;

sec. 21, That part of NE $\frac{1}{4}$ lying SW'ly of Pere Marquette R.R., and that part of E $\frac{1}{2}$ NW $\frac{1}{4}$ lying SW'ly of Pere Marquette R.R., and S. 235.13 ft. of W $\frac{1}{2}$ NW $\frac{1}{4}$ lying E'ly of State Trunk Line M-40; E $\frac{1}{2}$ NE $\frac{1}{4}$, That part of E $\frac{1}{2}$ SE $\frac{1}{4}$ lying NE'ly of Pere Marquette R.R.;

sec. 22, NW $\frac{1}{4}$; SW $\frac{1}{4}$, exc. 35 rds. E. and W. by 46 rds. N. and S. in SE cor. and exc. Pere

- Marquette R.R.; SE¼;
- sec. 27, NE¼NE¼, exc. S. 330 ft. of W. 660 ft.; That part of SW¼NE¼ lying S'ly and E'ly of Bear Creek, exc. a parcel com. 492 ft. N. of SW¼NE¼, th. E. 165 ft., th. N. to Bear Creek, th. W'ly along said creek to W. Line of NE¼, th. S. to beg.; That part of W½NW¼ lying SW'ly of Pere Marquette R.R.; SE¼NE¼ exc. Pere Marquette R.R.; That part of N½SW¼ lying E'ly of State Trunk Line M-40 and W'ly of Vill. of Dunningville, exc. the following: com. at pt. in cent. of hwy. known as Bee Line road 6 rds. SE from where sec. line crosses said hwy., running in NE'ly direction at right angles with said hwy. 13 rds., th. in SE'ly direction parallel with said hwy. 13 rds., th. in SW'ly direction at right angles with said hwy. 13 rds. to cent. of said hwy.; th. in NW'ly direction along cent. of said hwy. 13 rds. to place of beg.; also that part of N½SW¼ lying SE'ly of Vill. of Dunningville and W'ly of Pere Marquette R.R.; also lots as follows in Vill. of Dunningville: Lots 21, 22 and 35 to 55 inclusive, and unnumbered lots lying E'ly of lots 46 and 55, lots 56 to 65 inclusive, and unnumbered lots lying E'ly of lots 56 and 65, lots 66 to 75 inclusive, and unnumbered lots lying E'ly of lots 66 and 75, lots 76 to 108 inclusive;
- sec. 29, NW¼; E½SW¼; Lot 1; NW¼SE¼;
- sec. 30, SE¼NE¼; That parcel in NW¼ beg. at NE cor. of said NW¼, th. W. 40 rds., th. S. to N'ly bank of Kalamazoo River, th. SE'ly, along river to N. and S. one qtr. line of said Sec., th. N. to pt. of beg., being part of Gov't. Lot 1; Lot 5; Lot 6; Lot 7; SW¼;
- sec. 31, NE¼NE¼; SW¼NE¼; W½NW¼; SE¼NW¼; SW¼; NW¼SE¼; E½SE¼;
- sec. 32, Lot 1; Lot 4; Lot 5; Lot 6; N½NE¼; That part of W½ lying S. and W. of Kalamazoo River.

EOI-1670

- T. 3 N., R. 15 W.,
- sec. 13, NE¼NE¼; W½NE¼; NE¼NW¼; NW¼NW¼, exc. 1 acre in SW cor.; SW¼NW¼; SW¼, exc. SE¼SE¼SW¼; NW¼SE¼; S½SE¼;
- sec. 14, E½; S½NW¼; W½SW¼;
- sec. 22, Lot 3; Lot 4; NW¼NW¼; E½SW¼; W½SE¼;
- sec. 23, Lot 1; Lot 3; Lot 4; Lot 5; Lot 6; That part of S½ lying N. of Kalamazoo River;
- sec. 24, NE¼NE¼; W½NE¼; NW¼, exc. strip two rds. wide along E. side and also W. 10 acres of NW¼NW¼; Lot 3; Lot 4; Lot 5; Lot 6; Lot 7;
- sec. 25, Entire Sec.;
- sec. 26, NE¼; SE¼NW¼; That part of S½SE¼ com. 4 rds. E. of SW cor. of SW¼SE¼, th. N. 59 rds., E. 96 rds., S. 59 rds., W. 96 rds. to place of beg.; E. 30 acres of S½SE¼;
- sec. 27, NW¼NE¼; SE¼NE¼; E½SE¼;
- sec. 35, N½NE¼; SW¼NE¼; W. 60 acres of W½SW¼; S. 528 ft. of N. 1056 ft. of E½SE¼; SW¼SE¼, exc. parcel com. at SW cor. of SE¼, th. N. 31 rds., E. 10 rds. 8 in., S. 31 rds., W 10 rds. 8 in. to place of beg.;
- sec. 36, E½NE¼; SW¼NE¼; E½NE¼NW¼; W½W½; SE¼.

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- T. 3 N., R. 15 W.,
- sec. 30, W. 30.12 acres of NW¼NW¼; W½SW¼NW¼; W½SE¼;
- sec. 31, E½NW¼; NW¼NW¼; W½SW¼; NE¼SW¼, exc. parcel com. at NE cor. of SW¼, th. W. 33 1/3 rds., S. 24 rds. and 25 ft., th. E. 192 ft. to shore of Little John Lake, th. NE'ly along shore of said lake to E. line of NE¼SW¼, th. N. to place of beg.

Project Acreage: 27,302 acres

Proponent Address: Confidential

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)

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CHAPTER 1 – PURPOSE OF AND NEED FOR ACTION

Purpose of the Proposed Action

The purpose is to promote opportunities for private individuals or companies to explore for and develop oil and gas resources on public lands 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.

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 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.

The BLM Northeastern States Field Office has received a total of nine requests from the BLM Eastern States Office for National Environmental Policy Act (NEPA) analyses on a total of 36,265 acres of federal minerals in the 50,000-acre Allegan State Game Area in Allegan County. The NSFO verified Federal mineral ownership (FMO) on 27,302 (see title page for legal descriptions).

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 without causing undue negative impacts to natural resources.

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, available at the Northeastern States Field Office. This plan provides the basis for considering the proposed action and alternatives (43 CFR 1610.8). The Michigan Resource Management Plan was developed with public participation and governmental coordination, and this environmental assessment provides the site-specific environmental analysis required by the plan on 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. Likewise, 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 BLM must decide 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 Allegan State Game Area (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 (MDNR). The MDNR provided the BLM with GIS data showing the locations of trails, state natural areas, campgrounds, and waterways. The BLM and the MDNR met at the ASGA on May 19, 2011, and 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 were raised through the scoping process:

1. The MDNR recommends a no-surface-occupancy stipulation on the state game area, which would include the entire lease.
2. Noise from construction activities will detract from recreational opportunities that require quiet environments.
3. Construction of roads and additional traffic by large vehicles will degrade wildlife habitat by spreading invasive species.
4. Various construction-related activities could have adverse impacts on trout streams and designated Natural Rivers.

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. A federal oil and gas lease is a legal contract that grants exclusive rights to the lessee to develop oil and gas resources that may exist on split estate property.

