Chapter 3: The District Environment and Management

Introduction

Wetland Management District

The Leopold WMD covers 34 counties in eastern Wisconsin (Figures 10 to 27 beginning on page 47). This includes 21 counties approved for waterfowl production area acquisition, a 10-county Partners for Fish and Wildlife private lands district, and a 34-county Wetland Management District, involving management and enforcement of U.S. Department of Agriculture's Farm Service Agency Conservation Easements (CEs). Currently, there are 53 fee-titled WPAs and 45 CEs.

Monarch butterfly. USFWS photo.

Geographic/Ecosystem Setting

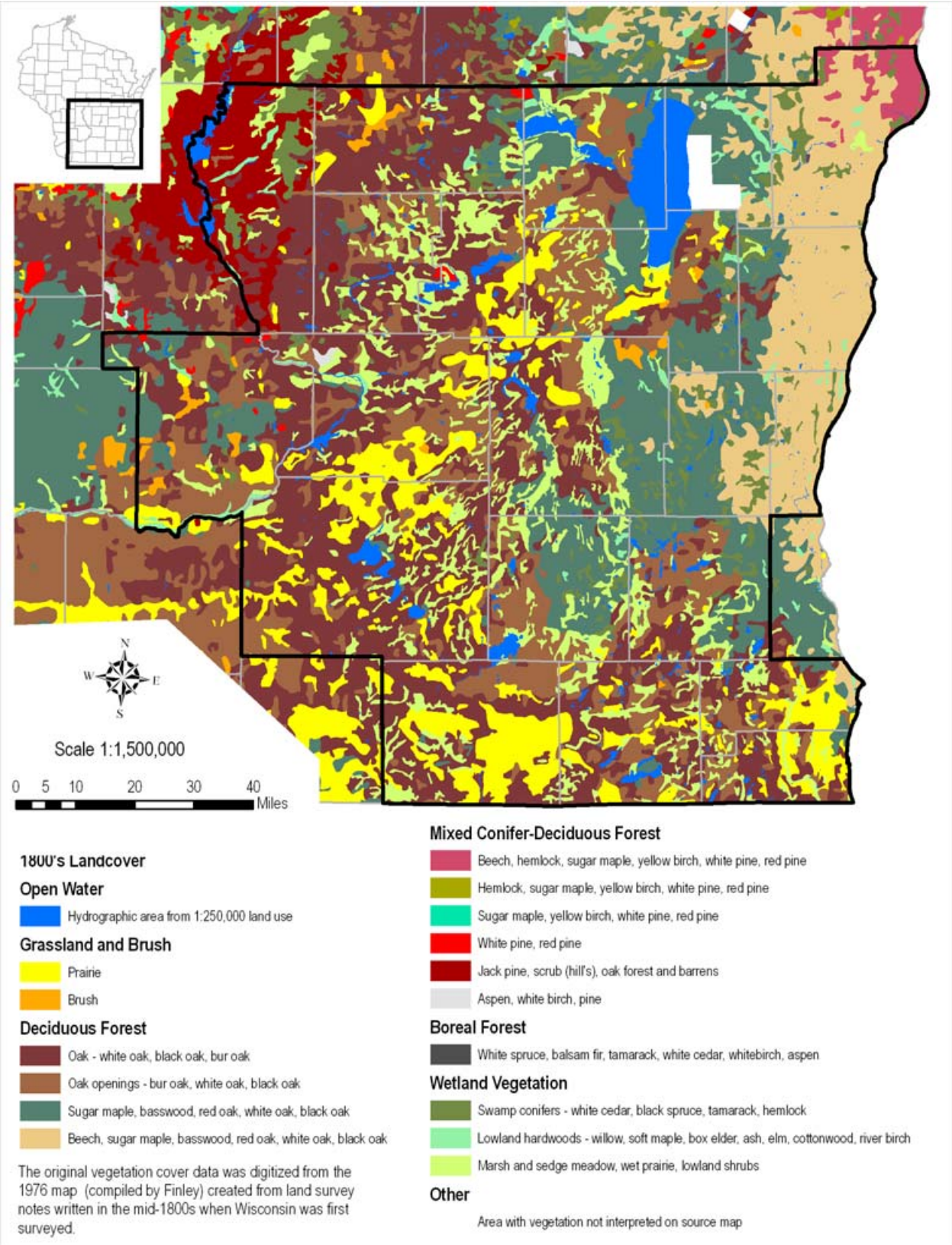
Historic Vegetation

The nature and distribution of vegetation types in Wisconsin are described by Curtis, in his 1959 book Vegetation of Wisconsin. The southern forests covered the southern half and western third of the state. Dominant species were primarily oak on the drier sites; sugar maple, basswood, slippery elm, red oak and ironwood on the mesic sites; and silver maple and American elm dominating the lowland sites. In pre-settlement times these forests covered approximately 5.2 million acres with another 7.3 million acres of what is considered oak savanna also falling into this category (Figure 2). In this region the closed woodlands and oak savannas provided no distinct boundaries but blended together. Scattered throughout the southern forest type were areas of true tall grass prairie. These prairies covered just over 2 million acres and were most dominant in the southwest corner of the state, becoming smaller and more scattered as one moved northeast. Forests dominated the northern half of Wisconsin. These northern forests supported jack, red, and white pine with red maple and red oak on the dry sites. The more mesic stands of the northern forests were dominated by sugar maple but hemlock and/or beech may have been co-dominant. Finally, the northern lowland (swamp) forests of Wisconsin are split into the tamarack-black spruce bog forests, the white cedar-balsam fir conifer swamps, and the black ash-yellow birch-hemlock hardwood swamps.

Land Use/Cover

Of the approximately 9.5 million acres of prairie and oak savanna that Wisconsin hosted just 150 short years ago, only one-half of 1 percent (less than 10,000 acres) of the prairies and less than one-tenth of 1 percent (less than 1,000 acres) of the savanna remains. Farming, urban sprawl, fire suppression, and other developments continue to threaten the few acres of prairie and savanna that remain. A quote that appears in Curtis's book provides a view of what we have lost in the last 150 years. This quote

Figure 2: Presettlement Landcover, Leopold Wetland Management District



is through the eyes of a Lieutenant D. Ruggles (1835) in writing about the prairies around Fort Winnebago in Columbia County:

> "In some instances, the prairies are found stretching for miles around, without a tree or shrub, so level as scarcely to present a single undulation; in others, those called the "rolling prairies", appears in undulation upon undulation, as far as the eye can reach presenting a view of peculiar sublimity, especially to the beholder for the first time. It seems when in verdure, a real troubled ocean, wave upon wave, rolls before you, ever varying, ever swelling; even the breezes play around to heighten the illusion; so that here at near two thousand miles from the ocean, we have a fac-simile of sublimity, which no miniature imitation can approach."

This is an interesting quote since the prairie Lt. Ruggles was speaking of was known as the Arlington Prairie. This prairie covered portions of Dane and Columbia Counties and included the property that is now called Schoenberg Marsh WPA. It is fitting then, that this WPA is also where the District has re-established local Wisconsin genotype native grasses and forbs for harvest and further seeding.

Shoveler Sink WPA in northern Dane County also lies within this "rolling prairie" and contains a unique geological feature as indicated in its name. Wisconsin geologists believe the sinkhole and the surrounding sandstone bluff on the WPA are natural features formed at the close of the Pleistocene era. In theory the site was initially a spring or groundwater discharge feature. Over time, as the hydraulic head in the bedrock aquifer system lessened, the system reversed itself and surface water now flows into the "sink."

The northern forests, much like the southern forests and prairies, have been altered through logging, farming, fire prevention, and urbanization. Because of this, few stands of "virgin" timber exist outside of those protected by conservation organizations, some Forest Service and State Forest areas, lands within the Wisconsin DNR State Natural Areas program.

Each of these communities are represented within the boundaries of the Leopold WMD, from the prairies and oak savannas of Green, Rock, Dane and Columbia Counties to the tamarack-cedar swamps of Forest and Florence Counties and all variations in between. Each community provides opportunities and challenges for restoration, protection, and management, which helps the District do its part to further the Service mission of conserving, protecting, and enhancing fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

In 2002 about 60 percent of the land area in the District was in farms (Table 1). On a statewide basis, about 45 percent of Wisconsin land is farmland. The counties with the highest proportion of farm land in the District are Calumet, Columbia, Dodge, Fond du Lac, and Rock with more 70 percent of their lands in farms. The counties with the least proportion of farm land are Adams, where about 44 percent of the county is in forest, and Waukesha, where about 12 percent of the county is urban land cover. Both of these counties have less than 30 percent of their land in farms. Within the District, 174,584 acres of land were enrolled in Conservation Reserve or Wetlands Reserve Programs in 2002. This represents 3.7 percent of the farm land or 2.3 percent of the total land area of the District.

A land cover map was completed for Wisconsin in 1999. The map was created though automated computer interpretation of satellite images. The work was completed by the partnership WISCLAND. The land cover for the District and nearby areas is depicted in Figure 3 on page 13. Percent land cover for each county are shown in Table 1.

Migratory Bird Conservation Initiatives

Several migratory bird conservation plans have been published over the last decade that can be used to help guide management decisions for the Districts. Bird conservation planning efforts have evolved from a largely local, site-based orientation to a more regional, even inter-continental, landscape-oriented perspective. Several transnational migratory bird conservation initiatives have emerged to help guide the planning and implementation process. The regional plans relevant to Leopold WMD are:

- The Upper Mississippi River/Great Lakes Joint Venture Implementation Plan of the North American Waterfowl Management Plan
- The Partners in Flight Boreal Hardwood Transition [land] Bird Conservation Plan
- The Upper Mississippi Valley/Great Lakes Regional Shorebird Conservation Plan

Table 1: Land Cover in the Leopold Wetland Management District

County	Urban	Agricultural	Grassland	Forest	Water	Wetland	Barren	Shrubland
Adams	0.3%	19.3%	16.3%	44.6%	6.2%	11.0%	0.9%	1.4%
Calumet	1.3%	63.9%	1.4%	3.2%	19.3%	9.4%	1.4%	0.0%
Columbia	1.2%	50.9%	12.4%	17.7%	2.8%	13.9%	1.0%	0.1%
Dane	5.5%	54.6%	13.2%	15.8%	3.1%	6.3%	1.6%	0.0%
Dodge	1.5%	62.3%	9.8%	3.9%	3.9%	16.9%	1.7%	0.0%
Fond du Lac	2.0%	62.2%	10.5%	4.6%	5.5%	13.5%	1.7%	0.1%
Green Lake	1.2%	45.5%	11.8%	11.9%	7.2%	21.5%	0.7%	0.1%
Jefferson	1.8%	57.7%	11.6%	7.5%	4.5%	15.4%	1.3%	0.0%
Kenosha	6.8%	52.5%	11.8%	11.2%	3.1%	9.3%	3.8%	1.5%
Manitowoc	2.2%	73.1%	3.3%	6.5%	0.3%	13.3%	1.2%	0.0%
Marquette	0.5%	27.6%	17.1%	30.0%	2.6%	21.9%	0.2%	0.2%
Ozaukee	6.9%	49.2%	19.3%	9.1%	1.6%	10.6%	1.1%	2.2%
Racine	7.6%	53.9%	11.5%	12.1%	2.9%	6.9%	3.8%	1.3%
Rock	4.0%	72.0%	10.4%	8.5%	1.0%	3.9%	0.3%	0.0%
Sauk	1.5%	40.7%	13.9%	35.9%	1.2%	5.8%	1.0%	0.0%
Sheboygan	3.6%	57.6%	10.4%	11.4%	0.9%	12.0%	1.5%	1.5%
Walworth	2.6%	59.0%	10.1%	12.4%	3.8%	7.6%	4.0%	0.5%
Washington	3.4%	49.1%	16.6%	11.6%	1.4%	15.3%	1.9%	0.7%
Waukesha	11.9%	29.4%	24.3%	13.3%	4.6%	13.9%	1.6%	1.0%
Waushara	0.3%	34.6%	20.2%	27.4%	2.0%	13.9%	1.5%	0.0%
Winnebago	5.4%	50.9%	3.8%	3.4%	24.1%	11.0%	1.3%	0.0%
Wisconsin	1.6%	30.8%	10.7%	37.5%	3.4%	14.1%	1.1%	0.9%

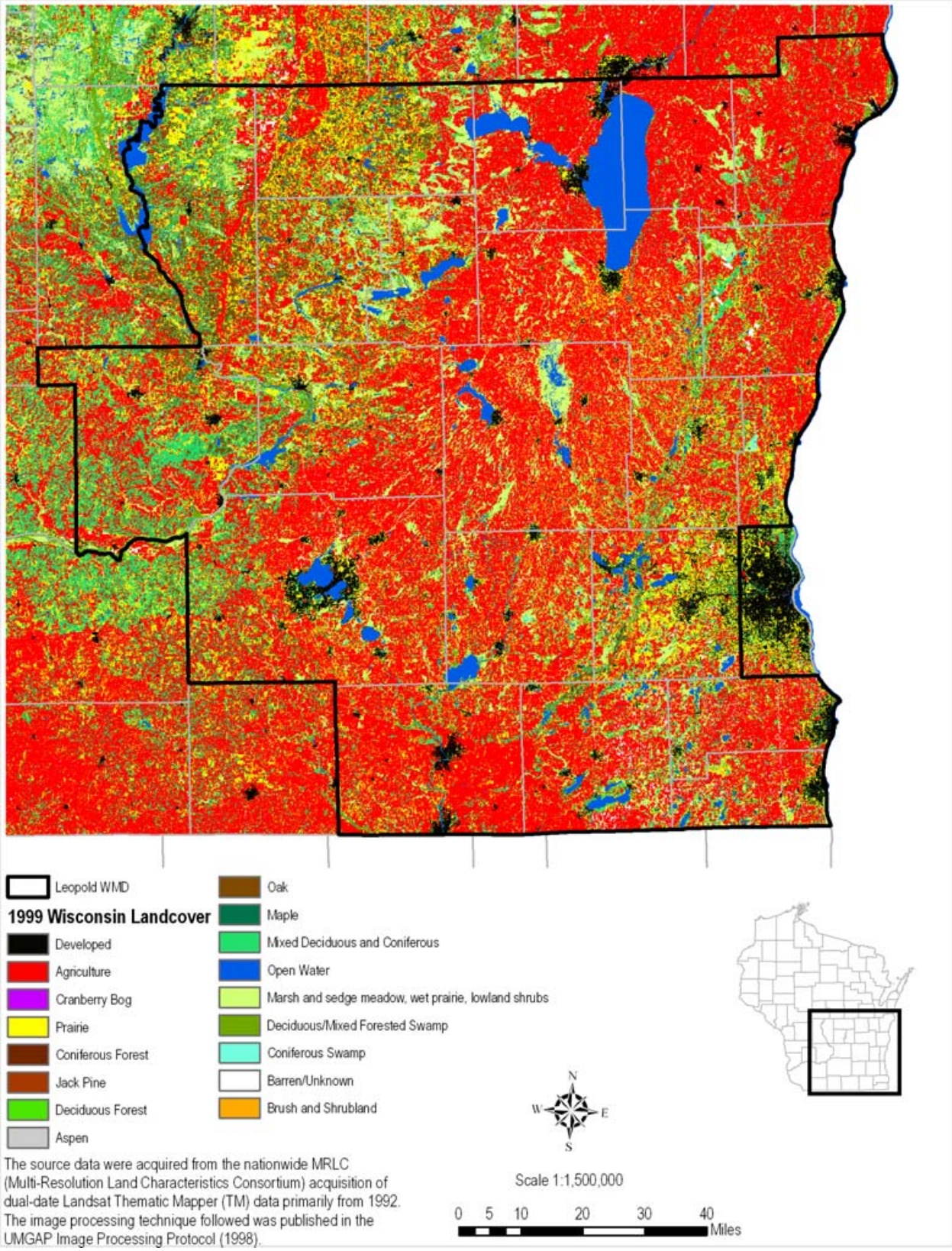
- The Upper Mississippi Valley/Great Lakes Regional Waterbird Conservation Plan

All four conservation plans will be integrated under the umbrella of the North American Bird Conservation Initiative (NABCI) in the Prairie Hardwood Transition Bird Conservation Region (BCR 23, see Figure 4 on page 14). Each of the bird conservation initiatives has a process for designating priority species, modeled to a large extent on the Partners in Flight method of computing scores based on independent assessments of global relative abundance, breeding and wintering distribution, vulnerability to threats, area importance, and population trend. These scores are often used by agencies in developing lists of priority bird species. The Service based its 2001 list of Non-game Birds of Conservation Concern primarily on the Partners in Flight, shorebird, and waterbird status assessment scores.

Wildlife Species of Management Concern

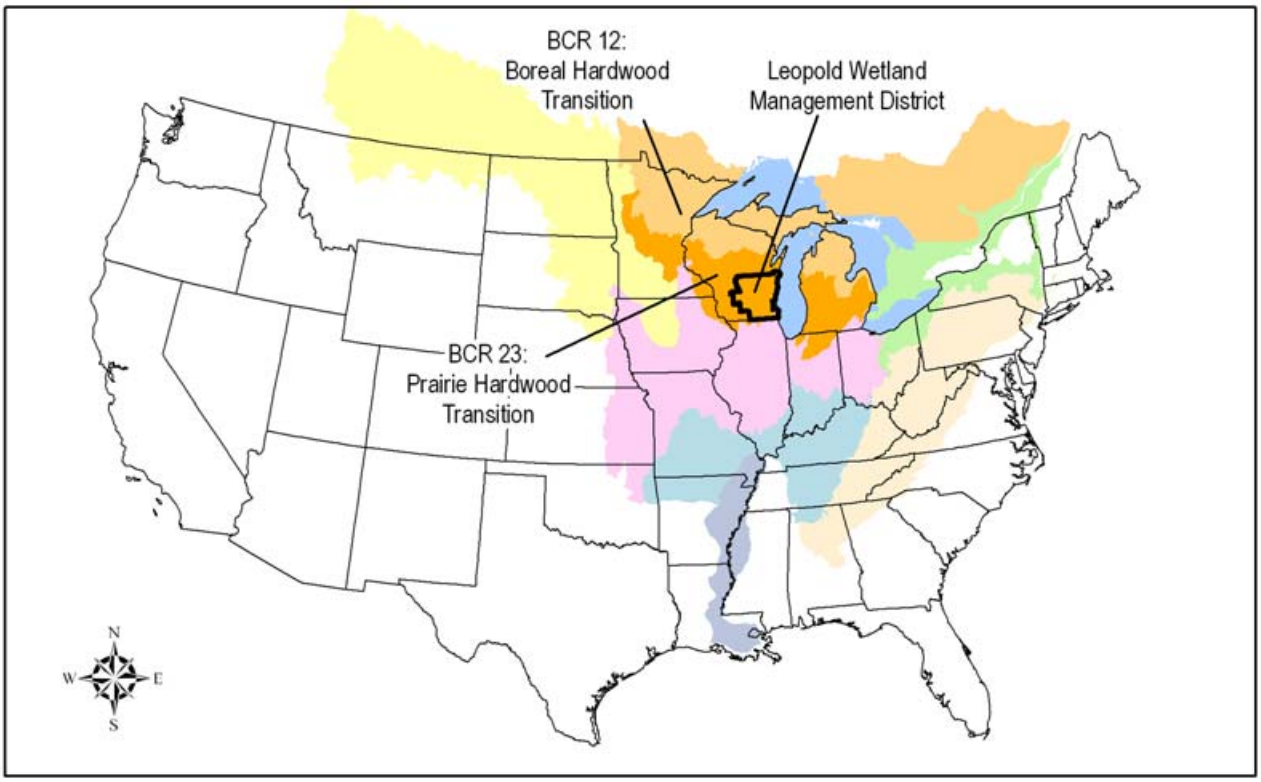
As described in the Biological Integriy, Diversity, and Environmental Health policy (601 FW 3), the goal of habitat management on units of the National Wildlife Refuge System is to ensure the long-term maintenance and, where possible, restoration of healthy populations of native fish, wildlife, plants, and their habitats. Resources of concern include species, species groups, and/or communities that support District purposes as well as Service trust resource responsibilities (including threatened and endangered species and migratory birds). Resources of concern are also native species and

Figure 3: Current Landcover, Leopold Wetland Management District



The source data were acquired from the nationwide MRLC (Multi-Resolution Land Characteristics Consortium) acquisition of dual-date Landsat Thematic Mapper (TM) data primarily from 1992. The image processing technique followed was published in the UMGAP Image Processing Protocol (1998).

Figure 4: Bird Conservation Region, Leopold Wetland Management District



natural, functional communities such as those found under historic conditions that are to be maintained and, where appropriate, restored on a refuge (601 FW 3.10B[1]. Resources of concern take into account the conservation needs identified within international, national, regional, or ecosystem goals/plans; state fish and wildlife conservaton plans; recovery plans for threatened and endangered species; regional fisheries management plans; and previously approved resource management plans.

Appendix D summarizes information on the status and current habitat use of important wildlife species found on lands administered by the District. Individual species, or species groups, were chosen because they are listed as Regional Resource Conservation Priorities or State-listed threatened or endangered species. Other species are listed due to their importance for economic or recreational reasons, because the District or its partners monitor or survey them, or for their status as an overabundant or invasive species.

Other Conservation and Recreation Lands in the Area

Other U.S. Fish and Wildlife Service land within the District include Horicon National Wildlife Refuge (more than 21,000 acres) and Fox River National Wildlife Refuge (about 1,000 acres). Necedah National Wildlife Refuge, which is more than 43,000 acres in size, is located a few miles west of Adams County, which is in the northwest part of the District.

The Wisconsin Department of Natural Resources manages over 307,000 acres of conservation and recreation lands within the District (Figure 5). The DNR lands include 58 State Wildlife Areas with a total acreage close to 144,000 acres. The largest Wildlife Area is more than 12,000 acres. The DNR manages more than 18,000 acres of natural areas, 22,000 acres of parks and trails, and nearly 29,000 acres of other wildlife habitat within the District. Most of the lands managed for wildlife and some other state lands are open to wildlife-dependent recreation.

Figure 5: Conservation Lands Adjacent to the Leopold Wetland Management District

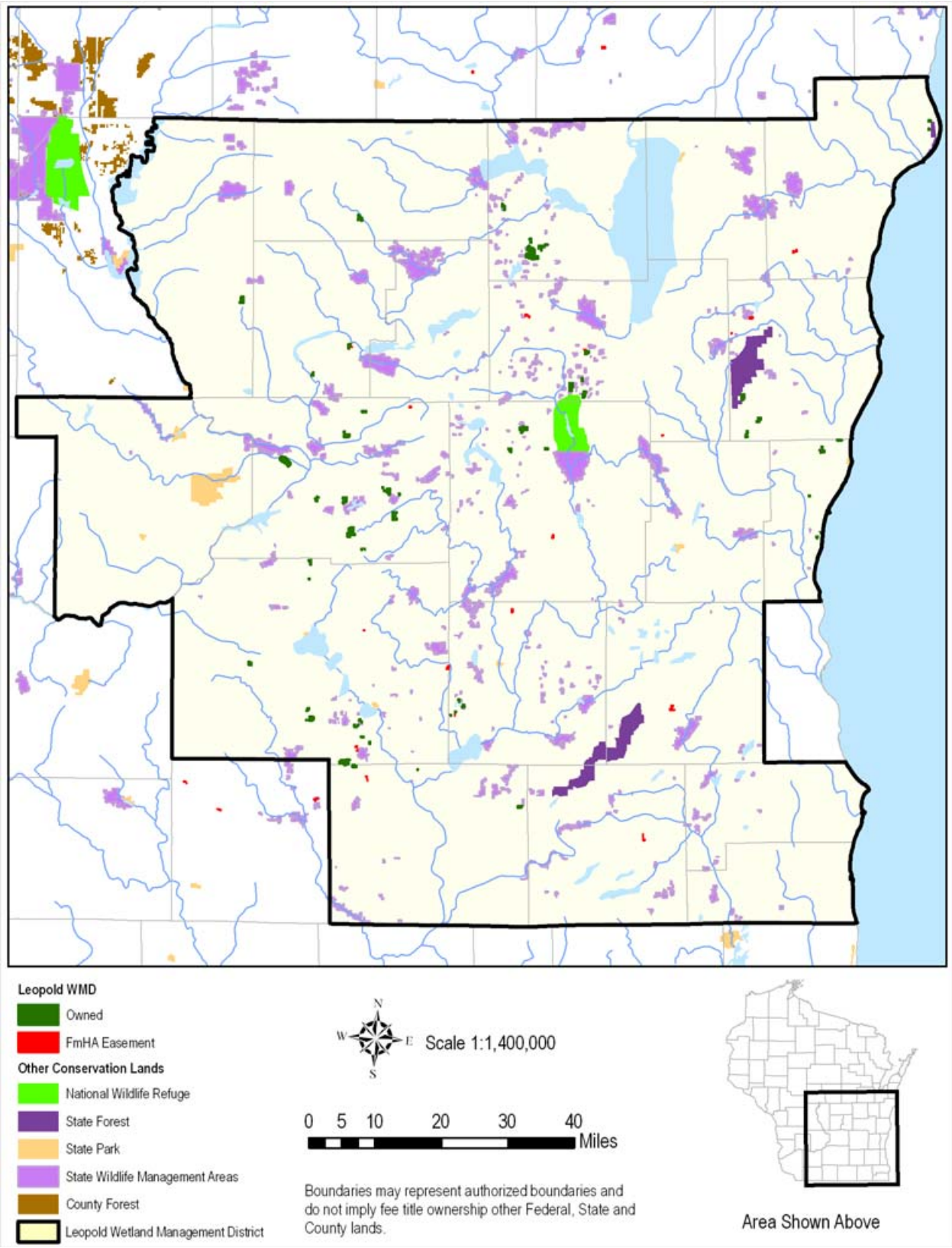
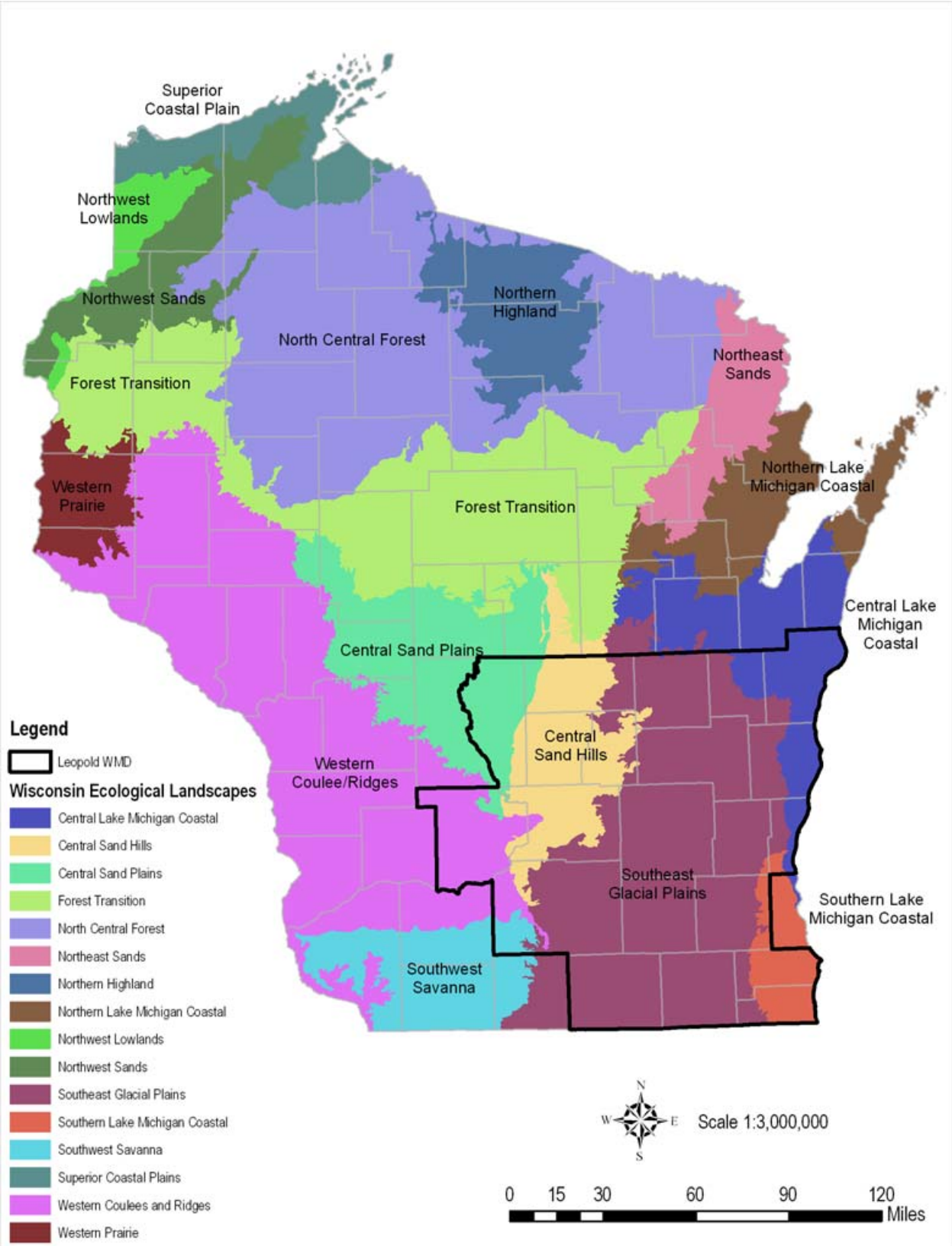


Figure 6: Wisconsin Ecological Landscapes



Wisconsin Strategy for Wildlife Species of Greatest Conservation Need

Using Wisconsin's State Wildlife Action Plan (WWAP), the State of Wisconsin has analyzed state animal species, identified those most in need of attention because they are declining or are dependent on habitat or places that are declining, and suggested conservation measures to ensure the survival of these species. The document describing their analysis and findings is filled with information that helps identify conservation needs. For each Ecological Landscape of Wisconsin (Figure 6), it provides information on the overarching needs and opportunities in the landscape as well as lists of the natural communities that are major and important management opportunities. It also lists those Species of Greatest Conservation Need with high, moderate, or low degrees of probability of occurring in the landscape. The State's analysis provides a good basis for coordination of District activities with the State and other conservation organizations.

Socioeconomic Setting

Just as the environmental characteristics vary across the District, so do the socioeconomic characteristics (Table 2). Milwaukee influences the southeastern portion of the District. The counties of Racine, Washington, and Waukesha in the southeast have the highest median household income and the highest median housing value in the District. Most of the District has a low minority population, much like the State of Wisconsin. The exception is the relatively higher Hispanic population in the three southeastern counties of Kenosha, Racine, and Walworth. Counties with a high urban population include the counties Kenosha, Racine, Waukesha near Milwaukee and the counties of Dane (Madison), Rock (Janesville and Beloit), and Winnebago (Oshkosh). The counties with the highest percentage of college educated people in the District are Dane, Ozaukee, and Waukesha. In comparison to the rest of the District and the State of Wisconsin, Adams, Marquette, and Waushara Counties in the northwestern part of the District have a higher median age, essentially no urban population, and well below median household income and housing value.

The population of the District is expected to grow about 1 percent per year over the next 20 years (Table 3). The counties projected to grow at the highest average annual rate are Calumet, Dane, Kenosha, Sauk, Walworth, and Washington. The District is projected to increase in population about 374,000 from 2005 to 2025. For additional detailed descriptions of the characteristics and projections for the counties and their implications for recreation see the regional demographic profiles prepared by the Applied Population Lab and Wisconsin Department of Natural Resources for the Wisconsin SCORP 2005-2010 planning process.

Potential District Visitors

We used block group data from the 2000 census to estimate how many people lived near WPAs. For the WPAs managed by the District, we learned that about 302,000 people lived within 5 miles of a WPA in 2000; 968,000 within 10 miles; and 1,549,000 within 15 miles.

In order to refine our understanding and estimate the potential market for visitors to the WPAs, we looked at 1998 consumer behavior data for an area within an approximate 15-mile distance from WPAs. The data were organized by zip code areas, which made the buffers around the WPAs irregular and not equidistant at all boundary points. We thought the distance was a good approximation for a reasonable drive to a WPA for an outing.

The consumer behavior data used in the analysis is derived from Mediamark Research Inc. data. The company collects and analyzes data on consumer demographics, product and brand usage, and exposure to all forms of advertising media. The consumer behavior data were projected by Tetrad Computer Applications Inc. to new populations using Mosaic data. Mosaic is a methodology that classifies neighborhoods into segments based on their demographic and socioeconomic composition. The basic assumption in the analysis is that people in demographically similar neighborhoods will tend to have similar consumption, ownership, and lifestyle preferences. Because of the assumptions made in the analysis, the data should be considered as relative indicators of potential, not actual participation.

We looked at potential participants in birdwatching, photography, freshwater fishing, hunting, and hiking. The consumer behavior data apply to persons more than 18 years old. For the area that we

Table 2: Socioeconomic Data, Counties Within the Leopold Wetland Management District[1]

County	Total Population	Percent Urban	Median Age	Percent Female	College[2] Educated	Percent Hispanic	Percent American Indian	Percent Asian	Percent Black	Median HH Income	Median Housing Value[3]
Adams County	19,920	0.0	44.5	49.3	10	1.4	0.6	0.3	0.3	$33,408	$83,600
Calumet County	40,631	60.3	35.2	50	21	1.1	0.3	1.5	0.3	$52,569	$109,300
Columbia County	52,468	36.8	38.0	49.6	17	1.6	n/a	0.3	0.9	$45,064	$115,000
Dane County	426,526	84.5	33.2	50.5	41	3.4	n/a	3.5	4.0	$49,223	$146,900
Dodge County	85,897	47.8	37.0	47.7	13	2.5	n/a	0.3	2.5	$45,190	$105,800
Fond du Lac County	97,296	62.1	36.9	51	17	2.0	0.4	0.9	0.9	$45,578	$101,000
Green Lake County	19,105	25.1	40.9	51	14	2.1	02	0.3	02	$39,462	$90,100
Jefferson County	74,021	57.8	36.6	50.4	17	4.1	n/a	0.4	0.3	$46,901	$123,800
Kenosha County	149,577	88.6	34.8	50.4	19	7.2	n/a	0.9	5.1	$46,970	$120,900
Manitowoc County	82,887	60.9	38.3	50.5	15	1.6	0.4	2.0	n/a	$43,286	$90,900
Marquette County	14,555	0.0	40.9	n/a	10	n/a	n/a	n/a	n/a	$35,746	$87,000
Ozaukee County	82,317	74.6	38.9	50.7	39	1.3	n/a	1.1	0.9	$62,745	$177,300
Racine County	188,831	87.0	36.1	50.5	20	7.9	n/a	0.7	10.5	$48,059	$111,000
Rock County	152,307	78.2	35.9	50.8	17	3.9	n/a	0.8	4.6	$45,517	$98,200
Sauk County	55,225	50.1	37.3	50.6	18	1.7	n/a	0.3	0.3	$41,941	$107,500
Sheboygan County	112,646	70.8	36.8	49.8	18	3.4	n/a	3.3	1.1	$46,237	$106,800
Walworth County	93,759	64.0	35.1	50.3	22	6.5	n/a	0.7	0.8	$46,274	$128,400
Washington County	117,493	65.2	36.6	50.1	22	1.3	n/a	0.6	0.4	$57,033	$155,000
Waukesha County	360,767	87.8	38.1	50.8	34	2.6	n/a	1.5	0.7	$62,839	$170,400
Waushara County	23,154	0.3	42.1	50	12	3.7	0.%	0.3	0.3	$37,000	$85,100
Winnebago County	156,763	84.2	35.4	50	23	2.0	0.5	1.8	1.1	$44,445	$97,700
Leopold WMD											
State of Wisconsin		68.3%	36.0	50.6%	22	3.6	0.8	1.6	5.6	$43,791	$112,200

1. *Source: Census 2000 as reported in Wisconsin SCORP*
2. *Percent college educated calculated for persons age 25 and older.*
3. *Housing value is calculated for owner occupied housing units.*