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, 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 would require applicants to adhere to lease stipulations (Appendix B), which have been formulated while conducting this environmental assessment and are incorporated into the proposed action.

Connected Action – Drilling and Production

Site-Specific Applications for Permit to Drill (APDs)

Once a lease is awarded, the successful bidder must 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 on-site 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 ESA-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 to comply with the recommendations of these consultations.

The most likely targeted zones in this area are the Trenton-Black River formation and overlying Collingwood shale. Shallower formations, produced in the county since the 1930s, include the Niagaran and Traverse Group, and are unlikely targets for current exploration. Most of the previous developments in the area were drilled to the Traverse and were vertical 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. This EA will analyze impacts to natural resources based on three scenarios:

- Low-intensity, in the event of unsuccessful exploration – 10 dry holes on four pads,
- Medium-intensity, in the event of moderate production – 25 oil and gas wells on 10 pads,
- High-intensity, in the event of high production – 50 oil and gas wells on 17 pads.

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 of 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.

Vertical Drilling

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 from a surface location outside of the park.

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 two to four 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. Artificial 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

Once a bore is drilled down to the depth of the target formation, a lateral can be drilled horizontally and extend for up to several thousand feet through the hydrocarbon-producing rock formation. The purpose of horizontal drilling is not necessarily to enhance access to the hydrocarbons, as in the case of directional drilling, 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. Horizontal drilling methods may be considered in the future if preliminary exploration is successful.

Wells drilled horizontally with multiple-stage hydrofracture operations require somewhat larger well pads and reserve pits than conventional vertical or directional wells. A typical 4-5-acre well pad in the eastern Ohio Utica shale play is designed to accommodate three to five horizontal wells, and similar pad sizes and well densities would be expected in Michigan. The larger pads are required to store the larger amounts of equipment and supplies used in drilling horizontal wells. **For the purpose of this analysis, the total disturbance associated with horizontal drilling is five acres per three-well pad, (including roads and pipelines), including 3.5 acres to be maintained for the life of the well and 1.5 acres to be restored upon well 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

When the wellbore reaches the hydrocarbon reservoir, various methods may be used to complete the well. Among these methods is hydraulic fracturing of the reservoir rock. 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. The use of fracturing depends on the type of reservoir rock encountered in the subsurface and is not used in all well completions. 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 50,000 gallons of water for completion. 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). A horizontal well includes a *lateral* – the horizontal portion of the wellbore – that travels a long distance into target formation, with the length of the lateral often exceeding the initial vertical portion of the well. Lateral lengths exceeding two miles 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. Completion of a horizontal shale well often requires two to six 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 six million 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 treatment and reuse or disposal in approved disposal methods. Water for treatment may be transported to off-site facilities or treated on-site in temporary facilities.

Production, Abandonment, and Site Reclamation

During well pad construction, the topsoil is stockpiled to be used during restoration activities. If the well is successful, then the reserve pit and a large portion of the well pad are re-graded and restored per BLM and surface owner requirements. Final seed mixtures and plantings are determined with recommendations from BLM with the surface owner’s approval. The remaining pad is maintained for the life of the well. Following abandonment, the pad is subject to the same restoration parameters.

No Action

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

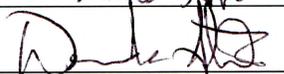
CHAPTER 3 – DESCRIPTION OF THE AFFECTED ENVIRONMENT

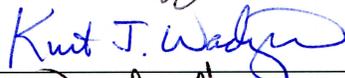
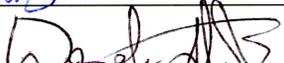
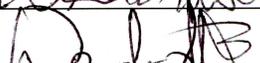
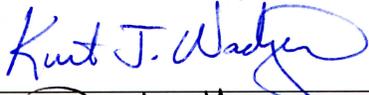
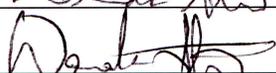
Introduction

The Decision Area (Figure 1, Appendix A), a total of 127,000 acres, consists of the EOI boundary and a two-mile buffer, which is the typical maximum distance that horizontal 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 22 percent of the Decision Area within the Black River watershed (HUC#04050002) and 78 percent in the Kalamazoo River watershed (HUC#04050003). The Decision Area overlaps most of the Allegan State Game Area, a 50,000-acre complex, owned by the State of Michigan and managed by the Michigan Department of Natural Resources, which includes wetlands, forests, wildlife refuges, recreational trails, campgrounds, and public hunting areas. The Decision Area contains a grid of paved roads, forestry roads, and recreational trails. Since the entire EOI will be off limits to development, this EA uses the term *Development Area* to refer to the portion of the Decision Area that is on non-state-owned lands. The Development Area encompasses 80,000 acres and is almost entirely privately owned.

Table 1, below, lists the resources that will be addressed in this EA.

Table 1. Technical Review.

X	Program	Reviewer	Signature	Date
X	Air Quality	Derek Strohl Natural Resources Specialist		3/22/13
X	Climate Change	Derek Strohl Natural Resources Specialist		3/22/13

X	Program	Reviewer	Signature	Date
X	Cultural/Paleontology	Jarrold Kellogg Archeologist		3/22/13
X	Environmental Justice	Kurt Wadzinski Planning & Environmental Coordinator		3/22/2013
X	Farmlands (Prime & Unique)	Derek Strohl Natural Resources Specialist		3/22/13
X	Fish and Wildlife	Derek Strohl Natural Resources Specialist		3/22/13
X	Floodplains	Derek Strohl Natural Resources Specialist		3/22/13
X	Geology/Mineral Resources/Energy Production	Jeff Nolder Geologist		3/22/13
X	Hazardous Wastes	Derek Strohl Natural Resources Specialist		3/22/13
X	Invasive Species/Noxious Weeds	Derek Strohl Natural Resources Specialist		3/22/13
X	Recreation	Derek Strohl Natural Resources Specialist		3/22/13
X	Socioeconomics	Kurt Wadzinski Planning & Environmental Coordinator		3/22/2013
X	Soils	Derek Strohl Natural Resources Specialist		3/22/13
X	Threatened, Endangered or Candidate Animal Species/Migratory Birds	Derek Strohl Natural Resources Specialist		3/22/13
X	Vegetation	Derek Strohl Natural Resources Specialist		3/22/13
X	Visual Resources	Derek Strohl Natural Resources Specialist		3/22/13
X	Water Resources/Quality (Drinking, Surface & Ground)	Derek Strohl Natural Resources Specialist		3/22/13
X	Wetlands/Riparian Zones	Derek Strohl Natural Resources Specialist		3/22/13
X	Wild & Scenic Rivers	Derek Strohl Natural Resources Specialist		3/22/13
X	Wilderness	Derek Strohl Natural Resources Specialist		3/22/13

Air Quality

The Decision Area and all of Allegan County meet 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 U.S. Environmental Protection Agency (EPA) 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 gases of lesser importance. These gases 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 appropriate Analysis 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. 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. 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. However, little is known about these early inhabitants, although several Paleo-Indian sites have been found throughout Michigan's Lower Peninsula. Mounds dating to the Hopewell cultural can be found 15 miles north of the Decision Area in Grand Rapids, Michigan, at the Hopewell Indian Mounds Park (also known as the Norton Mound Group). 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" (Beld, 2012). 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, all of which are historic structures including churches, domiciles, and barns. There are no listed prehistoric

properties in Allegan County. Information provided to the BLM by the Pokagon Band of Potawatomi Indians indicates that the Decision Area contains approximately 15 prehistoric archaeological sites.