Table 3: Wisconsin Department of Administration Official Population Projections June 2003

County	Historical			Projections					Average Annual Percent Increases	
	1980	1990	2000	2005	2010	2015	2020	2025	2005-2020	2005-2025
Adams	13,457	15,682	19,920	20,796	21,528	21,969	22,137	22,440	0.64	0.53
Calumet	30,867	34,291	40,631	44,182	47,398	50,381	53,473	56,336	2.10	1.83
Columbia	43,222	45,088	52,468	54,434	56,366	58,135	59,753	61,669	0.98	0.89
Dane	323,545	367,085	426,526	455,927	480,573	503,017	527,534	554,848	1.57	1.45
Dodge	75,064	76,559	85,897	88,192	90,565	92,842	94,882	96,828	0.76	0.65
Fond du Lac	88,964	90,083	97,296	100,163	103,031	105,777	108,494	110,748	0.83	0.70
Green Lake	18,370	18,651	19,105	19,321	19,666	19,913	20,064	20,032	0.38	0.25
Jefferson	66,152	67,783	75,767	79,030	82,161	85,178	88,302	91,464	1.17	1.05
Kenosha	123,137	128,181	149,577	157,935	165,678	173,624	181,693	190,145	1.50	1.36
Manitowoc	82,918	80,421	82,893	84,574	86,307	88,055	89,860	90,821	0.63	0.49
Marquette	11,672	12,321	14,555	15,052	15,579	16,035	16,293	16,583	0.82	0.68
Ozaukee	66,981	72,831	82,317	85,047	87,238	89,692	92,496	95,417	0.88	0.81
Racine	173,132	175,034	188,831	193,189	197,662	202,404	206,989	211,326	0.71	0.63
Rock	139,420	139,510	152,307	156,691	160,911	165,354	169,648	174,018	0.83	0.74
Sauk	43,469	46,975	55,225	58,121	60,930	63,520	65,821	68,208	1.32	1.16
Sheboygan	100,935	103,877	112,656	116,070	119,411	122,921	126,540	130,018	0.90	0.80
Walworth	71,507	75,000	92,013	96,182	100,634	106,588	111,237	113,506	1.57	1.20
Washington	84,848	95,328	117,496	123,570	129,085	134,255	139,214	145,314	1.27	1.17
Waukesha	280,203	304,715	360,767	374,891	386,460	397,922	409,570	424,472	0.93	0.88
Waushara	18,526	19,385	23,066	25,675	26,548	27,228	27,726	28,136	0.80	0.64
Winnebago	131,772	140,320	156,763	162,076	166,717	171,369	176,614	182,767	0.90	0.85
Leopold WMD	1,988,161	2,109,120	2,406,076	2,511,118	2,604,448	2,696,179	2,788,340	2,885,096	1.10	0.99

included in our analysis, the estimated maximum participants for each activity are: birdwatching (66,398), photography (97,790), hunting (61,263), freshwater fishing (115,837), and hiking (82,874). We interpret the estimates to represent the core audience for repeated trips to a WPA.

Climate and Climate Change Impacts

The District's climate is continental with cold winters and warm summers. Leopold Wetland Management District is large, and the long-term temperature averages vary from one end of the District to another. Lake Michigan moderates the temperatures in the eastern portion of the District. The average annual precipitation is higher in the southern part of the District than in the central and northern part. The normal temperatures and annual precipitation averages for the period 1971-2000 for a region that includes Columbia, Dane, Dodge, Green, Jefferson, and Rock Counties present an adequate indication of the climate of the District. The region has an average annual temperature of 45.9 degrees Fahrenheit. July is the warmest month with an average temperature of 71.3 degrees Fahrenheit. The coldest month is January with an average temperature of 16.8 degrees Fahrenheit. Annual precipitation is 34.11 inches. The average monthly precipitation exceeds 3 inches for April, May, and September. The average monthly precipitation exceeds 4 inches for June, July, and August. (Source: Wisconsin Agricultural Statistics Service, Wisconsin 2004 Agricultural Statistics, at www.nass.usda.gov/wi/rlsetoc.htm.)

The U.S. Department of the Interior issued an order in January 2001 requiring federal agencies, under its direction, that have land management responsibilities to consider potential climate change impacts as part of long range planning endeavors.

The increase of carbon dioxide within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. In relation to comprehensive conservation planning for wetland management districts, carbon sequestration constitutes the primary climate-related impact to be considered in planning. The U.S. Department of Energy's "*Carbon Sequestration Research and Development*" defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

Muskrat. USFWS photo.

Vegetated land is a tremendous factor in carbon sequestration. Terrestrial biomes of all sorts – grasslands, forests, wetlands, tundra, and desert – are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon dioxide. The Department of Energy report's conclusions noted that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere.

Conserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges and wetland management districts. The actions proposed in this CCP would conserve or restore land and habitat, and would thus retain existing carbon sequestration on the District. This in turn contributes positively to efforts to mitigate human-induced global climate change.

One Service activity in particular – prescribed burning – releases carbon dioxide directly to the atmosphere from the biomass consumed during combustion. However, there is actually no net loss of carbon, since new vegetation quickly germinates and sprouts to replace the burned-up biomass and sequesters or assimilates an approximately equal amount of carbon as was lost to the air (Boutton et al. 2006).

Several impacts of climate change have been identified that may need to be considered and addressed in the future:

- Habitat available for cold water fish such as trout and salmon in lakes and streams could be reduced.
- Forests may change, with some tree species shifting their range northward or dying out, and other trees moving in to take their place.
- Ducks and other waterfowl could lose breeding habitat due to stronger and more frequent droughts.
- Changes in the timing of migration and nesting could put some birds out of sync with the life cycles of their prey species.
- Animal and insect species historically found farther south may colonize new areas to the north as winter climatic conditions moderate.

The managers and resource specialists on the District need to be aware of the possibility of change due to global warming. When feasible, documenting long-term vegetation, species, and hydrologic changes should become a part of research and monitoring programs on the District. Adjustments in management direction may be necessary over the course of time to adapt to a changing climate.

The following is an excerpt from the 2000 report, *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*, produced by the National Assessment Synthesis Team, an advisory committee chartered under the Federal Advisory Committee Act to help the US Global Change Research Program fulfill its mandate under the Global Change Research Act of 1990. These excerpts are from the section of the report focused upon the eight-state Midwest region.

Observed Climate Trends

Over the 20th century, the northern portion of the Midwest, including the upper Great Lakes, has warmed by almost 4 degrees Fahrenheit (2 degrees Celsius), while the southern portion, along the Ohio River valley, has cooled by about 1 degree Fahrenheit (0.5 degree Celsius). Annual precipitation has increased, with many of the changes quite substantial, including as much as 10 to 20 percent increases over the 20th century. Much of the precipitation has resulted from an increased rise in the number of days with heavy and very heavy precipitation events. There have been moderate to very large increases in the number of days with excessive moisture in the eastern portion of the basin.

Scenarios of Future Climate

During the 21st century, models project that temperatures will increase throughout the Midwest, and at a greater rate than has been observed in the 20th century. Even over the northern portion of the region, where warming has been the largest, an accelerated warming trend is projected for the 21st century, with temperatures increasing by 5 to 10 degrees Fahrenheit (3 to 6 degrees Celsius). The average minimum temperature is likely to increase as much as 1 to 2 degrees Fahrenheit (0.5 to 1 degree Celsius) more than the maximum temperature. Precipitation is likely to continue its upward trend, at a slightly accelerated rate; 10 to 30 percent increases are projected across much of the region. Despite the increases in precipitation, increases in temperature and other meteorological factors are likely to lead to a substantial increase in evaporation, causing a soil moisture deficit, reduction in lake and river levels, and more drought-like conditions in much of the region. In addition, increases in the proportion of precipitation coming from heavy and extreme precipitation are very likely.

Midwest Key Issues

Reduction in Lake and River Levels

Water levels, supply, quality, and water-based transportation and recreation are all climate-sensitive issues affecting the region. Despite the projected increase in precipitation, increased

American badger. USFWS photo.

evaporation due to higher summer air temperatures is likely to lead to reduced levels in the Great Lakes. Of 12 models used to assess this question, 11 suggest significant decreases in lake levels while one suggests a small increase. The total range of the 11 models' projections is less than a 1-foot increase to more than a 5-foot decrease. A 5-foot (1.5-meter) reduction would lead to a 20 to 40 percent reduction in outflow to the St. Lawrence Seaway. Lower lake levels cause reduced hydropower generation downstream, with reductions of up to 15 percent by 2050. An increase in demand for water across the region at the same time as net flows decrease is of particular concern. There is a possibility of increased national and international tension related to increased pressure for water diversions from the Great Lakes as demands for water increase. For smaller lakes and rivers, reduced flows are likely to cause water quality issues to become more acute. In addition, the projected increase in very heavy precipitation events will likely lead to increased flash flooding and worsen agricultural and other nonpoint source pollution as more frequent heavy rains wash pollutants into rivers and lakes. Lower water levels are likely to make water-based transportation more difficult with increases in the costs of navigation of 5 to 40 percent. Some of this increase will likely be offset as reduced ice cover extends the navigation season. Shoreline damage due to high lake levels is likely to decrease 40 to 80 percent due to reduced water levels.

Adaptations: A reduction in lake and river levels would require adaptations such as re-engineering of ship docks and locks for transportation and recreation. If flows decrease while demand increases, international commissions focusing on Great Lakes water issues are likely to become even more important in the future. Improved forecasts and warnings of extreme precipitation events could help reduce some related impacts.

Agricultural Shifts

Agriculture is of vital importance to this region, the nation, and the world. It has exhibited a capacity to adapt to moderate differences in growing season climate, and it is likely that agriculture would be able to continue to adapt. With an increase in the length of the growing season, double cropping, the practice of planting a second crop after the first is harvested, is likely to become more prevalent. The carbon dioxide fertilization effect is likely to enhance plant growth and contribute to generally higher yields. The largest increases are projected to occur in the northern areas of the region, where crop yields are currently temperature limited. However, yields are not likely to increase in all parts of the region. For example, in the southern portions of Indiana and Illinois, corn yields are likely to decline, with 10-20 percent decreases projected in some locations. Consumers are likely to pay lower prices due to generally increased yields, while most producers are likely to suffer reduced profits due to declining prices. Increased use of pesticides and herbicides are very likely to be required and to present new challenges.

Adaptations: Plant breeding programs can use skilled climate predictions to aid in breeding new varieties for the new growing conditions. Farmers can then choose varieties that are better attuned to the expected climate. It is likely that plant breeders will need to use all the tools of plant breeding, including genetic engineering, in adapting to climate change. Changing planting and harvest dates and planting densities, and using integrated pest management, conservation tillage, and new farm technologies are additional options. There is also the potential for shifting or expanding the area where certain crops are grown if climate conditions become more favorable. Weather conditions during the growing season are the primary factor in year-to-year differences in corn and soybean yields. Droughts and floods result in large yield reductions; severe droughts, like the drought of 1988, cause yield reductions of over 30%. Reliable seasonal forecasts are likely to help farmers adjust their practices from year to year to respond to such events.

Changes in Semi-natural and Natural Ecosystems

The Upper Midwest has a unique combination of soil and climate that allows for abundant coniferous tree growth. Higher temperatures and increased evaporation will likely reduce boreal forest acreage, and make current forestlands more susceptible to pests and diseases. It is likely that the southern transition zone of the boreal forest will be susceptible to expansion of temperate forests, which in turn will have to compete with other land use pressures. However, warmer weather coupled with beneficial effects of increased carbon dioxide is likely to lead to an increase in tree growth rates on marginal forestlands that are currently temperature-limited. Most climate models indicate that higher air temperatures will cause greater evaporation and hence reduced soil moisture, a situation conducive to forest fires. As the 21st century progresses, there will be an increased likelihood of greater environmental

Ruddy Duck. USFWS photo.

stress on both deciduous and coniferous trees, making them susceptible to disease and pest infestation, likely resulting in increased tree mortality.

As water temperatures in lakes increase, major changes in freshwater ecosystems will very likely occur, such as a shift from cold water fish species, such as trout, to warmer water species, such as bass and catfish. Warmer water is also likely to create an environment more susceptible to invasions by non-native species. Runoff of excess nutrients (such as nitrogen and phosphorus from fertilizer) into lakes and rivers is likely to increase due to the increase in heavy precipitation events. This, coupled with warmer lake temperatures, is likely to stimulate the growth of algae, depleting the water of oxygen to the detriment of other living things. Declining lake levels are likely to cause large impacts to the current distribution of shoreline wetlands. There is some chance that some of these wetlands could gradually migrate, but in areas where their migration is limited by the topography, they would disappear. Changes in bird populations and other native wildlife have already been linked to increasing temperatures and more changes are likely in the future. Wildlife populations are particularly susceptible to climate extremes due to the effects of drought on their food sources.

Geology and Soils

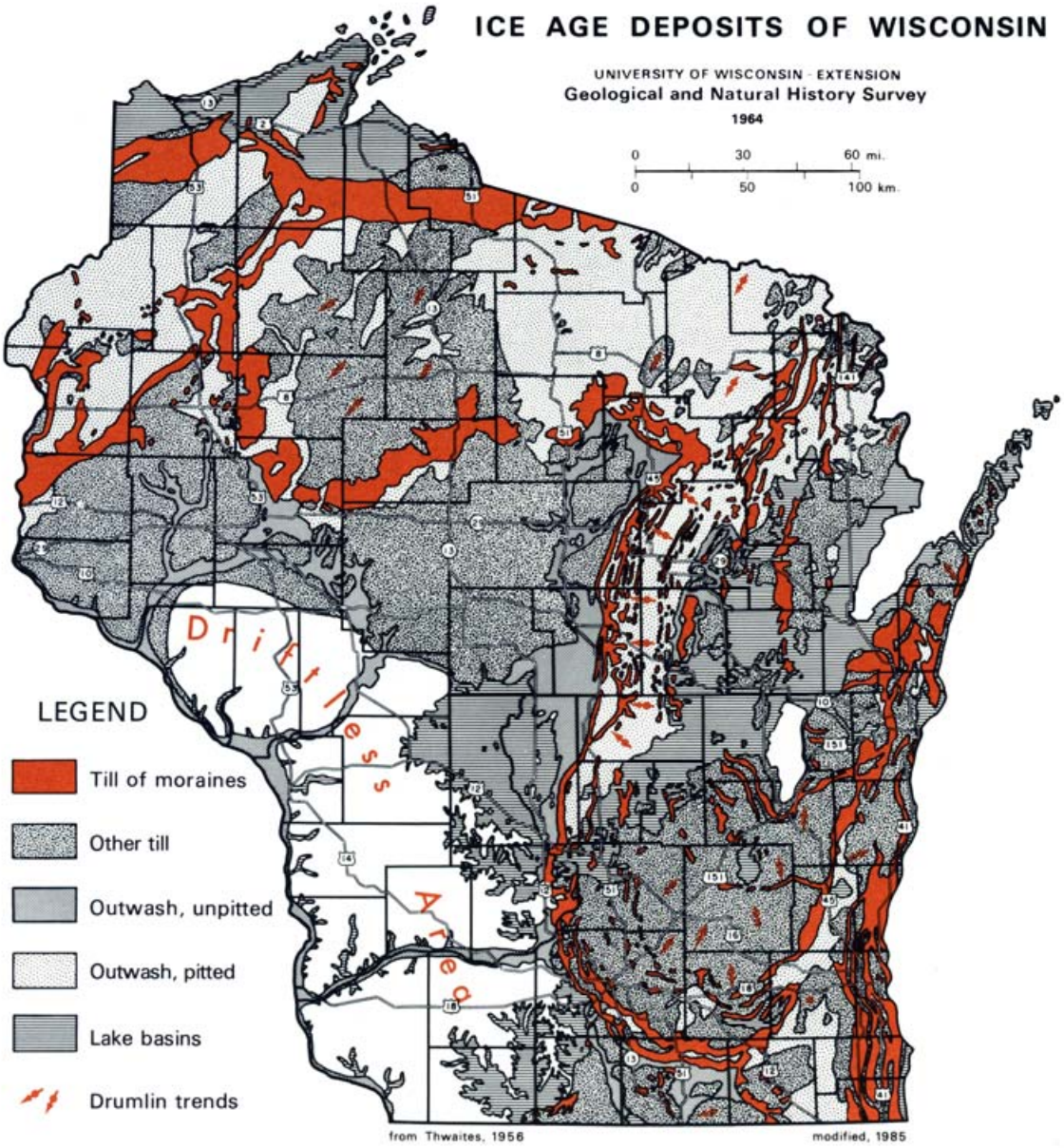
A majority of the District is quite similar to the glaciated prairie region of western Minnesota. This similarity is recognized with the inclusion of these glaciated prairie areas in Category 2, Prairie and Pothole Parklands, in the Service's revised Waterfowl Habitat Acquisition Plan. The counties that lie within the Leopold WMD boundaries owe much of their ecology to the glacial history of Wisconsin (see Figure 7). Glaciers most recently flowed into Wisconsin about 25,000 years ago and reached their greatest extent, covering approximately two-thirds of the state, some 14,000 to 16,000 years ago. The retreat of the ice front was interrupted a number of times by re-advances, the last one touched northwestern Wisconsin about 10,000 years ago. The advancing ice was channeled into the lowlands now occupied by Lakes Superior and Michigan, Green Bay, and the Fox River, and was impeded by the uplands of the Bayfield, Keweenaw and Door Peninsulas. The ice thus split into six major lobes as it flowed southward across the state. The Green Bay Lobe, which had few obstructions in its path, penetrated as far south as present-day Janesville in Rock County.

Soil types have characteristic properties that determine their potential and limitations for specific land uses. Knowledge of soils can contribute to managing the District's wildlife habitat programs. The Soil Survey Geographic Database is the most detailed level of soil mapping done by the Natural Resources Conservation Service (NRCS). This database was completed for Wisconsin in 2006. At the level of the waterfowl production area, soil data can be used to identify the potential natural vegetation.

Water and Hydrology

Hydrologic features vary across the ecological landscapes of the District, although the past draining of wetlands is consistent throughout the District. According to the Wisconsin DNR, watershed and groundwater pollution vary considerably across the District (see Figure 8). From a practical perspective, the relevance of hydrology to the establishment and management of a WPA is best analyzed and discussed at a local scale.

Figure 7: Ice Age Deposits of Wisconsin



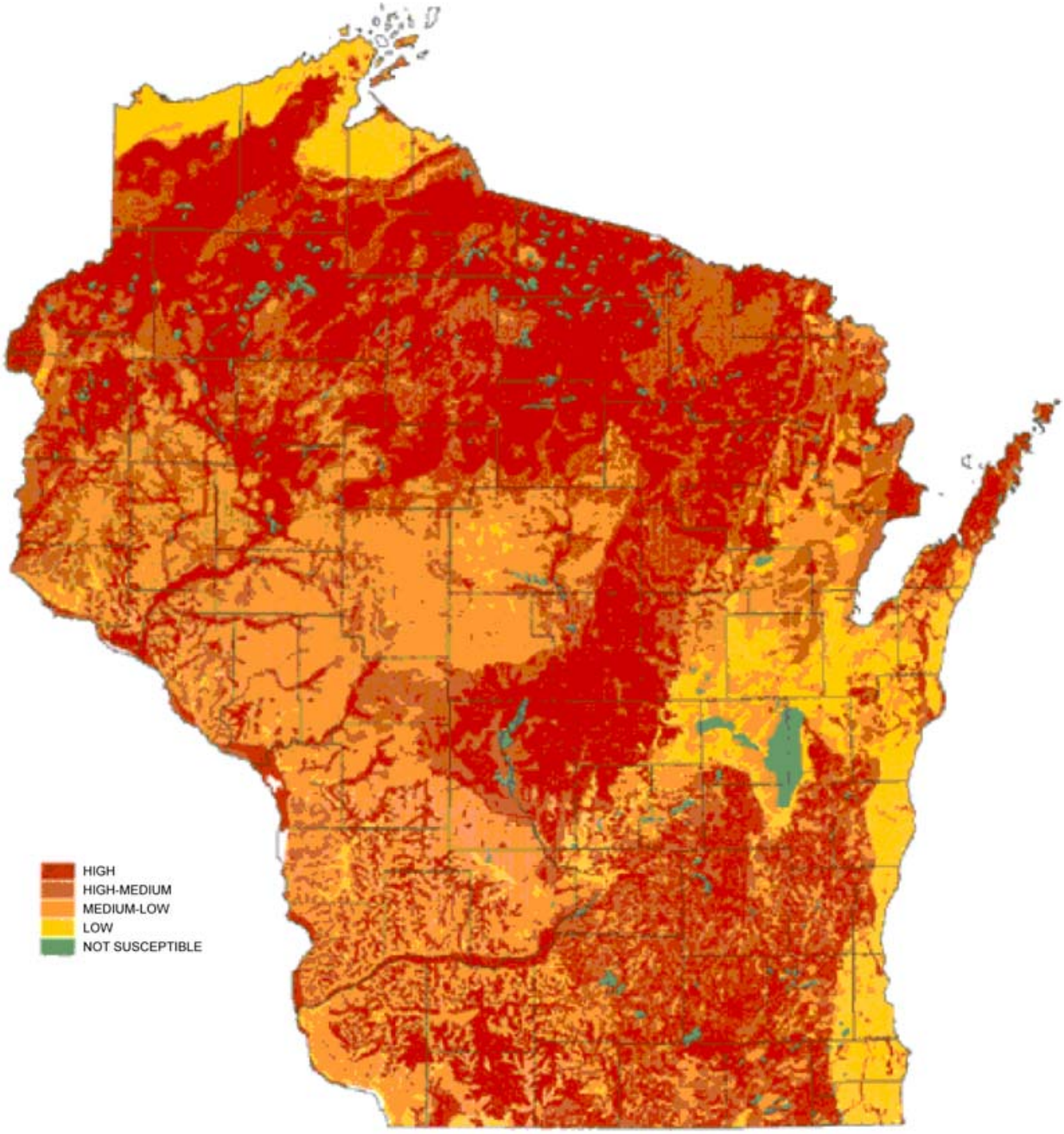
District Resources

Wetlands

Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin et al. 1979). It is estimated that the contiguous United States contained 221 million acres of wetlands just 200 years ago (Dahl 1990). By the mid-1970s, only 46 percent of the original acreage remained (Tiner 1984). Wetlands now cover about 5 percent of the landscape of the lower 48 states.

Wetlands are important to both migratory and resident wildlife. They serve as breeding and nesting habitat for migratory birds and as wintering habitat for many species of resident wildlife.

Figure 8: Wisconsin Groundwater Contamination Susceptitiblity Model



Humans also benefit from wetlands as these habitats improve water quality and quantity, reduce flooding effects, and provide areas for recreation.

Wetlands are classified using a number of attributes including vegetation, water regimes (the length of time water occupies a specific area), and water chemistry. District wetlands are classified using the following water regime descriptions (Cowardin et al. 1979):

- Temporarily flooded-surface water is present for brief periods during the growing season. The water table usually lies below the soil surface most of the season, so plants that grow in both uplands and wetlands are characteristic.
- Seasonally flooded-surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the surface.
- Semipermanently flooded-surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.
- Permanently flooded-water covers the land throughout the year in nearly all years. Vegetation is composed of obligate hydrophytes, such as cattails.

The District has focused on saving and restoring small wetlands. Wetland diversity is important because wetlands change continuously; a single wetland can not be maximally productive all the time. Waterfowl use different types of wetlands at different times during the breeding season. Laying hens may forage in ephemeral, temporary, and seasonal wetlands early in the season and shift to semi-permanent and permanent wetlands after the brood is hatched. Marsh birds need a variety of wetlands in close proximity so they can shift from one wetland to another as the wetlands cycle through different phases. Wetland complexes include a variety of basins, some shallow and some deep, in close proximity. Diverse wetland complexes are rare today because most shallow ephemeral, temporary, and seasonal basins have been drained.

Freshwater wetlands like those in the District are among the most productive in the world (Weller 1982). The dynamic water cycle creates a rich environment for many waterfowl and other marsh birds. Cycling water accelerates decomposition of marsh vegetation, resulting in a natural fertilizer. When the basins recharge in the spring, the water becomes a soup of nutrients and supports a diverse and healthy population of aquatic invertebrates, which feed reproducing waterfowl and marsh birds throughout the spring and summer. In the larger basins, the vegetation changes from densely closed cattail or bullrush to completely open over a period of years. In the process of transition, the cover vegetation moves through a phase, known as hemi-marsh, when clumps of emergent vegetation are interspersed with open water (Weller 1982). In this phase, the structure of the vegetation itself creates habitat and stimulates the production of aquatic invertebrates. The marsh, in this phase, hosts the maximum number of marsh birds. Unfortunately, the phase is only temporary and most wetlands cycle out of it in 1 to 3 years.

Table 4: Wetland Acres by Type, Leopold Wetland Management District

Wetland Feature	Cowardin Classification	Acres
River	R	14.3
Stock Pond	PUBF	5.6
Wetland Type I	Seasonally-flooded basin (PEMA)	12.7
Wetland Type II	Inland fresh meadow (PEMB)	1,732.2
Wetland Type III	Inland shallow fresh marsh (PEMC)	1,765.1
Wetland Type IV	Inland deep fresh marsh (PEMC)	990.1
Wetland Type V	Inland open fresh marsh (PEMH)	25.4
Wetland Type VI	Shrub swamp (PSSA)	359.3
Wetland TypeVII	Wooded swamp (PFOB)	360.3
	Total Wetland Acres	5,265.1

Wetlands within the District occur in a diverse distribution of sizes, types, locations, and associations. Table 4 displays the amount of wetland acres by type within the District. This data is likely skewed against Type I wetlands because of their ephemeral nature. Additionally many Type VI wetlands have converted from Type II sedge meadows as a result of drainage and the exclusion of fire.

Table 5: Grassland Features, Leopold Wetland Management District

Grassland Feature	Min. Acres	Max. Acres	Ave. Acres	Total Acres
Grass Introduced	0.048	49.057	5.1237	809.6
Grass Native Prairie	0.382	11.562	2.9821	47.7
Grass Seeded Cool	1.771	53.243	13.5318	622.5
Grass Seeded Warm	0.394	95.462	16.4	3,394.8
		Total Grassland Acreage		4,874.5

Plant Communities

Plant Communities Associated With Wetlands

Wetlands throughout the District provide both resting cover and food resources for migratory birds. Substantial emergent and submergent aquatic vegetation occurs in freshwater wetlands. Sago pondweed, coontail, and duckweed occur in the deeper, more permanently flooded zones, while cattail, bulrush, burreed, and smartweed grow in shallow areas that may go dry during some periods.

Most palustrine basins exhibit concentric zones of vegetation that are dominated by different plant species (Kantrud et al. 1989). The terms commonly used in reference to these zones are, in decreasing order of water permanency are: deep marsh, shallow marsh, and wet meadow. The water regime in a deep marsh zone is usually semipermanent. Dominant plants include cattail, bulrush, submergent or floating plants, and submergent vascular plants, but this zone also may be devoid of vegetation if bottom sediments are unconsolidated. Shallow marsh zones are usually dominated by emergent grasses, sedges, and some forbs, but submergent or floating vascular plants also may occur. Wet meadow zones also are typically dominated by grasses, rushes, and sedges, whereas submergent or floating plants are absent.

A variety of wildlife species, from ducks to rails to songbirds, use this community. Common breeding bird species include: Mallard, Blue-wing Teal, Wood Duck, Canada Geese, Sora Rail, Virginia Rail, Sandhill Crane, American Bittern, Least Bittern, Red-winged Blackbird, Yellow-headed Blackbird, Marsh Wren.

Species present during the fall migration include: Scaup, Ring-necked Duck, Widgeon, Tundra Swan, Greater Yellowlegs, Lesser Yellowlegs, Solitary Sandpiper, Pectoral Sandpiper, Least Sandpiper, Semipalmated Sandpipers.

Herptile species such as Blanchard's cricket frog, Blanding's turtle, Butler's garter snake, pickerel frog, and four-toed salamander are a few of the species of concern in Wisconsin associated with the various wetland types. Several mammal species of concern, primarily bat species such as eastern red, hoary, silver-haired, and northern long-eared bats are highly associated with District wetlands.

Plant Communities Associated With Uplands

Upland vegetation is essential to provide nesting habitat for migratory and resident bird species. Upland habitats also provide necessary habitat requirements for resident wildlife throughout the year. The District currently uses a variety of management techniques to maintain and enhance upland habitat conditions including prescribed fire, native grass seeding, tree cutting, and invasive species management.

Grasslands

Past habitat management emphasized the establishment of warm-season native grasses to provide dense nesting cover for waterfowl. Several areas on the District were planted to monotypic stands of switchgrass. These fields initially provided good cover for nesting birds; however, they lacked species composition and structural diversity. The District has begun restoring grasslands to a relatively diverse mixture of native grasses and forbs. The native grass restoration process generally involves seeding directly into or onto croplands that have come out of production as a result of WPA acquisition or cropping idle/cool-season grass fields for 3 or more years to eliminate exotic cool-season grass seeds and rhizomes, control Canada thistle and other invasive plants, and prepare a seed bed for planting native grass seed.

Some uplands in the District were historically comprised of cool-and warm-season grasses characteristic of the tall-grass prairie. Vegetation composi-

tion at local levels was determined by numerous interrelated factors, including elevation, topography, climate, soil characteristics, herbivory, and fire. Species typical of the historical mixed-grass prairie include big bluestem, little bluestem, Indian grass, porcupine grass, prairie dropseed, and switchgrass, prairie docks, lead plant, heath and smooth asters, sand coreopsis, prairie sunflower, flowering spurge, beebalm, prairie coneflower, and spiderwort.

The District has been planting native grasses and forbs as former croplands are converted to more favorable wildlife habitat. The District has approximately 4,900 acres of grassland in block sizes that range from less than 1 acre to just over 230 acres.

Bird species that benefit from the District's grasslands include Bobolink, Dickcissel, Eastern and Western Meadowlark, Northern Harrier, Henslow's Sparrow, Upland Sandpiper, and Sedge Wren. Reptiles and amphibians of concern in Wisconsin including boreal chorus frog, Butler's garter snake, eastern massasauga rattlesnake, bull snake, Blanding's turtle, ornate box turtle, and western slender glass lizard are highly associated with the various grassland community types. Least shrew, prairie vole, badger, and western harvest mouse are just a few mammal species of conservation concern in Wisconsin which are commonly associated with grasslands.

Becker WPA in Columbia County, part of Leopold WMD. USFWS photo.

Shrub-Scrub

This community is often found in bands around the margins of wetlands, lakes, floodplains, and glacial lakebeds. Historically shrub wetlands occurred throughout southern Wisconsin and were an integral part of prairie/savanna landscapes. Drainage for the conversion to cropland or marsh hay production likely had a negative impact on the total acreage. However, the elimination of fire from the landscape permitted the succession of many acres from sedge meadow/wet prairie type communities to shrub/scrub habitats.

Shrub/scrub communities in the District are primarily limited shrub wetland or shrub carr wetlands. Dominant plant species include red osier and silky dogwood, meadowsweet and various willows. Canada bluejoint and reed canarygrass are common grass species.

Some of the bird species of concern in Wisconsin that benefit from this community type are American Woodcock, Bell's Vireo, Willow Flycatcher, and Black-billed Cuckoo. Shrub/scrub wetlands also provide preferred habitat for several reptiles and amphibians of concern in the state including Butler's garter snake, eastern massasauga rattlesnake, four-toed salamander, queen snake, western ribbon snake, and wood turtle.

Forests

Forest communities most often associated with District WPAs are southern dry and dry-mesic woodlands dominated by oaks with basswood, sugar and red maples, shagbark hickory, and black cherry. An understory shrub layer of brambles (*Rubus spp.*), gray dogwood and hazelnut are often associated with these forest types. Most of these are small farmland woodlots, and remnants of larger woodland ecosystems. Oak savanna with less than 50 percent canopy coverage of oak species (burr, white, and black) and a herbaceous layer similar to that of the prairies, and oak woodlands, considered an intermediary between the oak savanna and oak forest, were historically significant components of the forest community types that existed throughout much of southern Wisconsin. Fire suppression and conversion to agriculture have all but eliminated these forest types from the landscape. Sugar maple

is the dominant species on mesic forest sites with basswood and, near Lake Michigan, beech potentially co-dominant. Another common forest type that occurs is the floodplain forest community. These are forested wetlands along the floodplains of large rivers and may include silver maple, river birch, green and black ash, hackberry, swamp white oak, and cottonwood. Wood nettle, stinging nettle, sedges (*Carex grayii, C. lupulina, C. hystericina, and C. tuckermanii*), native grasses (*Cinna arundinacea, Elymus villosus, and Leersia virginica*), ostrich fern and green-headed coneflower are important understory herbs, and lianas such as Virginia creepers, grapes, Canada moonseed, and poison-ivy are often common.

Several bird species of concern are highly associated with these forested community types including Red-headed Woodpecker, Whip-poor-will, Wood Thrush, Acadian Flycatcher, and Cerulean Warbler. Ornate box turtle, black rat snake, and wood turtle are examples of herptile species of concern that are also considered highly associated with these forests. Bat species such the eastern red, hoary, silver-haired, and northern long-eared along with the woodland vole and the northern flying squirrel, are highly associated with District woodlands.

Shrubs and Trees in Fencerows

Some WPAs contain old fencerows that are remnants from previous land owners. The fencerows contain shrubs and trees that are beneficial for some wildlife and are, generally, a detriment to grassland bird species. Fencelines in areas of intensive agriculture may provide important habitat, travel corridors, and refugia for some species. However, in grassland ecosystems, these same features function as linear woody edges and are sources for invasive species, provide predator roosts and travel corridors, attract nest predators and parasites, and decrease the value of associated grasslands. As a result, attempts are generally made to remove remnant treelines/fencelines separating grassland fields.

Fish and Wildlife Communities

The variety of vegetative communities on the District provides habitat for both wetland and upland associated wildlife, such as ducks, herons, songbirds, deer, and turkey. The District also hosts furbearers, marsh birds, raptors, and a variety of woodland mammals, in addition to amphibians and reptiles. The majority of wetlands are too shallow to be fish habitat.

Becker Savanna, part of Leopold WMD. USFWS photo.

Birds

The District encompasses a broad range of habitats over a large geographic area. A bird species list of WPAs along the Southern Lake Michigan Coastal area would likely contain a number species not found on lands in the Southeastern Glacial Plains. As a result the District has not completed a definitive bird species list. The Wisconsin Society for Ornithology (WSO) Annotated Checklist for the state includes 426 valid species found in Wisconsin over the past 160 years. From this list the WSO has developed a field checklist of 345 species of regular to casual occurrence. The Horicon Marsh Bird Club has developed an even more refined checklist of 249 species (Appendix C). Because of the similarity in habitats and management this has been adopted as the checklist for District WPAs. A few of the most commonly identified species are listed in Table 6.

Three properties managed by the District, Robbins Shorebird WPA, Uihlein WPA, and Vienna WPA, are not only productive waterfowl areas but are also considered some of the best shorebird viewing areas in the state.