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 survey record searches, consultation with the Michigan State Historic Preservation Office, and appropriate Native American Tribes.

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. Potential development of the proposed tracts is not anticipated to have adverse human health and environmental effects on minority and low-income populations or individuals near the project area.

Prime and Unique Farmlands

There are 29,200 acres of prime, locally important, or potentially prime farmlands in the Decision Area. These figures are detailed in Table 3.1 below, and illustrated in Figure 3, Appendix A. The prime farmlands are concentrated in the northeastern quadrant and southern edge of the Development Area. The farmlands of local importance are moderately concentrated in the western edge of the Decision Area and along the Kalamazoo River but are also interspersed among the prime farmlands. Based on aerial photo interpretation, most of the prime farmlands are in some sort of agricultural production.

Table 3.1. Prime and Unique Farmlands in Analysis and Development Areas.

Type of farmland	Area in Decision Area (Ac)	Area in Development Area (Ac)
Prime farmland	4,231	4,189
Prime farmland if drained	2,601	2,582
Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season	2,161	1,516
Farmland of local importance	20,226	14,909

Fish and Wildlife

The Allegan State Game Area encompasses 50,000 acres. The Decision Area overlaps 47,246 acres, or 94%, of the ASGA. This overlap includes all of the 600-acre Bravo Unit and 560-acre Swan Creek Unit Wildlife Refuges. The ASGA is managed for a diverse array of game and nongame species. The

Development Area contains abundant forests and woodlots, interspersed among croplands, and it contains also at least nine inland lakes, including a 115-acre lake in the southwestern corner and most of the 1,587-acre Lake Allegan.

Floodplains, Wetlands, and Riparian Zones

Wetlands comprise 38,600 acres, or 30 percent, of the Decision Area and 23,200 acres, or 18 percent of the Development Area. These are most abundant in the southern half of the Decision Area and include lowland hardwood forests, floodplain forests, wet meadows, fens, relict Atlantic coastal plains marshes, and other types. The Kalamazoo River comprises 3,900 acres of Michigan Natural River area, a designation that may establish heightened local development restrictions, within the Decision Area and 1,600 acres within the Development Area.

Geology/Mineral Resources/Energy Production

Michigan's Lower 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. The majority of oil and gas exploration and development centers around *plays*, formations of discovered or undiscovered fields that are assumed to have similar structural and stratigraphic features. Recognized oil and gas plays within the Michigan Basin are as follows:

- Mid-Michigan Rift-Related Structures,
- Mid-Michigan Rift Reactivation-Related Structures,
- Niagaran Pinnacle Reefs,
- Shallow Salt-Related Structures,
- Antrim Shale,
- Collingwood Shale.

Allegan County produced large quantities of oil and gas from shallow reservoirs, including the Traverse Group, the Niagaran and the Detroit River. Most of these fields are now depleted, and some have been converted to gas storage. The density of drilling in the county makes unlikely the possibility of significant remaining reserves in formations above the Silurian Cabot Head Shale. It is more likely that future production may be found in deeper, older formations, such as the Ordovician Trenton-Black River carbonates. Although the Collingwood Shale, which overlies the Trenton-Black River, is not known to be productive in the area, it is possible that exploration in this formation may take place.

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

Hazardous Wastes

The Decision Area contains approximately 30 closed underground storage tanks (USTs), 20 of which are classified as closed *leaking* underground storage tanks (LUSTs), 12 active USTs, 10 open LUSTs, and 7 sites of environmental contamination, which are unique from USTs and LUSTs, according to the Michigan Department of Environmental Quality's online Environmental Mapper (MDEQ, 2013). Most of

these sites are in the villages and cities within the Development Area. The closed USTs and LUSTs are included in this description because there may still be contamination present from those tanks. 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

The BLM, as the lead federal agency, invited 12 Federally Recognized Indian Tribes into government-to-government consultation by letters dated January 25, 2013 (see Chapter 5). The BLM has received responses from the Pokagon Band of Potawatomi Indians, the Lac Vieux Desert Band of Lake Superior Chippewa, the Keweenaw Bay Indian Community, and Nottasawepi Huron Band of Potawatomi, indicating their interest in further consultation regarding this EOI and any subsequent APDs. The Pokagon Band stated that they have information about archaeological sites within the project area and that it is the preference of the Tribe that these sites be protected. The Nottasawepi Huron Band indicated that they believe archaeological sites are located along the Kalamazoo River within the Decision Area. The consultation process is still ongoing.

Recreation

The Decision Area contains most of the Allegan State Game Area (ASGA), a 50,000-acre, regionally popular recreation area. The ASGA features hunting land, trails for motorized, non-motorized, and equestrian use, motorized and non-motorized lakes, campgrounds, and other recreational features that are detailed in Table 2 below, and illustrated in Appendix A, Figure 3.

Besides the ASGA, the lower Kalamazoo River and its tributary Swan Creek within the Decision Area are state-designated Natural Rivers (Michigan DNR, 1991). Most of the motorized Lake Allegan lies within the Development Area. Littlejohn Lake Park and Silver Creek Park and Campground, both Allegan County parks, are in the Development Area. While data on recreational use on private lands within the Development Area are unavailable, such use is likely limited to private hunting, fishing, and similar activities.

Table 2. Selected types of recreational resources within the Decision Area.

Type	Total	Notes
Hiking trails	22 miles	Entirely within ASGA

Type	Total	Notes
Equestrian trails	50 miles	Entirely within ASGA, managed by Allegan County
Biking/skiing trails	20 miles	Entirely within ASGA
Snowmobiling trails	24 miles	Mostly within ASGA
Parks (day use only)	1 (113 acres)	Littlejohn Lake Park – picnic areas, softball fields, basketball court, beach, nature trail
Campgrounds	3 (180 sites)	2 in ASGA, 1 in Silver Creek Park
Trout streams	78 miles	Distributed among 18 different streams and tributaries
Small lakes	9 lakes, 320 acres	
Motorized lakes	5,020 acres	Lake Allegan

Socioeconomics

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 34,039 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 89.5% White, 6.8% Hispanic or Latino, 1.6% Two or More Races, 1.5% African American, 0.7% Native American or Alaska Native, and 0.7% Asian. 74.2% 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 76.8%, with 14.1% aged 65 or older.

In 2011, there were 49,568 housing units in the county with a homeownership rate from 2007-2011 of 82.8%, which is 9% higher than the state as a whole. The median value of these owner-occupied homes was \$147,600 for the period 2007-2011, slightly higher than that of the state.