The Robbins Shorebird WPA, named for renowned Wisconsin ornithologist Sam Robbins, is in an area regarded as one of Wisconsin's best inland shorebird viewing areas. Known to Wisconsin birders as the "AW Ponds" this area supports over 20 migrating shorebird species including all plovers, Red Knot, White-rumped Sandpiper, Baird's Sand-

Table 6: Most Common Bird Species, Leopold WMD [1]

Pied-billed Grebe	Eastern Kingbird	**Western Meadowlark**
American Bittern	Red-eyed Vireo	Brewers Blackbird
Great Blue Heron	Blue Jay	Common Grackle
Green Heron	American Crow	Brown-headed Cowbird
Canada Goose	Tree Swallow	American Goldfinch
Wood Duck	Barn Swallow	House Sparrow
Mallard	Black-capped Chickadee	**Blue-winged Teal**
White-breasted Nuthatch	**Northern Harrier**	Sedge Wren
Red-tailed Hawk	Marsh Wren	American Kestrel
Eastern Bluebird	Ring-necked Pheasant	American Robin
Wild Turkey	Gray Catbird	Virginia Rail
Tennessee Warbler	Sora	Nashville Warbler
American Coot	Yellow Warbler	Sandhill Crane
Magnolia Warbler	Killdeer	Yellow-rumped Warbler
Greater Yellowlegs	Black-throated Green Warbler	Lesser Yellowlegs
Palm Warbler	Wilson's Snipe	Black-and-white Warbler
American Woodcock	American Tree Sparrow	Ring-billed Gull
Savannah Sparrow	Herring Gull	Fox Sparrow
Mourning Dove	Song Sparrow	Great Horned Owl
Swamp Sparrow	Barred Owl	White-throated Sparrow
Belted Kingfisher	Dark-eyed Junco	Downy Woodpecker
Northern Cardinal	Hairy Woodpecker	Rose-breasted Grosbeak
Northern Flicker	**Dickcissel**	Eastern Wood-Pewee
Bobolink	Least Flycatcher	Red-winged Blackbird
Eastern Phoebe	**Eastern Meadowlark**	

1. *Species in bold are listed as USFWS Region 3 Species of Concern*

piper, Stilt Sandpiper, Western Sandpiper, Buff-breasted Sandpiper, Ruff, Dowitcher and godwits, and Wilson's and Red-necked Phalaropes.

Uihlein WPA in Winnebago County is another locally significant shorebird location (4,000-20,000 birds annually). Species such as Greater Yellowlegs, Lesser Yellowlegs, Solitary Sandpiper, Dunlin, Short-billed Dowitcher, Wilson's snipe, American Woodcock, and Wilson's Phalarope commonly stop over at this site.

Vienna WPA in northern Dane County lies in an area commonly referred as the "Highway V Ponds Area." While this area is considered a minor site (500-4,000 birds annually) the proximity to Madison makes the area a prime birding destination.

Mammals

The District has not completed extensive mammal inventories on the WPAs. A checklist of mammals in Wisconsin can be found in Appendix C. A brief list of species likely to occur on WPAs, although they have not all been confirmed, is shown in Table 7.

Table 7: Mammal Species Likely to Occur on Leopold WMD

Virginia Opossum	Long-tailed Weasel	Woodland Vole
Northern Short-tailed Shrew	Mink	White-footed Mouse
Masked Shrew	Badger	Deer Mouse
Pigmy Shrew	Stripped Skunk	Muskrat
Eastern Mole	Least Chipmunk	S. Bog Lemming
Star-nosed Mole	Eastern Chipmunk	House Mouse
Big Brown Bat	Woodchuck	Brown Rat
Little Brown Bat	Franklin's Ground Squirrel	White-tailed Deer
Keen's Myotis	Thirteen-lined Ground Squirrel	Eastern Cottontail
Red Bat	Eastern Gray Squirrel	Hoary Bat
Eastern Fox Squirrel	Silver-haired Bat	Red Squirrel
Coyote	Southern Flying Squirrel	Red Fox
American Beaver	Gray Fox	Southern Red-backed Vole
Raccoon	Prairie Vole	Northern River Otter
Meadow Vole		

Table 8: Amphibian and Reptile Species Likely to Occur on Leopold WMD

Central Newt	Common Snapping Turtle	Blue-spotted Salamander
Common Musk Turtle	Spotted Salamander	Blanding's Turtle
Tiger Salamander	Western Painted Turtle	Mudpuppy
Midland Painted Turtle	Eastern American Toad	Eastern Spiny Softshell Turtle
Chorus Frog	Eastern Hognose Snake	Spring Peeper
Smooth Green Snake	Cope's Gray Treefrog	Western Fox Snake
Gray Treefrog	Eastern Milk Snake	Bull Frog
Common Garter Snake	Green Frog	DeKay's Brown Snake
Northern Leopard Frog	Northern Red-bellied Snake	Wood Frog
Northern Water Snake		

Amphibians and Reptiles

The District has not completed extensive herptile inventories on the WPAs. A checklist of amphibians and reptiles of Wisconsin can be found in Appendix C. A brief list of species likely to occur on WPAs, although they have not all been confirmed, is shown in Table 8.

Invertebrates

No formalized invertebrate sampling has been conducted on the WPAs. Freshwater invertebrates are important waterfowl food, but no studies have been done to determine the species present.

Threatened and Endangered Species

The District coordinates Eastern prairie fringed orchid management and monitoring activities on the Uihlein WPA. The success of this project is primarily due to the efforts of the Partners for Plants volunteers (a subgroup of the Garden Club of America), Wisconsin Department of Agriculture, Trade, and Consumer Protection, and the U.S. Fish & Wildlife Service Green Bay Ecological Services. This 10-year project has monitored the plant population on the WPA and its relationship to habitat management and water conditions.

Wilcox WPA in Waushara County hosts a population of Karner blue butterfly as a result of a lupine planting established as a seed source. The District is in consultation with Ecological Resources office in Green Bay to mitigate potential issues, per the Karner blue butterfly Wisconsin Habitat Conservation Plan, with take as a result of habitat management and seed harvest activities.

In recent years, reintroduced Whooping Cranes have been identified on Anderson WPA in Columbia County and Uihlein WPA in Winnebago County. The birds have been using the wetlands on these properties for roosting and feeding and no nesting activity has taken place on these properties as of yet.

Several Wisconsin state listed species and species of concern either have the potential to be found on, or are documented as using, WPAs throughout the District. A list of state species of concern, threatened and endangered species can be found in Appendix D.

Prairie fringed orchid. USFWS photo.

Threats to Resources

Invasive Species

Three categories of undesirable species (invasive, exotic, and noxious) are found within the District. Invasive species are those that cause or are likely to cause economic or environmental harm or harm to human health. Executive Order 13112 requires the District to monitor, prevent, and control the presence of invasive species. Exotic species are species that are not native to a particular ecosystem. Service policy directs the District to try to maintain habitats free of exotic species. Noxious weeds are designated by the U.S. Department of Agriculture or the Wisconsin Department of Agriculture as species which, when established, are destructive, competitive or difficult to control. Canada thistle and field bindweed (creeping Jenny), and leafy spurge are introduced species classified as noxious weeds in Wisconsin. Purple loosestrife and multiflora rose are introduced species classified as nuisance weeds.

Invasive, exotic and noxious weed species are relatively abundant within the District. These species are quite diverse and are found in most District habitats, although some are typically found in agricultural fields or lakes and ponds. Currently, most District control efforts focus on Canada thistle (*Cirsium averense*), spotted knapweed (*Centaurea maculosa*), purple loosestrife (*Lythrum salicaria*), black locust (*Robinia pseudoacacia*), and box elder (*Acer negundo*). The principal invasive and exotic plant species within the District are non-native buckthorns, honeysuckles, black locust, multiflora rose, garlic mustard, spotted knapweed, Canada thistle, crown vetch, teasels, leafy spurge, birds-foot trefoil, purple loosestrife, sweet clovers, wild parsnip, Japanese knotweed, reed canary grass, phragmities, and hybrid cattail. Exotic and invasive plant species pose one of the greatest threats to the main-

tenance and restoration of the diverse habitats found on WPAs. They threaten biological diversity by causing population declines of native species and by altering key ecosystem processes like hydrology, nitrogen fixation, and fire regimes. Left unchecked, these plants have come to dominate areas on some WPAs and reduced the value of the land as wildlife habitat. There is a bountiful seed source of many of these exotic/invasive species on the lands surrounding the WPAs, thus in order to be effective in our management plans, we must bring together a complex set of interests including private landowner, commercial, and public agencies.

Purple loosestrife. USFWS photo.

Drainage and Pesticides

Waterfowl Production Areas are often islands in a sea of intensive agriculture. Natural drainage patterns have been altered throughout the landscape, increasing the frequency, intensity, and duration of water flowing into many units. Siltation, nutrient loading, and contamination from point and non-point sources of pollution are a serious problem on many WPAs. Waterfowl Production Areas are also threatened by farming, trespass, dumping, wildfires, and pesticide applications on adjacent agricultural land. A study in Ontario examined the effects of habitat and agricultural practices on birds breeding on farmland and determined that the most important variable decreasing total bird species abundance was pesticide use (Freemark and Csizy 1993).

Recent changes in agriculture have accelerated the impact of pesticides on surrounding land. Genetically altered Round-up ready corn and soybeans have expanded the window of opportunity for pesticide applications and promises to kill everything green on fields except the genetically altered crops. Another altered crop, Bt. Corn, contains a genetically engineered insecticide.

Research has shown that insecticides commonly used for sunflowers, soybeans and corn can kill wildlife directly and indirectly (e.g. by decreasing the amount of food available to ducks). For example, ducks feed on grain much of the year but in the spring they shift to aquatic invertebrates (insect larvae, amphipods, snails, etc.) and depend on this food source for reproduction and survival. Even when pesticide applications are done carefully and wetlands are avoided, the chemicals can drift into wetlands in measurable amounts and kill aquatic invertebrates (Tome et al. 1991 and Grue et al. 1986).

Insecticides have a direct effect by killing aquatic invertebrates, but herbicides may have an indirect effect on food available to waterfowl. The Service conducted a study of the impact of agricultural chemicals on selected wetlands in four Wetland Management Districts (Ensor and Smith, 1994). Herbicides from surrounding agricultural land enter wetlands and disrupt the functional interaction between vegetation structure and aquatic invertebrate life. The changing dynamic reduces food available to breeding waterfowl.

Seasonal and semi-permanent wetlands (the majority of WPA wetlands) are the most exposed to agricultural chemicals. These wetlands are small and interspersed with croplands, which increases the probability of pesticides from over-spray and aerial drift. Most herbicides and insecticides are applied to crops in the spring and early summer, coincident with maximum runoff and waterfowl breeding. Ensor and Smith (1994) write:

> "A result of our survey... indicates that prairie pothole wetlands may involve interactions of multiple herbicides (and potentially insecticides) comprising chemical "soups" unique to individual wetlands."

This study showed that "typical agricultural use" of pesticides on surrounding land had a significant impact in reducing the biological quality of WPA wetlands.

Rural Development

Rural development may threaten District lands in counties with growing populations. Lands adjoining WPAs are often seen as highly desirable rural building lots that are purchased as small hobby farms or rural home sites. This can result in the WPA being "ringed" by homes, with a series of negative impacts on the WPA. In addition to the fragmentation of habitat, such development may limit the use of prescribed fire; increase trespass on District lands by neighbors using ATVs, horses, or vehicles; increase harassment of wildlife from cats and dogs; increase use of District land by neighbors for illegal uses such as dumping, gardening, and equipment storage; and can place hunters and neighbors at odds over concerns about safety during the hunting seasons. Large-scale rural development may also bring threats from noise and storm water runoff.

Administrative Facilities

The Service is responsible for maintaining the District headquarters building and maintenance buildings. The headquarters is located on the Baraboo River WPA about 2 miles west of Portage. The headquarters building consists primarily of office space for the District, Fire, and Private Lands Programs. In addition to District staff, the Headquarters also houses a Zone Fire Management Officer and a Wildland Urban Interface Coordinator who are supervised from the Regional Office and have multi-state responsibilities for fire management. The building is a modified residential house which has 2,100 square feet and was built in the mid-1900s. There is also a 3,000-square-foot heated storage building, 3,000-square-foot storage shed, and a 900-square-foot seed storage and processing building.

The District also maintains storage facilities at the Uihlein and Schwengel WPAs.

Cultural Resources and Historic Preservation

Cultural resources are important parts of the Nation's heritage. The Service is committed to protecting valuable evidence of human interactions with each other and the landscape. Protection is accomplished in conjunction with the Service's mandate to protect fish, wildlife, and plant resources. Responding to the requirement in the National Wildlife Refuge System Improvement Act of 1997 that comprehensive conservation plans include "the archaeological and cultural values of the planning unit," the Service contracted for an archeological and historic resources study of the Leopold and St. Croix Wetland Management Districts. The St. Croix WMD is located in northwestern Wisconsin, and the report combines the information for both Districts. The study report was submitted in 2003.

Egan-Bruhy (2003) reports:

> "Wisconsin has a rich and complex history of 11,500 years of change. Through time, populations adapted to the unique and changing environmental setting of the region. The archeological and historical records reflect alterations in the economy, belief systems, social organization, cultural composition, and lifeways of the people of what is now the state of Wisconsin."
>
> "The archeological data ... provides information regarding the probability of identifying prehistoric sites in association with specific environmental attributes. An association between site location and types of water bodies, soils, and elevations was established for several of the prehistoric time periods. The analysis also indicates that there is a relatively high probability of encountering historic archaeological sites ... particularly proximate to transportation routes and along section lines....".

The Leopold and Saint Croix WMDs cover 30 counties in Wisconsin. Consequently they are likely to contain archeological sites from all of the cultural periods found in Wisconsin: PaleoIndian, Archaic, Woodland, Mississippian, Oneota, and Western (French, British, and United States) cultures. (See Chapter 3 of the Egan-Bruhy report for a more complete discussion of cultural resources on the Districts.) In addition, Indian tribes may identify sacred sites and traditional cultural properties on WPAs, and the Districts may acquire buildings and other structures of historical importance. However, as of 2006, the Service has no record of extant sacred sites, traditional cultural properties, and historic buildings and structures on any WPA.

Just 118 acres of District land have been subjected to an archeological survey. From those surveys and other sources, 89 cultural resources sites

are reported on the Districts. The potential, therefore, is high for finding many more cultural resources sites. At this time no sites on the Districts have been nominated or placed on the National Register of Historic Places, although all sites are considered eligible until determined not eligible through the Section 106 process.

The following listed Indian tribes have been recognized by the Federal government or self-identified by the tribe as having a potential concern for traditional cultural resources, sacred sites, and cultural hunting and gathering areas in Wisconsin.

- Bad River Band of the Lake Superior Tribe of Chippewa Indians of the Bad River Reservation, Wisconsin
- Bois Forte Band (Nett Lake) of the Minnesota Chippewa Tribe, Minnesota
- Citizen Potawatomi Nation, Oklahoma
- Flandreau Santee Sioux Tribe of South Dakota
- Fond du Lac Band of the Minnesota Chippewa Tribe, Minnesota
- Forest County Potawatomi Community, Wisconsin
- Grand Portage Band of the Minnesota Chippewa Tribe, Minnesota
- Hannahville Indian Community, Michigan
- Ho-Chunk Nation of Wisconsin
- Iowa Tribe of Kansas
- Keweenaw Bay Indian Community, Michigan
- Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin
- Lac du Flambeau Band of Lake Superior Chippewa Indians of the Lac du Flambeau Reservation of Wisconsin
- Lac Vieux Desert Band of Lake Superior Chippewa Indians, Michigan
- Leech Lake Band of the Minnesota Chippewa Tribe, Minnesota
- Lower Sioux Indian Community in the State of Minnesota
- Menominee Indian Tribe of Wisconsin
- Mille Lacs Band of the Minnesota Chippewa Tribe, Minnesota
- Minnesota Chippewa Tribe, Minnesota
- Nottawaseppi Huron Band
- Oneida Tribe of Indians of Wisconsin
- Peoria Indian Tribe
- Pokagon Band of Potawatomi
- Prairie Band of Potawatomi Nation, Kansas
- Prairie Island Indian Community in the State of Minnesota
- Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin
- Sac & Fox Nation of Missouri in Kansas and Nebraska
- Sac & Fox Nation, Oklahoma
- Sac & Fox Tribe of the Mississippi in Iowa
- Santee Sioux Nation, Nebraska
- Sisseton-Wahpeton Oyate of the Lake Traverse Reservation, South Dakota
- Sokaogon Chippewa Community, Wisconsin
- Spirit Lake Tribe, North Dakota
- St. Croix Chippewa Indians of Wisconsin
- Stockbridge Munsee Community, Wisconsin
- Upper Sioux Community, Minnesota
- White Earth Band of Minnesota Chippewa Tribe, Minnesota
- Winnebago Tribe of Nebraska

Although Indian tribes are generally understood to have concerns about traditional cultural properties, other groups such as church congregations, civic groups, and county historical societies could have similar concerns.

Museums and Repositories

The Districts have museum property. Archeological collections are not stored on-site, but 526 artifacts from four collections are stored in non-Federal repositories. Artifacts are owned by the Federal Government and can be recalled by the RHPO at any time. The Districts have no other types of museum property such as artwork, historical

objects or documents (including photographs), nor natural resources collections. They have no scope of collections statement.

Cultural resources are important parts of the Nation's heritage. The Service is committed to protecting valuable evidence of human interactions with each other and the landscape. Protection is accomplished in conjunction with the Service's mandate to protect fish, wildlife, and plant resources.

Visitor Services

The Refuge Improvement Act established six priority uses of the Refuge System, which includes the WPAs in the District. These priority uses all depend on the presence of or the expected presence of wildlife, and are thus called wildlife-dependent uses. These uses are hunting, fishing, wildlife observation, photography, environmental education, and interpretation. Although Congress clearly expects managers to facilitate these priority uses, they must be compatible with the purpose for which the WPA was established and the mission of the Refuge System. Compatibility Determinations for the priority uses and numerous other uses in compliance with the Refuge Improvement Act and national compatibility policy and regulations are included as Appendix F of this Draft CCP.

Waterfowl production areas differ from national wildlife refuges in that they are open to hunting, fishing, and trapping by specific regulation, and open to the other wildlife-dependent activities by notification in general brochures available at the District office. New and existing WPAs are thus "open until closed" versus national wildlife refuges, which are "closed until opened." Within the Leopold WMD, the Blue-wing WPA in Ozaukee County and Wilcox WPA in Waushara County are closed to hunting. These WPAs are closed to hunting either because there are concerns for the safety of nearby neighbors or because it was a condition of sale stipulated by previous owner.

Hunters and hunting have a long and linked history with WPAs. When Congress amended the Migratory Bird Hunting and Conservation Stamp Tax Act (Duck Stamp Act) in 1958, it authorized the acquisition of wetlands and uplands as WPAs and waived the usual "inviolate sanctuary" provisions for new migratory bird units. Thus, WPAs were intended to be open to waterfowl hunting, in part because waterfowl hunters, through the purchase of Duck Stamps and support for price increases of the stamp, played a major role in acquisition of these areas.

Environmental education at Leopold WMD. USFWS photo.

Other District Uses

Wildlife observation, photography, interpretation, and environmental education are encouraged on WPAs and are increasing in popularity with the public. In general, WPAs lack adequate fishing to support sport fishing. In addition to the wildlife-dependent recreational uses, the District occasionally receives requests for various non-wildlife-dependent uses such as dog trials, horseback riding, plant collecting, berry picking, and special events. Also, various economic uses such as haying, grazing, and timber harvest are used as habitat management tools and involve the issuance of special use permits. The manager must often make decisions about other "uses" including requests for rights-of-way for new or expanded roads, utilities, pipelines, and communications equipment. Generally the District receives a few requests each year for these "uses," although the quantity has been increasing.

Current Management

Habitat Management

Wetland Management

The intention of the District is to restore and manage wetlands on the WPAs. As the District purchases new WPAs or round-outs to existing WPAs, restoring or enhancing wetlands often provides a challenge to securing the necessary funding to complete the work in a timely manner. The District has frequently utilized grant funds from the North American Wetland Conservation Act or donations from conservation organizations to accomplish much of the work on these projects. In addition to wetland restorations on new tracts, restorations are also completed on existing lands whenever possible. Some restoration opportunities are limited due to potential impacts on adjacent properties. This is frequently true when drainage ditches are involved.

Once wetlands are restored, management activities include maintenance of levees and water control structures, water level manipulation through natural flow and pumping, prescribed fire, and control of exotic and invasive plants. In general, the wetlands are managed to mimic natural processes and cycles.

Grasslands

As lands are acquired, uplands are restored with native prairie plantings using Wisconsin ecotype grasses and forbs. Prior to European settlement, fire influenced the structure and function of prairie and savannah in the area that is now the District. Fire was less of a factor in open forests, and even less in closed forests. Now, the natural process of fire has been replaced by fire management that includes suppression and prescribed burning. Fire is essential for proper management of native, warm-season grasses and associated forbs. Prescribed fire stimulates growth of the grasses, increases seed germination and growth of forbs, retards encroachment of woody vegetation, and reduces the fuel load. Tallgrass prairie has been established on several WPAs. Fire will play a significant role in maintaining this habitat type, which benefits grassland bird species. The District's fire program benefits from the expertise of two Regional Office employees that are housed at the District headquarters. A Fire Management Officer and a Wildland Urban Interface Coordinator are readily available for advice and consultation. Other grassland management activities may include conversion of non-native cool-season grassland to native warm-season grasses and forbs, haying, mowing, grazing, and tree and brush removal.

Forests

Most forest management consists of cutting invasive or exotic trees to restore the WPA to grassland or oak savanna. During oak savanna restoration, the native burr and white oaks are not removed. The removal of the understory vegetation and the frequent use of prescribed fire is used to stimulate the growth of the native prairie grasses and forbs. Long-term management of these areas includes periodic prescribed fire combined with occasional mechanical removal of unwanted trees and brush.

Small woodlots also occur on several WPAs, however timber stand improvements have not been conducted.

Cropland

Most cropland acres are retired and converted to native grasslands upon acquisition. Under certain circumstances the previous landowner may be allowed up to 3 years land use under Land Use Reservation (LUR) conditions stipulated in the purchase contract. It is usually specified that the final crop will be soybeans to provide a smooth seedbed and facilitate planting to native grasslands. Cooperative Farming Agreements (CFA) are often utilized in instances when it is desired to convert established cool-season field (usually retired hay or pasture land) to native plantings or when an older, often monotypic switchgrass or non-Wisconsin ecotype grass varieties, have degraded to the point that they

A prescribed burn in progress at Leopold WMD. USFWS photo.

Ring-necked Pheasant. USFWS photo.

need re-seeding. Often the Cooperative Farmer is required to conduct post-planting management of the native grassland (i.e. mowing) for 2 years as compensation to the Service for the harvestable crops.

The District usually has between 100 and 200 acres farmed under LUR or CFA in any given year.

Management of Resident Species

Federal trust species are generally those that cross state and international boundaries or are afforded national protection through various laws and treaties, such as the Migratory Bird Treaty Act and the Endangered Species Act. The well-being of waterfowl populations is a classic Federal trust responsibility and the main purpose for the creation of the Small Wetland Acquisition Program in the 1960s. This does not mean that resident species such as white-tailed deer and pheasants found on WPAs should not receive management attention. Rather it is the degree of management focus, based on the knowledge that management for trust resources like waterfowl will usually benefit the myriad of resident wildlife that share the prairie-wetland landscape.

Local and regional residents, however, may often favor the management for those species like white-tailed deer and pheasant that provide consumptive recreation opportunities. Thus, managers are often faced with requests for food plots, tree and shrub plantings, or direct stockings of game species that may have a negative effect on the primary purpose of waterfowl production and the broader goals of restoring native plant communities. The key is to seek the proper balance between practices focused on trust species and those that can accommodate the public's desire for resident wildlife management. The District currently does not manage for resident wildlife.

Habitat Management: Partners for Fish and Wildlife Program

The Partners for Fish and Wildlife Program is very important for the Leopold Wetland Management District since significant wetland, prairie and oak savanna habitat has been restored in partnership with many conservation organizations and the Wisconsin DNR. Through this program, the Service assists local landowners with restoration of a variety of habitat on their property. Projects in the past several years have included wetland, prairie grassland, oak savanna and riparian restoration projects. Projects range in size from small half-acre basins to 50-acre prairie and oak savanna restoration projects. The District private lands biologists also assist landowners with other agency programs, such as USDA agricultural programs, that provide habitat restoration funding.

Land Acquisition

Funds for land acquisition come from the Migratory Bird Conservation Fund (MBCF) account. The primary source of funds for this account come from the revenue from the sale of the Migratory Bird Hunting and Conservation Stamp, commonly known as the Federal Duck Stamp. The MBCF monies are allocated yearly for the purchase of wetlands that will become waterfowl production areas or national wildlife refuges.

The Leopold WMD is distinguished from most other wetland management districts in a number of ways:

- The District is located on the edge of the prairie rather than in the middle of it.
- The District is adjacent to the metropolitan areas of Madison and Milwaukee.
- In addition to wetland drainage, wetland degradation and loss of upland habitat caused by rural residential development is a significant threat.
- Land values for WPAs are commensurate with metropolitan/suburban land values for development.

- Development around WPAs is accelerating rapidly. A rural residential property owner feels secure that the WPA out his back door will never be sold for development. Therefore, lands adjacent to WPAs are very desirable for rural residential development.

Because of the elements listed above, an acquisition strategy has been developed for the Leopold WMD. The District has identified four focus areas (Figure 9) for priority acquisition based on current management ownership, high waterfowl production potential, and land protection by other conservation agencies/organizations. One area, Fairfield Marsh, has exceptional potential for wetland restoration. These focus project areas are:

- Uihlein WPA, Winnebago County
- Fairfield Marsh WPA, Columbia and Sauk Counties.
- Oakfield Township, Fond du Lac County
- Leeds Township, Columbia County

Additionally, a model based on current land cover, pre-settlement vegetation, and the predicted Mallard distribution model for the Great Lakes developed by Ducks Unlimited is used to identify priority acquisition areas. In the future it would be useful to include average land values and rates of urban development into the model.

Acquisition funding will always be in short supply. Funding levels have been static, which combined with increasing land values, results in fewer acres acquired. Because of land values, acquisition dollars in Wisconsin do not go as far as in the Prairie Pothole Region. And, biologically, the larger the tract of land the healthier the wildlife populations. Therefore, our acquisitions are prioritized as follows:

- Round-outs of existing WPAs.
- New WPAs over 120 acres.
- Wildlife corridors connecting WPAs/State wildlife areas.

Monitoring and Studies

A number of surveys, censuses, studies, and investigations are conducted on the District that help to monitor the status of its wildlife and plant populations. The surveys provide information for management and support state and national conservation efforts. The following paragraphs describe monitoring programs that have been completed or are presently under way and may continue to support management regimes, land acquisition strategies, or research. New studies, investigations and monitoring projects will be evaluated based on priority species and funding and may be conducted by third parties, volunteers, or staff.

Waterfowl Surveys

Waterfowl Breeding Pair Survey

The District has established two zones, east and west, which serve to focus management and biological activities. Although informal surveys have been conducted by District staff in the past, formal pair surveys began in 2005. Surveys were conducted from May 15 to May 31 on a random sample of 20 percent of Type III and Type IV wetlands in the western portion of the District.

Waterfowl Brood Survey

Similar to the Waterfowl Pair Counts noted previously, the District has completed informal brood surveys on and off throughout the years but until 2005 nothing formal had been established. In 2005 the same sample of wetlands used in the pair surveys were sampled between June 21 and July 7 for brood use. Again, the same wetlands used in the Pair Counts in 2007 will be sampled for broods.

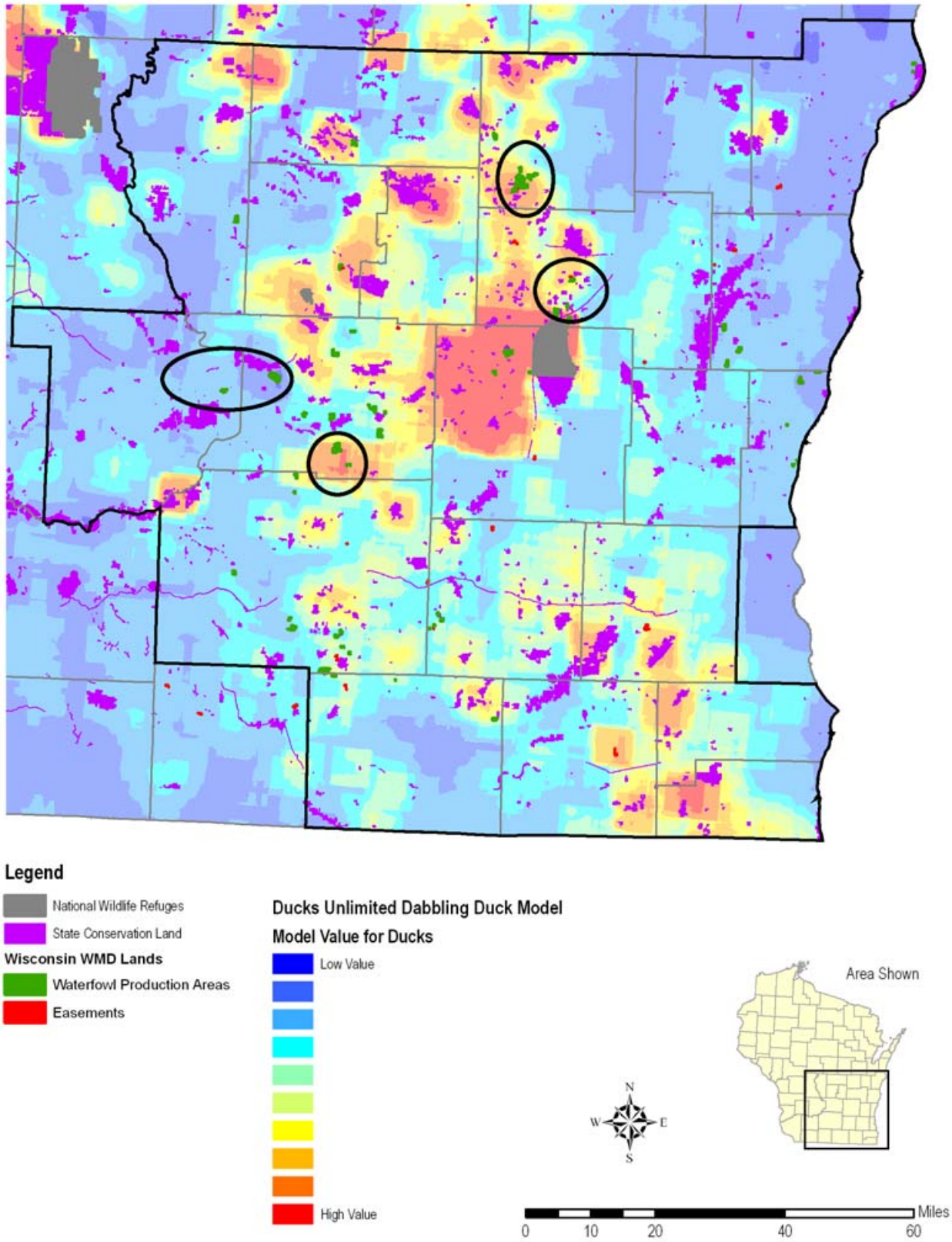
Nesting Tunnel/Wood Duck Box Production

The District maintains 27 Delta type Mallard nesting tunnels on nine WPAs and seven Wood Duck boxes on Baraboo River WPA. In general nest success from the nesting tunnels is very high although use remains variable. Some recent research indicates that use can best be increased by locating nesting tunnels in areas that already have sufficient adjacent nesting cover.

Great Lakes Mallard Study

Conducted by Ducks Unlimited, this study began in 2001 and ran through 2003. The goal was to identify factors limiting the production of Mallards in the Great Lakes region. Research resulted in the development of a Mallard distribution model for the Great Lakes similar to the thunderstorm maps developed for the Prairie Pothole Region and the development of the Great Lakes Habitat Evaluation Network (HEN), which can be used as a tool to identify important areas for waterfowl breeding and the type of conservation action needed in those areas.

Figure 9: Focus Areas, Leopold Wetland Management District



Evaluation of Duck Production on Private Lands in Wisconsin

Initiated in 2000 by the Wisconsin DNR, this study is directed at estimating productivity of ducks on the private landscape of southern Wisconsin. Research focuses on Mallards and Blue-winged Teal, the two most abundant breeding duck species in Wisconsin. The objectives are to directly estimate productivity of ducks on the private landscape of southern Wisconsin where wetlands and grasslands have been restored and develop planning tools for management in our state. Specifically:

1. Estimate duck recruitment parameters (habitat preferences for feeding, nesting, and brood rearing, nest success among landcover types, brood and duckling survival, and adult hen survival during the breeding season) to determine if production is adequate to maintain populations.

2. Compare duck recruitment parameters within strata of grassland and wetland abundance to evaluate the importance of habitat restoration to duck production.

3. Develop regression models to estimate the landscape potential for duck breeding pairs from wetland areas in Wisconsin.

4. Develop a map of duck management potential from duck-wetland regressions for state planning.

5. Adapt the Mallard Model to Wisconsin with data collected locally to guide management.

Conservation Planning Tools for spring migration in the Upper Mississippi River/ Great Lakes Region: understanding habitat and nutrient requirements of spring staging waterfowl and shorebirds

This cooperative study involves Ducks Unlimited, Southern Illinois University, and Ohio State University. The objectives of this study are to determine the amount and types of wetland habitat that are required to support the nutritional needs of spring migrant birds in Illinois, Wisconsin, Michigan, Indiana, and Ohio. This research will require an understanding of the current landscape condition, availability of food resources from existing wetlands, and spatial and temporal habitat use patterns during spring migration. To establish habitat objectives, planning will be focused on four key questions:

- How much habitat is needed to support desired waterfowl populations?
- What types of habitats are needed to meet these objectives?
- Where in the Upper Mississippi/Great Lakes watersheds are these habitats needed?
- Are the types, amounts, and locations of habitats needed to support spring-migrating waterfowl sufficient to meet the needs of spring-migrating shorebirds?

By doing so, we will ensure that habitat conservation efforts will provide maximum benefits to waterfowl, shorebirds, wetland dependent passerines, and other wetland dependent wildlife.

The results of this project will provide a planning tool that will allow more accurate and cost-effective determination of habitat priorities for the Upper Mississippi and Great Lakes watersheds. By considering first the extent to which an area is meeting its foraging habitat objectives, second the location of the area in relation to future development or other pressures, and third the amount of unprotected habitat in the area, appropriate wetland conservation and enhancement strategies can be developed.

Horicon NWR. USFWS photo.

Bobolink. USFWS photo.

Non-Game Bird Studies

Breeding Bird Point Counts

Breeding Bird Point Counts on WPAs throughout the District were surveyed from 1995 to 1997 through contract with money provided by Migratory Birds. We attempted to conduct surveys again in 2003 and 2004 however lack of ability to compensate volunteers for travel expenses to and from sites limited the survey to Shoveler Sink WPA in Dane County and Schoenberg Marsh and Rowe WPAs in Columbia County. Point count locations that fit within protocols are relatively easy to establish utilizing GIS and every WPA with large enough blocks of grassland cover has points assigned. To date none of the data has been evaluated.

Marsh Bird Call Back Survey

This survey has been completed once using protocols and compact disk of calls developed by Dr. Courtney Conway. The survey was conducted on Uihlein WPA prior to prolonged drawdown as part of a cattail management study.

Importance of Wet Meadows for Grassland Birds in the Upper Midwest

This study was conducted by Dr. Eileen Kirsch out of the USGS Upper Midwest Environmental Sciences Center in La Crosse from 1999 to 2002. The study was designed to provide information on the effects of habitat management, diversity of vegetation within grasslands, grassland size, and landscape features of the surrounding area on bird abundance and diversity in wet meadows. The study was conducted on several WPAs within the western portion of the District as well as other areas of Wisconsin, Minnesota, and Iowa.

Evaluation of Marsh Bird Demographic Response to Wetland Restoration in the Upper Midwest

Research is being conducted by Dr. John B. Dunning and Ms. Kathleen Coates, Department of Forestry and Natural Resources at Purdue University, starting in 2006 and is currently ongoing. The objectives of this project are to:

1. Compare marsh bird reproductive success at natural and restored wetlands using the Swamp Sparrow as a representative species.
2. Evaluate how wetland attributes influence reproductive success and nest predation rates and compare these relationships between natural and restored wetlands.
3. Determine whether each wetland functions as demographic source or sink.

Anderson, Baraboo River, Manthey, Schoenberg, and, and Vangen WPAs in Columbia County are included in this study.