For the period 2007-2011, median household income was \$51,232 for Allegan County, over \$2,400 higher than for the state. Approximately 12.6% of persons lived below the poverty level, much below the 15.7% statewide that live below the poverty level. 89.4% of the county population 25 years of age and over graduated from high school, one percent higher than the state. 20.1% of county residents 25 years of age and older have a bachelor's degree compared to 25.3% 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 (U.S. Census Bureau, 2012).

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

The unemployment rate for Allegan County was 5.6% in November 2012, a 1.4% decrease from the 7.0% rate in November 2011 which is 3.4% lower than Michigan's unemployment rate of 9.0% for the same month (U.S. Dept. of Labor, 2012). 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 (11,682), followed by Trade, Transportation, and Utilities (5,259), and Local Government (4,502); there were only 38 employees involved in Mining in Allegan County in 2011 with wages that were over 18% higher than the county average (U.S. Dept. of Labor, 2012).

The project area is located in rural townships, in a game area frequented by recreational users. There are no known communities, businesses, or multiple family dwellings within a one-mile radius of the project area that are known to be inhabited or owned by predominantly minority or low-income populations.

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 Decision Area has a total of 10,350 acres of soils that are characterized by the U.S. Department of Agriculture as *highly erodible* and 4,220 acres characterized as *potentially high erodible*. The Development Area contains 5,900 acres of highly erodible soils and 4,130 acres of potentially highly erodible soils (Figure 4, Appendix A). These occur mostly in the eastern side of the Development Area. The highly erodible types generally occur 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, Michigan, as of October 1, 2012. Pitcher's thistle (*Cirsium pitcheri*), the sole plant species on this list, 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 animals and are also state-listed. Two of these species, the Eastern massasauga and Karner blue butterfly, are known to occur in Allegan County. The table in Appendix C shows 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.

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 use multiple habitat types 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, agricultural lands, and urban/residential areas.

Visual Resources

Most of the Decision Area consists of undeveloped lands within a grid of paved roads and various openings for unimproved roads, trails, and utility rights-of-way. Based on aerial photo interpretation, the Development Area's non-wetland areas are roughly evenly divided between forests and agricultural fields. Urban areas associated with Allegan, Pullman, New Richmond, and other smaller communities make up a small portion of the Development Area.

Water Resources and Water Quality

The Decision Area contains more than 200 miles of navigable streams as well as Lake Allegan and several other small lakes.

The Decision Area includes 804 drinking water wells, 766 of which are also in the Development Area. A community well or multiple community wells provide groundwater to the City of Allegan and a portion of Allegan Township. Groundwater in the Decision Area flows toward the Kalamazoo River.

Wild and Scenic Rivers and Wilderness

There are no designated Wild and Scenic Rivers or Wilderness in the Decision Area. No further analysis is warranted.

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 subsequently be followed by Applications for Permits to Drill (APDs), this section provides a qualitative examination of most 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 based on the area's geology, well spacing stipulations and standard industry practices, and other factors:

- Low-intensity, in the event of unsuccessful exploration – 10 dry holes on four pads,
- Medium-intensity, in the event of moderate production – 25 oil and gas wells on 10 pads,
- High-intensity, in the event of high production – 50 oil and gas wells on 17 pads.

Air Quality

Air quality modeling is directed under an MOU between the Departments of the Interior and Agriculture and the U.S. Environmental Protection Agency. This MOU directs that air quality modeling will be conducted for actions that meet certain emissions or geographic criteria:

- Creation of a substantial increase in emissions,
- Material contribution to potential adverse cumulative air quality impacts,
- Class I or sensitive Class II Areas
- Non-attainment or maintenance area
- Area expected to exceed NAAQS or Prevention of Significant Deterioration (PSD) increment

The proposed action is not expected to produce amounts of any of these pollutants in excess of *de minimis* amounts, which are defined by the U.S. EPA as maximum amounts that will not threaten a state's efforts to attain or maintain conformity with the National Ambient Air Quality Standards (NAAQS). Trucks using temporary roads are expected to generate dust, depending on the volume of traffic, condition of the roads, and weather conditions. Operators may be required by local authorities to suppress dust by wetting the roads. The use of pipelines or on-site wells to supply water would reduce the volume of dust generated.

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.
- 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 at <http://www.epa.gov/statelocalclimate/state/state-examples/ghg-inventory.html>. Guidelines for estimating project-specific GHG emissions are available, 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

Information provided by the Pokagon Band of Potawatomi Indians indicates that approximately 15 prehistoric archaeological sites are located within or near the current Decision Area. The Bay Mills Indian Community informed the BLM that they believe “significant” cultural resources may be located along the Kalamazoo River within the Decision Area. Additionally, because of the size of the Decision Area, there is a high likelihood of additional cultural resources being found.

The BLM will 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 survey record searches, consultation with the Michigan State Historic Preservation Office, and appropriate Native American Tribes.

Prime and Unique Farmlands

Most of the prime and unique farmlands in the Decision Area are also in the Development Area. 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 10, 25, or 45 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 20, 50, or 85 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 hydrocarbon-related use. Because the ASGA will be off-limits to drilling and infrastructure development, the designated wildlife areas will not be directly impacted. It is possible, though, that important wildlife habitat under private ownership could be impacted.

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 are highly tolerant of human development, such as white-tailed deer, raccoon, wild turkey, and coyote.

The BLM will impose conditions of approval (COAs) on proposing operators that are intended to reduce direct mortality to birds and other animals in open pits, tanks, secondary containment structures, and venting stacks. These COAs will require netting, fencing, or a combination thereof to keep animals such as mammals, birds, and amphibians from entering stored saltwater, spilled or leaked chemicals, or other toxic fluids and grated covers to keep birds and bats from perching or roosting in vent stacks.

Floodplains, Wetlands, and Riparian Zones

Applicants will be informed by a lease notice (see Appendix B) that they will be required to comply with Federal, state, and local wetland and waterway protection laws. These will prevent direct filling of wetlands as well as polluted runoff directly entering wetlands, and local regulations may restrict surface occupancy in the Natural River Zone associated with the Kalamazoo River and selected tributaries. Operators may get special permission from the BLM to fill or disturb small portions of wetland in order, for example, to widen existing roads or lay pipelines, which will still be subject to permits and water quality certification under Sections 404 and 401 of the Clean Water Act. In this case, it is expected that less than one tenth of an acre per incident would be disturbed.

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, any oil and gas produced from these lands will no longer 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 stabilization. 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 a waste injection well or hydrocarbon production well. 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, 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 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 invasion by edge-loving species. Where the forest canopy is broken, invasive species that thrive in sunny conditions may proliferate.

As with air quality, trucking water to a well pad, instead of drilling a well on site, would result in a great deal more truck traffic and the associated introduction and possible spread of noxious weeds, and this impact would be far greater in the unlikely case of horizontal drilling.

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, transportation and utility rights-of-way, and recreation. 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

Government-to-government consultation has been initiated by the BLM with 12 Federally Recognized Indian Tribes regarding this proposed undertaking (see Chapter 5 for a complete list of consulted parties). The Pokagon Band of Potawatomi Indians and Bay Mills Indian Community have indicated that there are sites located or potentially located within the Decision Area. Information regarding the locations of archaeological sites is currently forthcoming from the Pokagon Band.