Wetland/Water Quality Studies

Baraboo River WPA Water Quality Study

Establishment or enhancement of wetlands is often an effective means of reducing water-borne nutrient concentrations. However, little is known about the efficacy of floodplain wetland in removing riverine nutrients. University of Wisconsin Department of Limnology students measured soil nitrogen concentrations and rates of nitrogen removal from soils and water over the past three years. Their goal was to improve our understanding of floodplain nutrient cycling, and to understand how the floodplain responds to restoration activities. They collected soil samples in different zones of the floodplain (defined by their connection to the river)

during the 2 years prior to restoration activities, and also have information on these same characteristics for 2 years post-restoration. By comparing post-restoration nitrogen removal in the floodplain after restoration, we hope to be able to evaluate the restoration benefits in terms of nutrient reduction.

Cattail Management Study

This is a joint USGS/FWS study designed to investigate the possible control of cattail in managed wetlands on refuges and wetland management districts in Regions 5 and 3. The study involves the prolonged drawdown of units combined with prescribed burns conducted on separate units in the summer (late June/early July) when carbohydrate reserves are lowest and dormant season (fall) burns prior to frozen ground conditions. The biggest issues to date have been the difficulty in achieving sufficient drying of the units in order to burn at least a portion of the peat layer, and when those conditions were achieved a reluctance to burn due to drought conditions and resultant extreme fire behavior.

Threatened and Endangered Species Monitoring

Eastern Prairie Fringed Orchid Monitoring

Since 1997 the District has conducted Eastern prairie fringed orchid management and monitoring activities on the Uihlein WPA with the Partner for Plants (PFP) volunteers (a subgroup of the Garden Club of America) and Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP). Since management and monitoring actions have been in place the Eastern prairie fringed orchid population on this property has increased from the three individuals located in 1996 to a high of 568 in 2004, but has declined in recent years due to dry conditions.

Karner Blue Butterfly Monitoring

There is currently a documented population of Karner blue butterflies on Wilcox WPA occupying a site where 2 acres of lupine and other native species were established with the objective of providing a seed source. Surveys are conducted annually using the monitoring protocols outlined in the Karner Blue Butterfly Habitat Conservation Plan.

Prescribed Fire Monitoring

Prescribed Fire Monitoring Plan

Prescribed fire is the main tool used by the District for management of the grassland habitats. However, stringent monitoring of the behavior and effects of prescribed fire, beyond occasional photo points, has not been implemented. A Draft Fire Effects Monitoring Protocol has been developed around the breeding bird point count locations for monitoring changes in habitat and grassland bird use due to fire.

Visitor Services

The District facilitates wildlife-dependent recreational uses by distributing information and maps of the WPAs and developing wildlife trails, interpretive signs, and kiosks. The number of people visiting the District is estimated from the number of cars employees see in WPA parking lots as they go about their duties.

Hunting

Hunting is allowed on Waterfowl Production Areas within state, federal, and District regulations. Baiting is not allowed, and non-toxic shot must be used for small game. The only WPAs closed to hunting are Blue-wing WPA in Ozaukee County and Wilcox WPA in Waushara County.

Thirty-eight parking lots are provided on 24 WPAs in the District. County maps indicating WPA locations are provided on the Districts web page. The majority of hunters on WPAs are pursuing waterfowl, Wild Turkey, and deer.

The District receives one or two requests a year for special use permits for accessible hunting opportunities.

Fishing

Fishing consistent with state regulations is allowed on all WPAs. Only a limited number of WPAs have wetlands, streams, or rivers capable of supporting fish. Parking lots that can be used for fishing access are available on some WPAs.

Interpretation, Wildlife Observation, and Photography

District staff provide several interpretive programs each year to groups and conservation organizations. There are limited specific facilities on WPAs for wildlife observation or photography.

Environmental Education

District staff respond to the occasional request for environmental education programs for school groups. The District does not have a visitor services specialist and therefore does not provide structured curriculum based environmental education.

Non-wildlife-dependent Recreation.

The District receives several requests from snowmobile clubs to establish and use trails on WPAs. This has been determined to be a non-appropriate use and therefore not allowed; however, cross-country skiing is permitted as a means of winter access for wildlife observation and photography.

Pest Management

Various herbaceous and woody pest plants are found on District lands. Of primary concern are Canada thistle, spotted knapweed, purple loosestrife, box elder, black locust, and buckthorn.

Chemical, biological, and mechanical methods are employed in an integrated approach to control unwanted plant growth. Chemicals and mowing are used to control Canada thistle. *Galerucella* beetles are used to discourage purple loosestrife, which has increased on several WPAs. Small populations of spotted knapweed (*Centaurea maculosa*) have been found on many WPAs. In most cases the spotted knapweed was found in the parking lots or invading from roadside ditches where highway department mowing activities perpetuate and further its spread. More recently this pest plant has invaded into established grassland fields. Plants are hand pulled prior to seed set. Chemical control is also being evaluated on several small areas. Brush and tree species are controlled to restore oak savanna, improve woodlands, maintain grasslands, and remove wooded fence lines between grassland fields. Mechanical and/or chemical control is used to control brush and trees.

Archaeological and Cultural Resources

Cultural resources management in the Service is the responsibility of the Regional Director and is not delegated for the Section 106 process when historic properties could be affected by Service activities, for issuing archeological permits, and for Indian tribal involvement. The Regional Historic Preservation Officer (RHPO) advises the Regional Director about procedures, compliance, and implementation of cultural resources laws. The District Manager assists the RHPO by informing the RHPO about Service undertakings, by protecting archeological sites and historic properties on Service managed and administered lands, by monitoring archeological investigations by contractors and permittees, and by reporting violations.

Farm Service Agency Conservation Easements

When the Farm Service Agency (FSA), formerly the Farmers Home Administration (FmHA), acquires property through default of loans, it is required to protect wetland and floodplain resources on the property prior to resale to the public. The Service has assisted the FSA in identifying important wetland and floodplain resources on these properties. Once those resources have been identified, FSA may protect the areas through a perpetual conservation easement and transfer management responsibility to the Service. The authority and direction comes from the Consolidated Farm and Rural Development Act (7 U.S.C. 1981 and 1985, as amended); Executive Order 11990 providing for the protection of wetlands; and Executive Order 11988 providing for the management of floodplain resources. The Service administers the easements as part of the National Wildlife Refuge System.

The District manages 45 conservation easements totaling approximately 3,000 acres located within the Wildlife Management District, a 34-county area in eastern and central Wisconsin (see Figure 10). Most of conservation easements are visited each

White-tailed deer. USFWS photo.

year for boundary sign condition, trespass violations, and various other infractions. Letters are generally sent to the easement landowners notifying them of the upcoming visit and to inquire about concerns or changes in ownership. Oftentimes on-site meetings with the landowner are held to discuss and rectify findings of the annual easement check, or to address their questions and concerns regarding the easement.

Existing Partnerships

The District has partnerships with local, state, and national organizations. These partnerships benefit the District in many ways, including fostering good community relations and enhancing habitats and wildlife populations. Examples of partnerships include the following:

- *The Fairfield Marsh: A Conservation Partnership* is a Service initiative working with a community based group of local, state, and federal governments, special interest groups and landowners who call themselves FACT (Farming and Conservation Together).
- The District works closely with partners in several NAWCA grant areas: South Central Wisconsin Prairie Pothole Initiative, Southeast Coastal Wisconsin Initiative, Rush Lake/Lake Winnebago System Initiative, and the Glacial Habitat Restoration Area Initiative.
- District staff have been involved in a restoration project on Rush Lake in Winnebago County. This project uses funding through the Upper Fox River Natural Resource Damage Assessment (NRDA) and NAWCA program dollars to replace a water control structure on the outlet of the lake to facilitate better water management to improve habitat conditions for historic wetland vegetation (hard and softstem bulrushes), control carp, and manage lead shot issues.
- A seed nursery has been established in cooperation with the Madison Chapter of the Audubon Society, Madison Private Lands Office, and the Wisconsin DNR for growing and harvesting local ecotype native grass and forb seeds.
- The Partners for Fish and Wildlife Program is in partnership with the Wisconsin DNR and other partners for cost share on private lands wetland and grassland restoration projects within the District.
- The Service partnered on a cooperative restoration project with Ducks Unlimited providing funding, design, construction oversight, and contract management; NRDA which provided funding; and Wisconsin DNR as the permitting agency, to complete rehabilitation of dikes and water control structures on Uihlein WPA in Winnebago County. The District has also partnered with NRCS, Ducks Unlimited, Wisconsin DOT, Wisconsin Waterfowl Association, Wisconsin DNR, USGS, and others to restore a 200-plus acre wetland in the floodplain on the Baraboo River WPA in Columbia County.
- The District and Waterfowl USA have formed a close partnership over the years. The Northwest Indiana Chapter has provided funding for habitat restoration efforts on Oakfield WPA in Fond du Lac County and the Southern Wisconsin Chapter provided funding for land acquisition on Lund WPA in Rock County.
- District fire staff have partnered with Wisconsin tribal entities, Wisconsin DNR, the U.S. Forest Service, and the National Park Service to coordinate fire management functions.