Recreation

Well construction, operation, and, eventually, abandonment would 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 would drive away the animals that hunters seek. Visual impacts would be considered in the *Visual Resources* section, below.

Noise that is generated by construction or operation is naturally damped as it travels from the source, 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. Also, the time of year during which the noise is produced affects the value of the impact, since different types of users, some of which require silence and some of which do not, are present and/or active at some times of the year more than at others.

Construction equipment generates between 70 and 115 decibels (dB), and a forest may damp noise by five to 20 dB per 100 feet. The maximum noise level that hunters or game animals are likely to tolerate is 40 dB. Using these figures, the affected radius with respect to hunting around construction operation would range from 150 feet to 1,500 feet (0.28 mile). 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, it is possible that noise will have little to no impact on game and hunting in the ASGA. Drilling a well close to the ASGA boundary would affect roughly half of the areas calculated above.

These noises are expected to continue non-stop for 30 days for each well that is constructed. Table 3 lists the quantities of different types of trails and campgrounds that fall within various distances of the Development Area. The value of the disruption is affected by both timing of construction and the type of recreational feature that is impacted by noise. For example, noise created at the height of a hunting season may render the affected area unsuitable for hunting for the part or all of a 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). Likewise, noise generated near a snowmobile trail may have little to no impact on the recreational use of the trail, while noise generated near an equestrian trail may render use of that trail undesirable.

Table 3. Trails and campgrounds within 150 feet and 1,500 feet of Development Area.

Type	Total	150 feet	1,500 feet
Hiking trails	22 mi	0.4 mi	6 mi
Equestrian trails	50 mi	3.1 mi	25 mi
Biking/ski trails	20 mi	0.6 mi	3 mi
Snowmobiling	24 mi	2.7 mi	9 mi
Campgrounds	120 ac	0.0 ac	1 ac

Private lands also provide recreational opportunities, and sometimes these opportunities may be available to the public, since some state-sponsored private 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.

The BLM would mitigate the auditory and visual impacts of well construction and operation by developing conditions of

approval with respect to noise control for wells planned within sensitive distances of recreational trails, campgrounds, and key hunting areas. Likewise, the BLM would require operators to maintain, to the extent practicable, existing screening vegetation, establish new screening vegetation, and use paint structures in colors that will blend in with the natural surroundings.

Socioeconomics

Potentially, several hundred direct and indirect mining-related jobs could be expected if marketable quantities of oil and/or natural gas are eventually produced in the project area. Increased royalty payments to the State of Michigan would help to offset the property tax burden for state residents. As described in the **Recreation** section above, decreased recreational opportunities during well construction would adversely affect revenue from, and enjoyment derived from, the various outdoor activities that draw the public to the ASGA. The mitigation measures described throughout Chapter 4 of this EA can help to alleviate some of the impacts of increased mining activity.

Soils

Wells would likely be scattered across the entire Development Area, and one or two well pads 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. The BLM would incorporate soil-conserving BMPs into permits to drill. The Michigan DNR has compiled a guide to using BMPs to prevent erosion. 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 and/or the Natural Resources Conservation Service (NRCS), as conditions of approval for APDs.

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 and the no-surface-occupancy stipulation over the ASGA 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. Cost factors 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 rental payments to owners. Second, cleared, agricultural areas tend to have better road access than forestlands. 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 10, 25, or 45 acres, respectively, of forest vegetation being cleared. Open vegetation types, including agricultural crops, would be cleared at rates of 10-20 acres, 25-50 acres, and 45-90 acres, respectively, based on the three development scenarios. These clearings would persist for the life of each well, and vegetation would be restored according to plans that are approved by the BLM and the surface owners. The BLM will require the use of native plant materials in site restoration unless the surface owner prefers otherwise. In the process of reestablishing native plant communities, some non-native species may be used, such as oats planted as a cover crop to suppress weeds until the native species become established.

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 80, 200, and 500 acres in which well pads would be visible during construction. After construction, when most of the large equipment is gone from the site, these figures would shrink to a small percentage of the areas visible during construction.

Wells constructed in forested areas would be visible from only a short distance due to the forest cover. If we assume that a three-acre well pad construction site is roughly circular and that the well pad will be visible from up to 100 feet into the forest, still assuming that half the wells would be constructed in forested areas, then each well pad construction site in a forest will convert six acres of forest to an industrial appearance, totaling 12, 30, or 50 acres, for the duration of production.

Water Resources and Water Quality

As described in Chapter 2, drilling consumes water for drilling mud, 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. 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. Horizontal drilling with hydrofracture would be expected to consume up to 60,000,000 gallons in the low scenario, 180,000,000 gallons in the medium scenario, or 300,000,000 gallons in the high scenario.

Some of the water that is used in hydrofracture remains in the producing formation, and some of that water returns to the surface, where it can be disposed of or treated and reused. Water that returns to the surface, known as *produced water* or *frack water*, may be injected into deep disposal wells. Treatment technologies are being promoted as economical alternatives to deep-well disposal.

Both hydrofracture and deep-well disposal take place in formations thousands of feet below the lowest potable water, making contamination of potable water supplies unlikely (Abdalla, 2012). However, the science that has been used to demonstrate the isolation between fractures and fresh water aquifers has considered only single fractures, whereas producers typically use multiple fractures, which may travel farther in combination with one another than a single fracture does (Mooney, 2011). Likewise, natural fissures in some geological settings may allow fluids to travel toward potable water supplies. Fractures may also connect to existing wells, allowing contaminants to travel through the wells' annular spaces to fresh water aquifers. These spaces are sealed with cement, and failure of these cement seals is considered to be an important vulnerability in well construction and permitting.

There is anecdotal evidence of fracking chemicals contaminating drinking water wells (Lustgarten, 2011), and there are studies demonstrating that horizontal drilling in shale gas formations does not contaminate them (Boyer, 2012). The U.S. Environmental Protection Agency is planning to conduct a study of the issue (U.S. Environmental Protection Agency, 2011), and the BLM will continue to consider ongoing scientific evidence as it becomes available throughout the process of analyzing APDs.

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. Regardless of the use of hydrofracture, 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 drinking water wells.

Persons, Groups, Agencies, Federally Recognized Indian Tribes 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.
Consulted via website	U.S. Fish and Wildlife Service	Compiled list of endangered, threatened, and candidate species
Brian D. Conway, State Historic Preservation Officer	Antiquities Act, Section 106 of the National Historic Preservation Act, 36 CFR 800 (as amended)	No response received, indicating no concerns or issues at present time.

Federally Recognized Indian Tribes

Government to government consultation was initiated with the Federally Recognized Indian Tribes listed below by letter on 2/7/2013.

Tribe and Individual(s) contacted.	Purpose & Authorities for Consultation or Coordination	Responses
Kurt Perron, Chairman Bay Mills Indian Community 12140 West Lakeshore Drive Brimley, MI 49715	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Letter dated 2/18/12 states that the Tribe feels that there is a high likelihood of archaeological sites located along the Kalamazoo River in and near the Decision Area, and would like this to be a consideration as the project moves forward. The Tribe would also like to be notified if any cultural resources are discovered and to be consulted with as the project moves forward.

Tribe and Individual(s) contacted.	Purpose & Authorities for Consultation or Coordination	Responses
Alan Shively, Chairman Lac Vieux Desert Band of Lake Superior Chippewa Indians P.O. Box 249 Watersmeet, MI 49969	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Response dated 2/14/13 stated that the Tribe had no knowledge of cultural or archaeological resources in the area but would like to be further consulted as the project moves forward and to be notified if any cultural resources are discovered.
Aaron Payment, Chairman Sault Ste. Marie Tribe of Chippewa Indians 523 Ashmun St. Sault Ste. Marie, MI 49783	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response received, indicating no concerns or issues at present time.
Dexter McNamara, Chairman Little Traverse Bay Bands of Odawa Indians 7500 Odawa Circle Harbor Springs, MI 49740	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response received, indicating no concerns or issues at present time.
Alvin Pedwaydon, Chairman Grand Traverse Band of Ottawa & Chippewa Indians 2605 N. West Bay Shore Dr. Peshawbestown, MI 49682-9275	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response received, indicating no concerns or issues at present time.
Kenneth Meshigaud, Chairman Hannahville Indian Community N14911 Hannahville B-1 Rd. Wilson, MI 49896	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response received, indicating no concerns or issues at present time.
Homer Mandoka, Tribal Council Chairperson Nottawaseppi Huron Band of Potawatomi 2221 1-½ Mile Road Fulton, MI 49052	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response received, indicating no concerns or issues at present time.
D.K. Sprague, Chairman Match-E-Be-Nash-She- Wish Band of Pottawatomi Indians PO Box 218 Dorr, MI 49323	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response received, indicating no concerns or issues at present time.

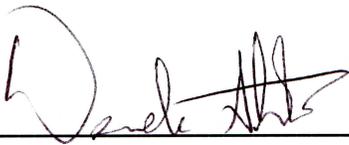
Tribe and Individual(s) contacted.	Purpose & Authorities for Consultation or Coordination	Responses
Matthew Wesaw, Mekko Pokagon Band of Potawatomi Indians 58620 Sink Road, Box 180 Dowagiac, MI 49047	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Phone call on 2/11/13 by Tribal Historic Preservation Officer Michael Zimmerman, Jr., in which Mr. Zimmerman stated the Tribe had knowledge of archaeological sites within the Decision Area and would be sending information on these sites to the BLM. The Tribe would like to be further consulted as the project moves forward and notified if any cultural resources are discovered or disturbed.
Warren Swartz, Jr., President Keweenaw Bay Indian Community 16429 Beartown Rd. Baraga, MI 49908	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	Response dated 2/14/13 stated that the Tribe had no knowledge of cultural or archaeological resources in the area but would like to be further consulted as the project moves forward and to be notified if any cultural resources are discovered.
Dennis Kequom, Chief Saginaw Chippewa Indian Tribe 7070 East Broadway Road Mt. Pleasant, MI 48858	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response received, indicating no concerns or issues at present time.
Larry Romanelli, Tribal Ogema Little River Band of Ottawa Indians 375 River Street Manistee, MI 49660	36 CFR 800 (as amended), National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O. 13007, and/or other statutes and executive orders.	No response received, indicating no concerns or issues at present 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 Coordinator	Environmental Justice, Socioeconomics
Jarrold Kellogg	Cultural Resources Specialist	Cultural Resources and Native America Religious Concerns
Jeff Nolder	Geologist	Geology/Mineral Resources/Energy Production



 Preparer

3/22/13

 Date



 Planning & Environmental Coordinator

3/22/2013

 Date



 AFM (Minerals or Natural Resources)

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 Date

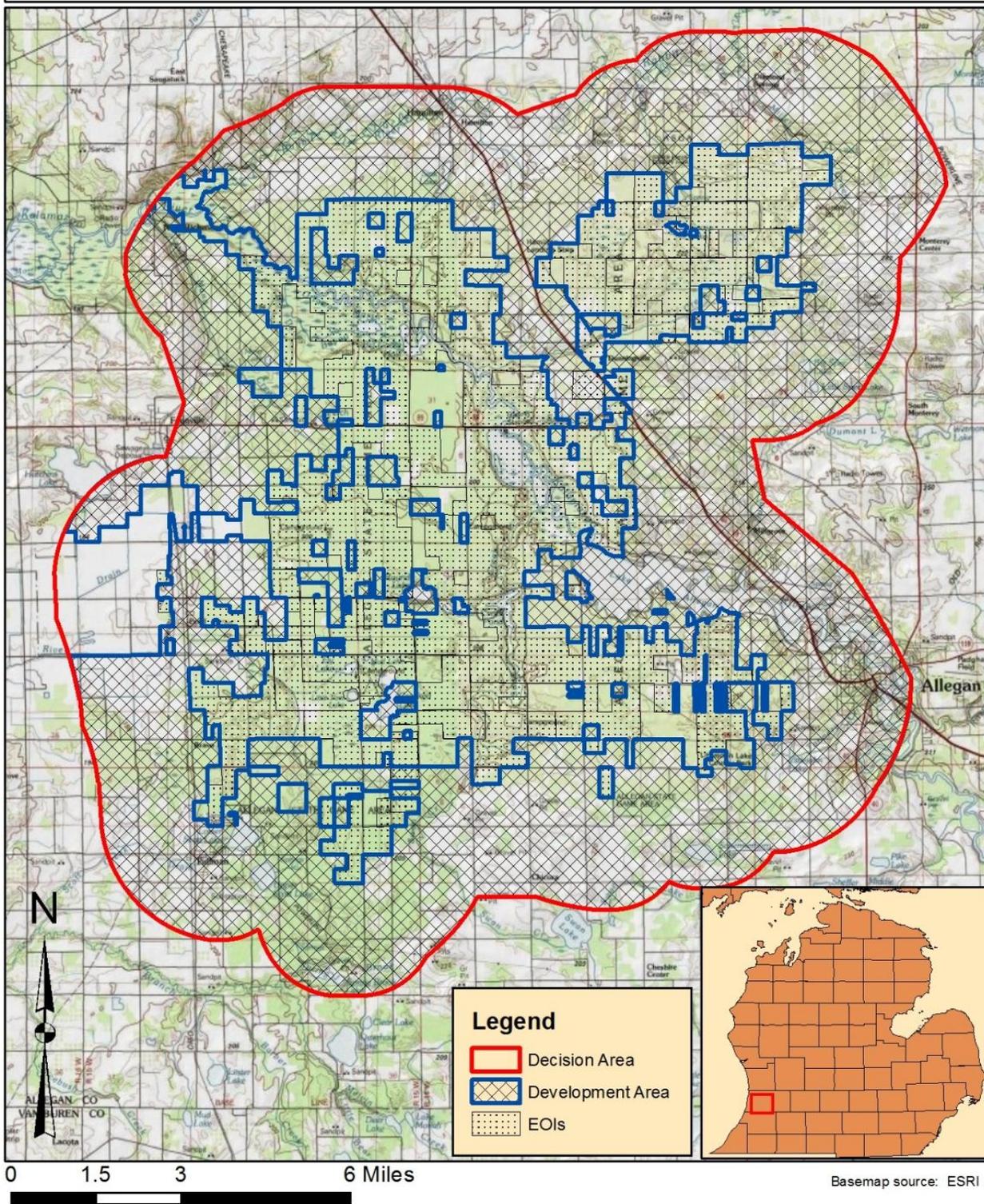
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Appendix A – Figures

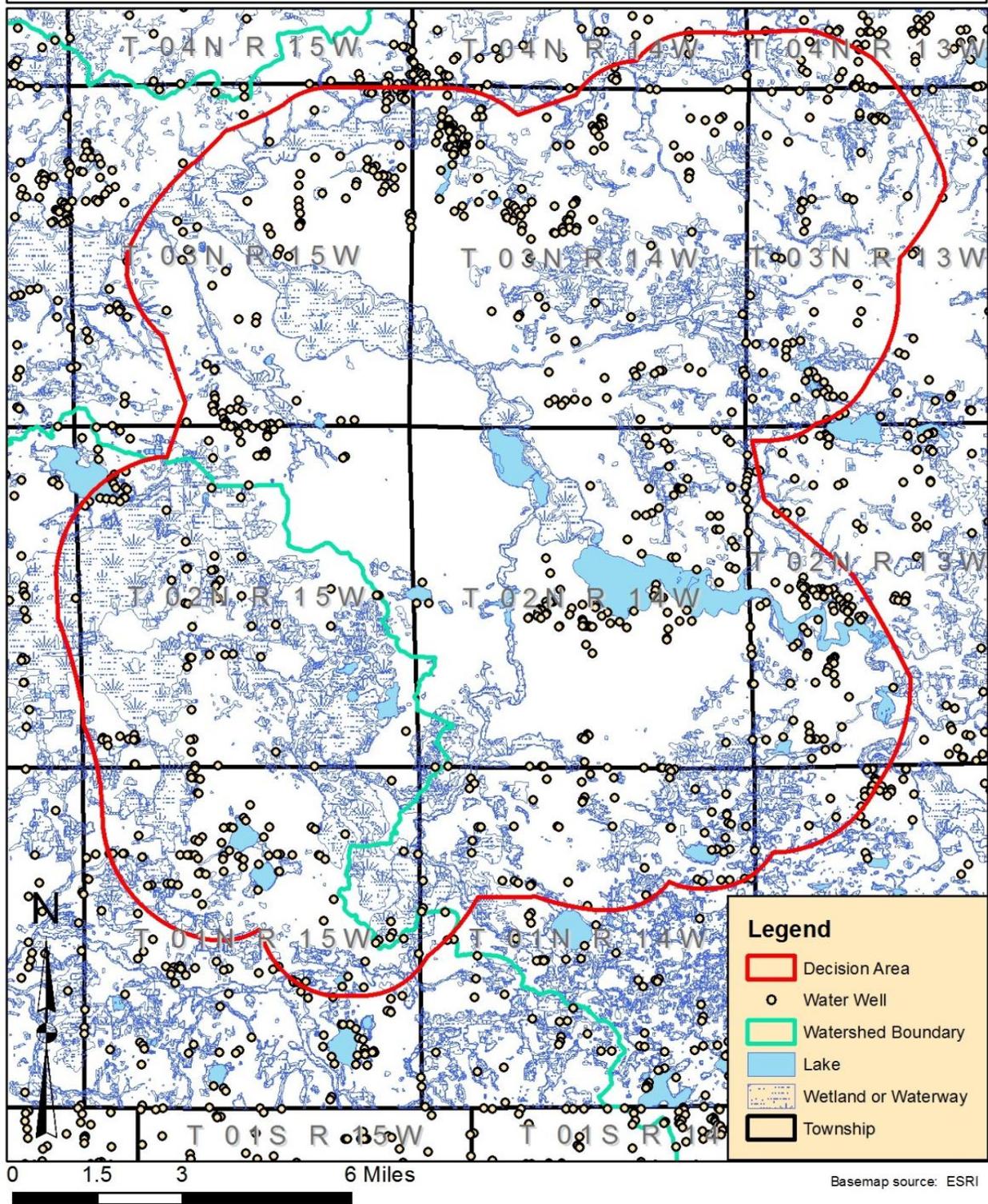
Figure 1. Proposed Lease Area, Decision Area, and Development Area



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.



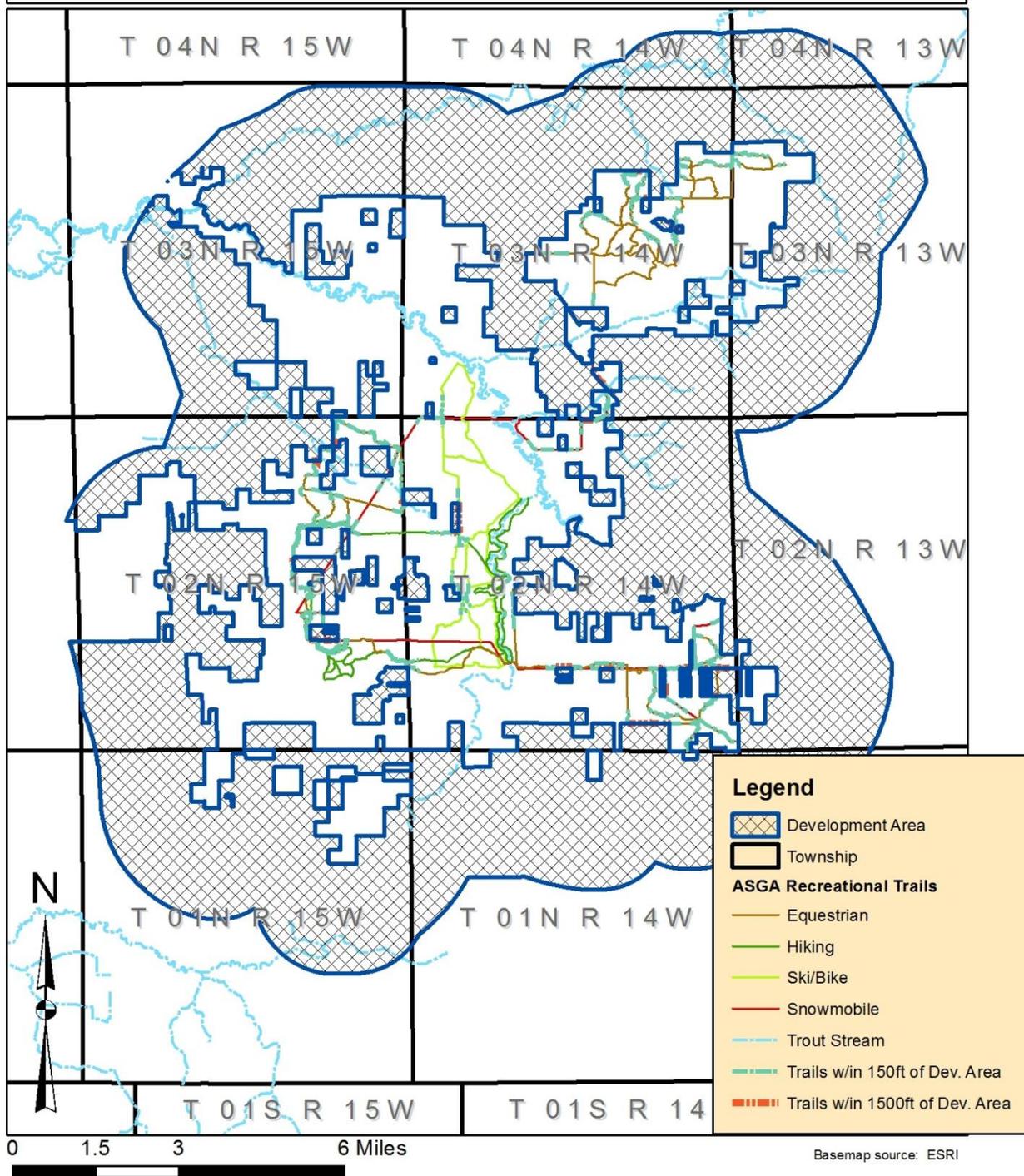
Figure 2. Hydrologic Setting



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.



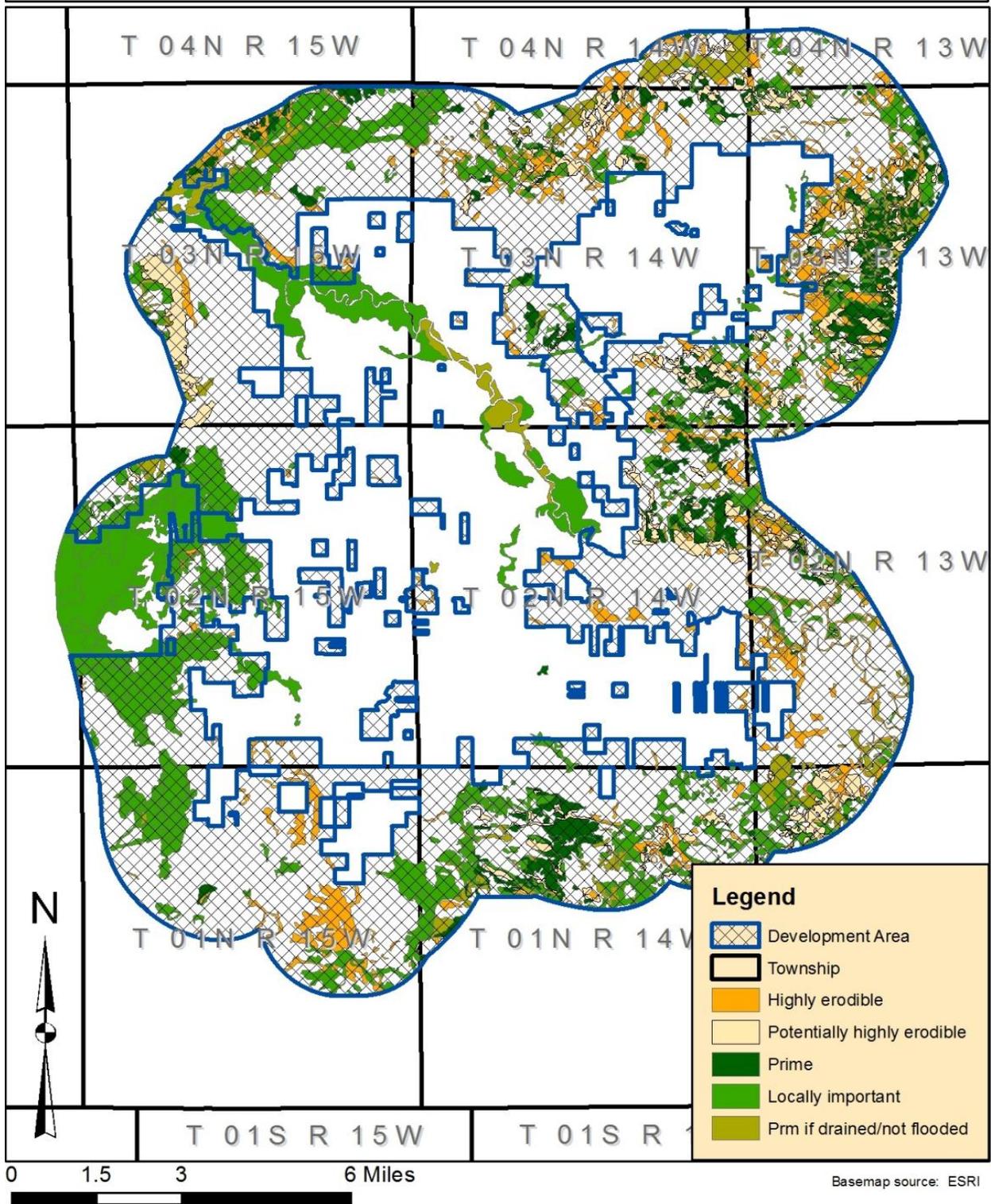
Figure 3. Selected Recreational Resources



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Figure 4. Highly Erodible Soils and Prime Farmlands



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Appendix B – Lease Notices and Stipulations

LEASE NOTICES

1. The Development Area contains many wetlands. Disturbance in or discharge into wetlands must comply with the Clean Water Act, notably Sections 401 (Water Quality Certification) and 404 (wetland filling).
2. The Development Area contains steep slopes and highly erodible soil types. The operator may be required to use best management practices in order to prevent unacceptable amounts of soil erosion due to construction on steep slopes and highly erodible soil types.
3. A cultural resources Phase I survey will be required before approval of an Application for Permit to Drill/Notice of Staking. Cultural Resource surveys may also be required prior to the start of subsequent well operations which involve additional surface disturbance. Mitigation measures or movement of planned ground disturbance may be necessary to avoid adverse effects to cultural resources. The need and requirements for mitigation or alterations will be based on consultation between the lessee, Bureau of Land Management, the Michigan State Historic Preservation Office, and the Advisory Council on Historic Preservation.
4. Any approved APD may require a Discovery Plan for accidental archaeological discoveries that occur during ground disturbing activities that were detected during initial surveys. This may include consultation between the Bureau of Land Management, Michigan State Historic Preservation Office, and the Advisory Council on Historic Properties.

NO-SURFACE-OCCUPANCY STIPULATION

No surface occupancy will be permitted on the entire lease.

Purpose: Protect recreational use of the Allegan State Game Area.

Exception/modification/waiver: No exceptions, modifications, or waivers will be made to this stipulation.

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 pygarctia	<i>Pygarctia spraguei</i>	SC	Openings of oak or oak-pine barrens and other habitats with flowering spurge (<i>Euphorbia corollata</i>)

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

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)