Figure 10: Conservation Easements Managed by Leopold Wetland Management District

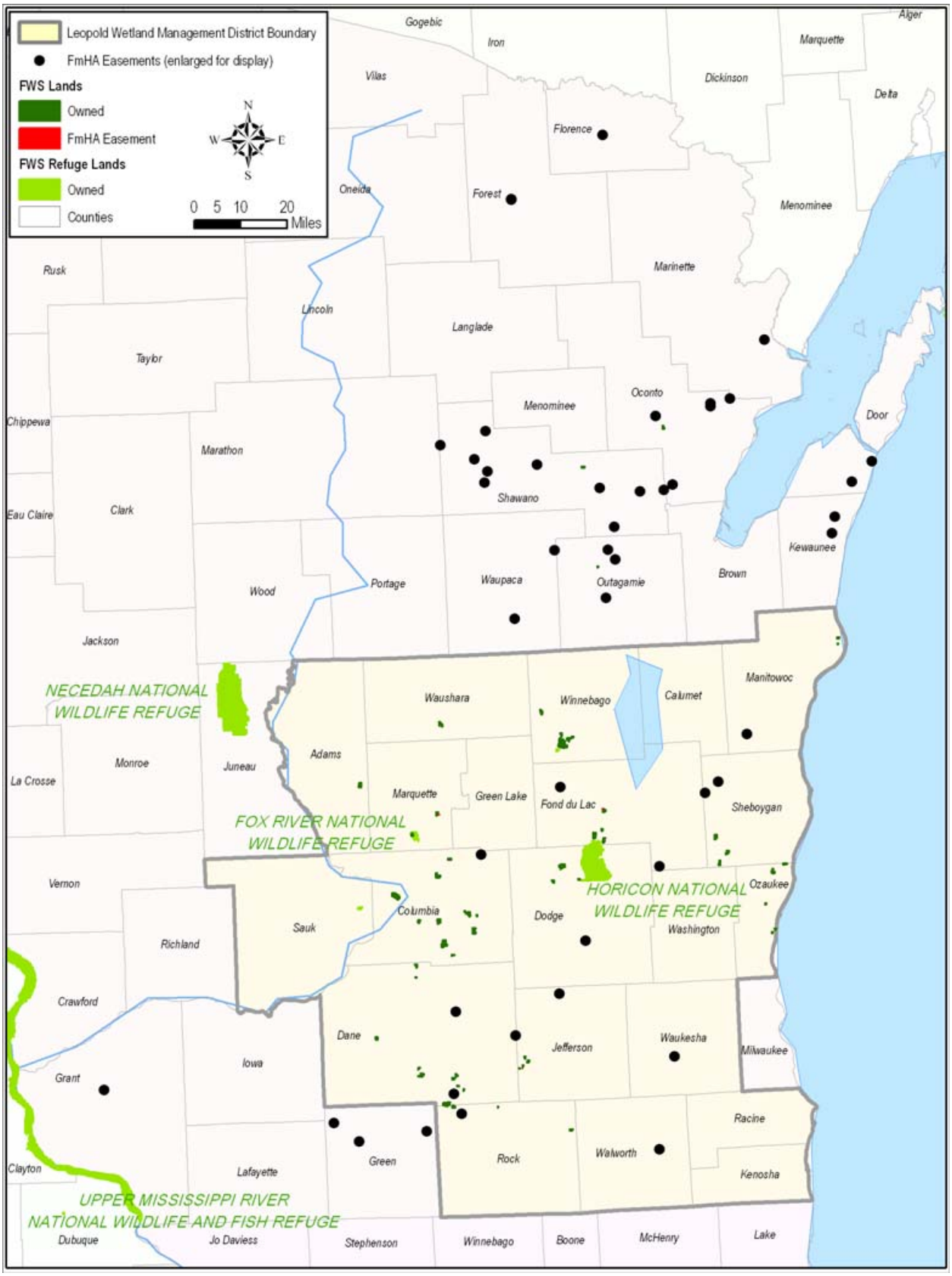


Figure 11: Index to Leopold WMD County Maps

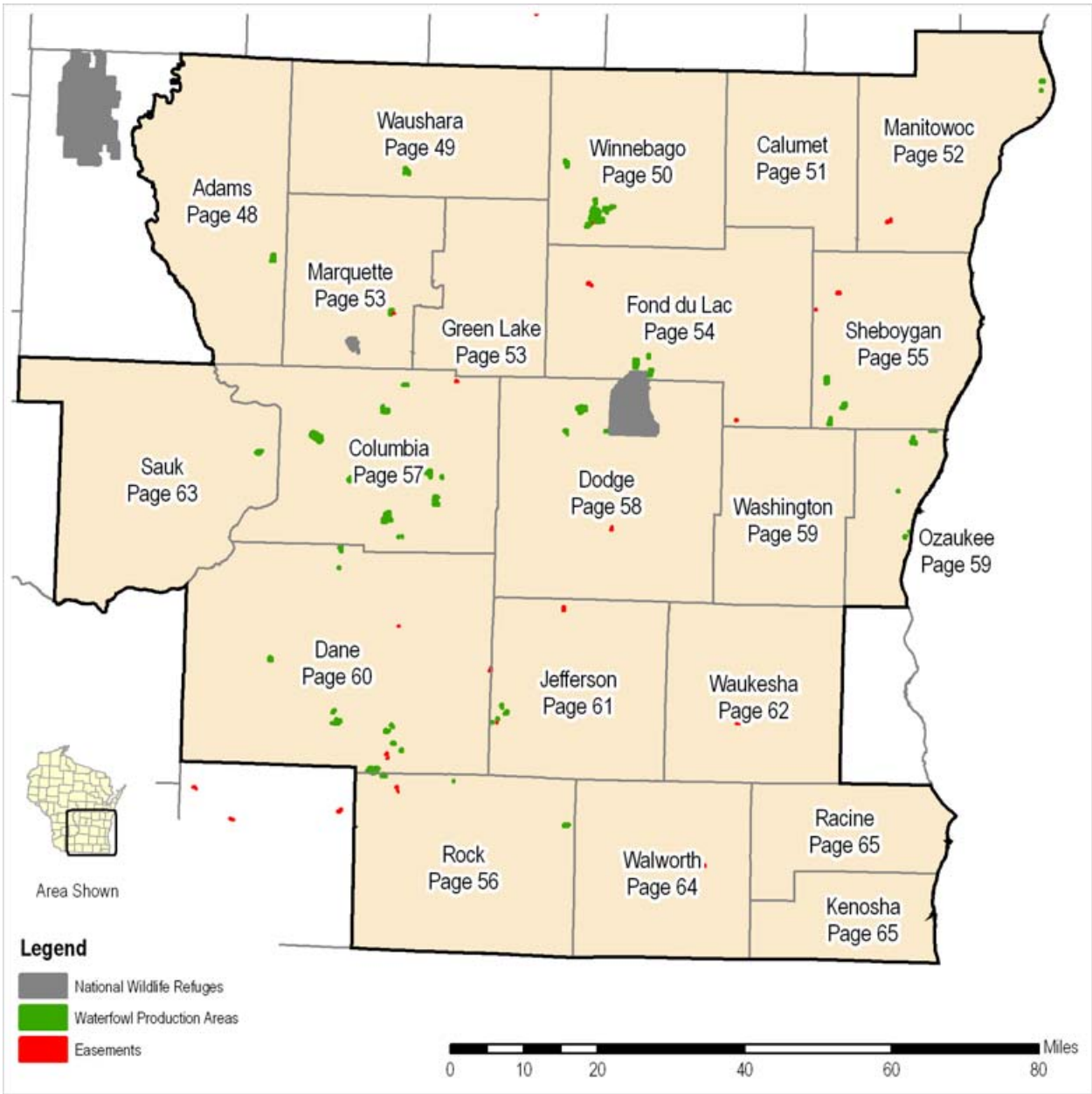


Figure 12: Adams County, Leopold Wetland Management District

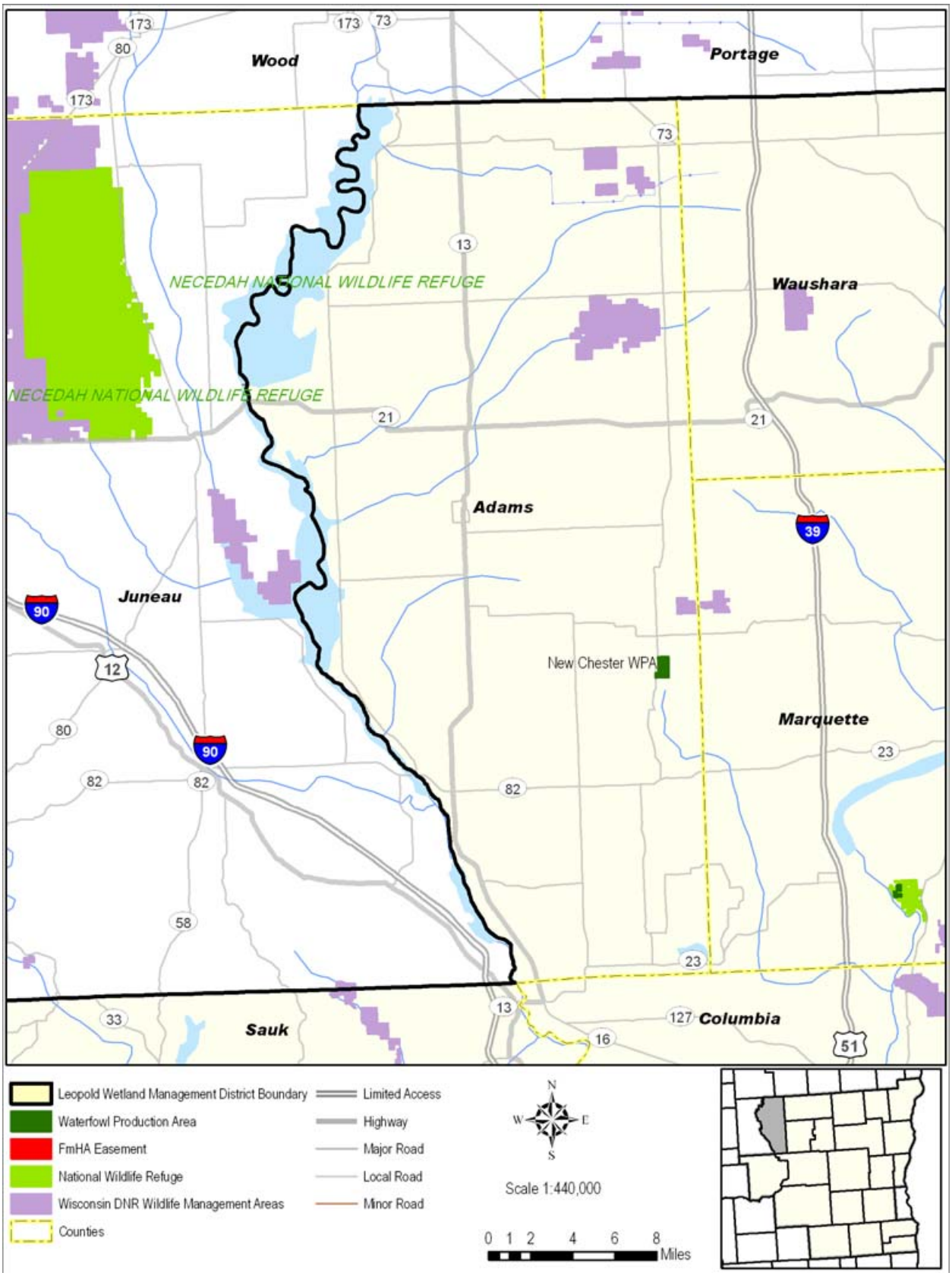


Figure 13: Waushara County, Leopold Wetland Management District

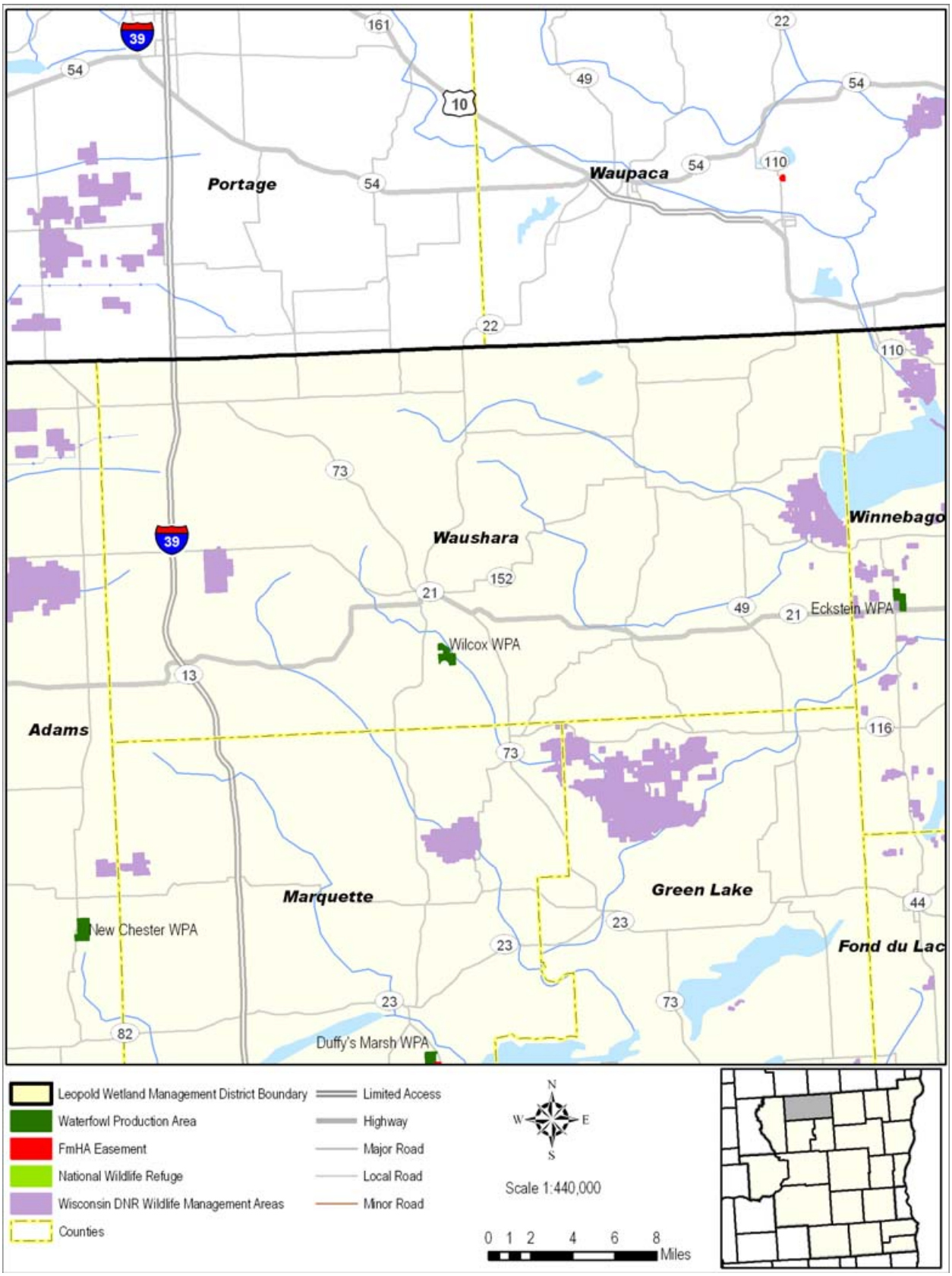


Figure 14: Winnebago County, Leopold Wetland Management District

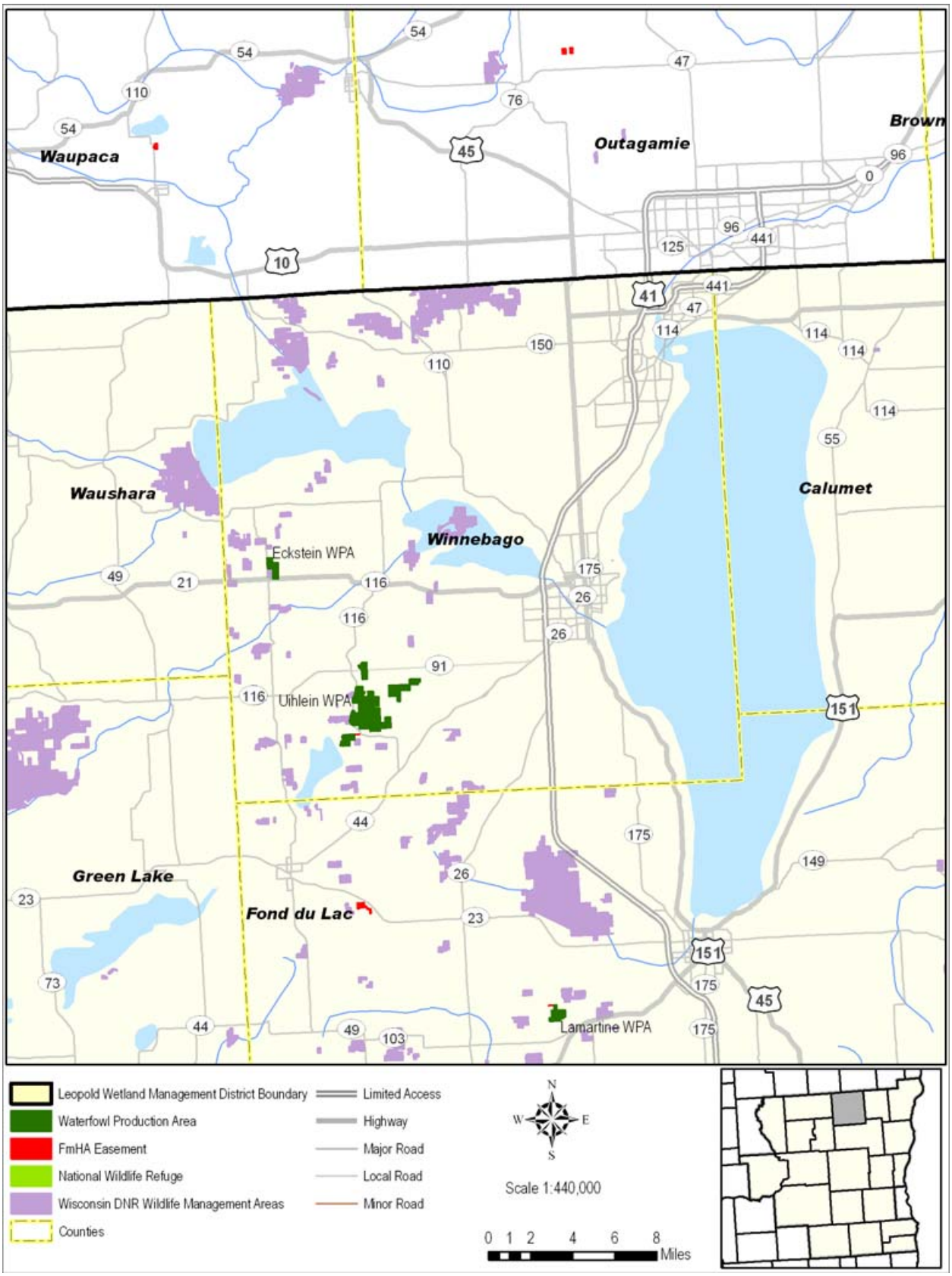


Figure 15: Calumet County, Leopold Wetland Management District

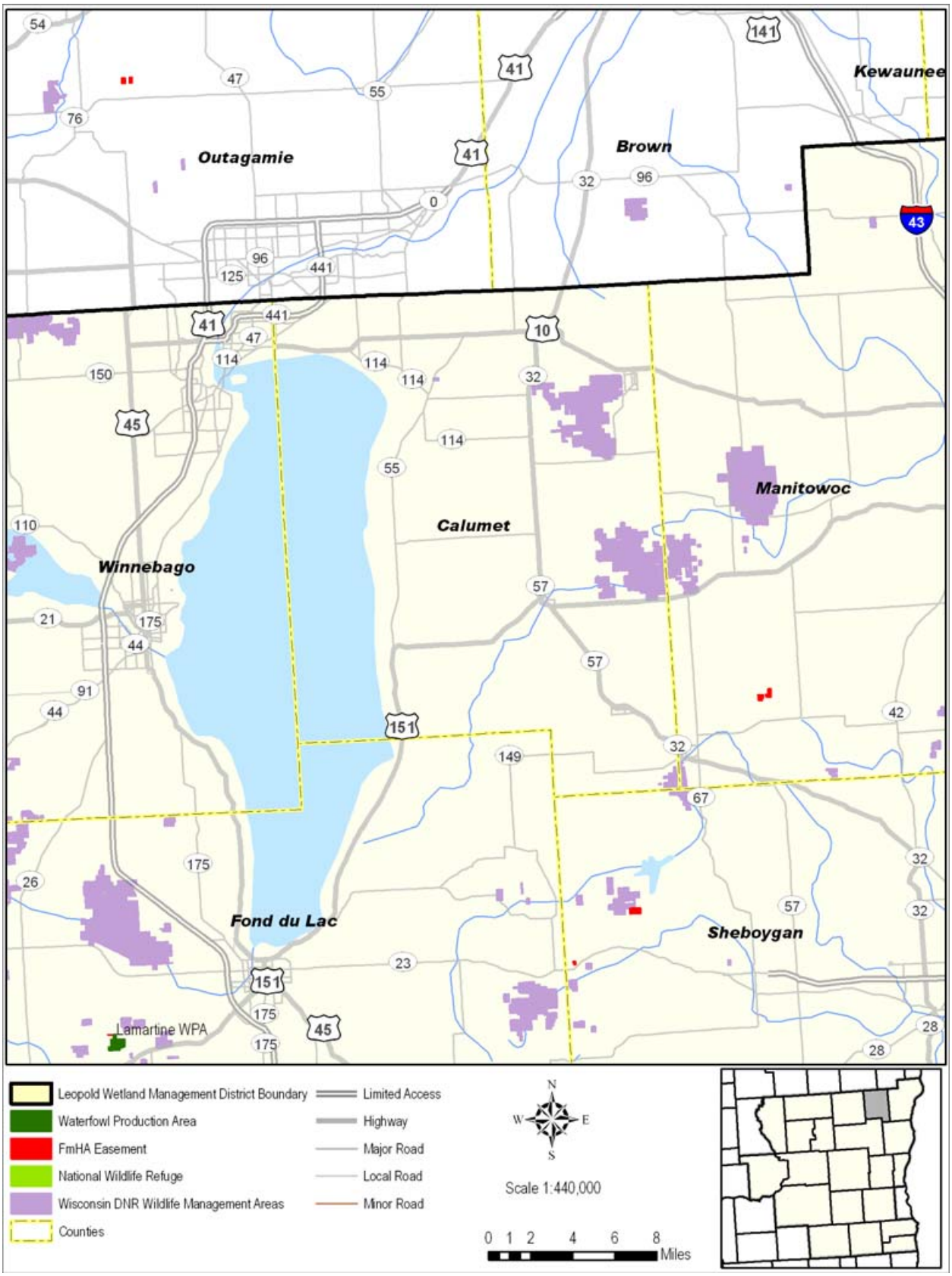


Figure 16: Manitowoc County, Leopold Wetland Management District

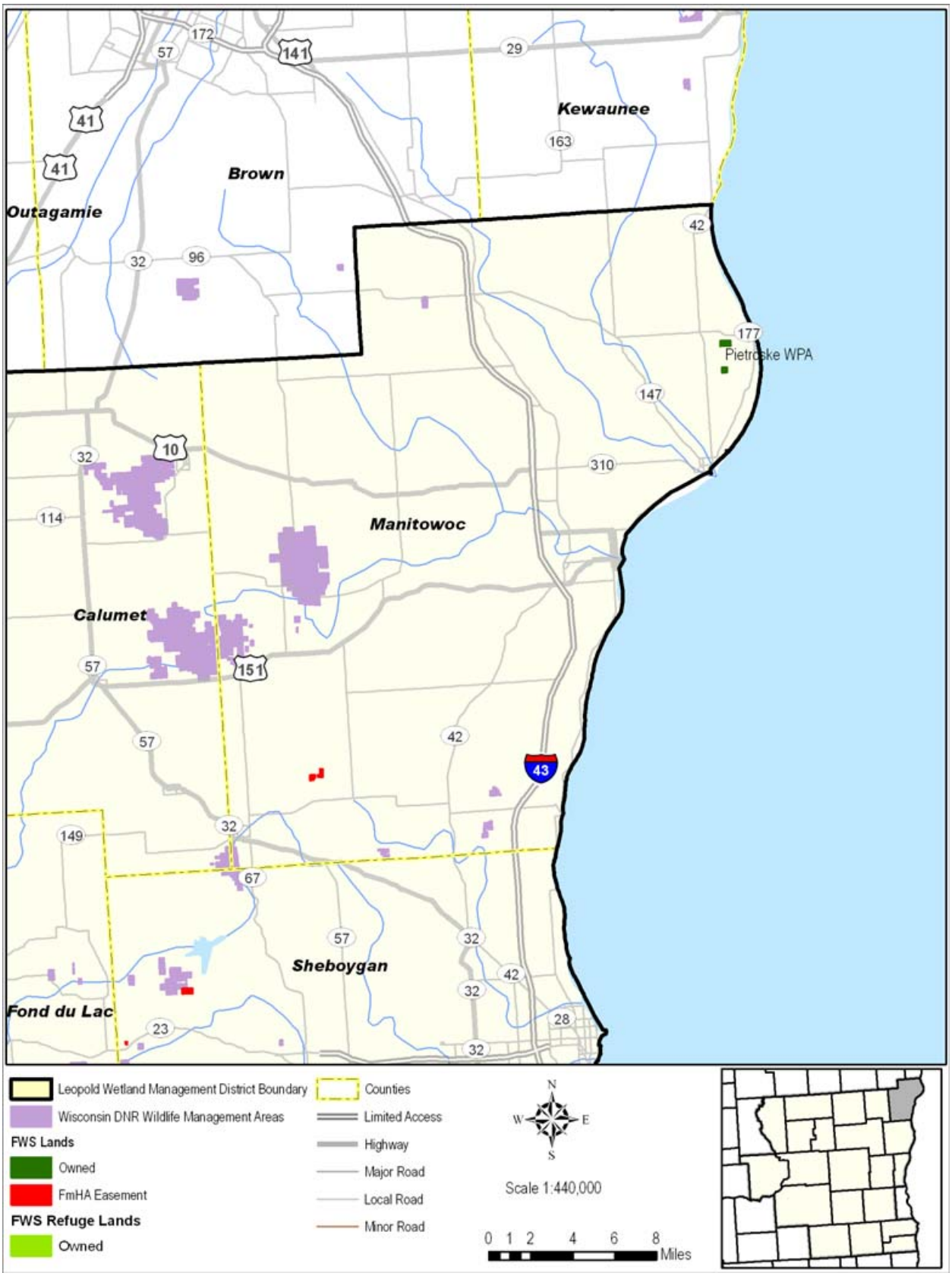


Figure 17: Marquette and Green Lake Counties, Leopold Wetland Management District

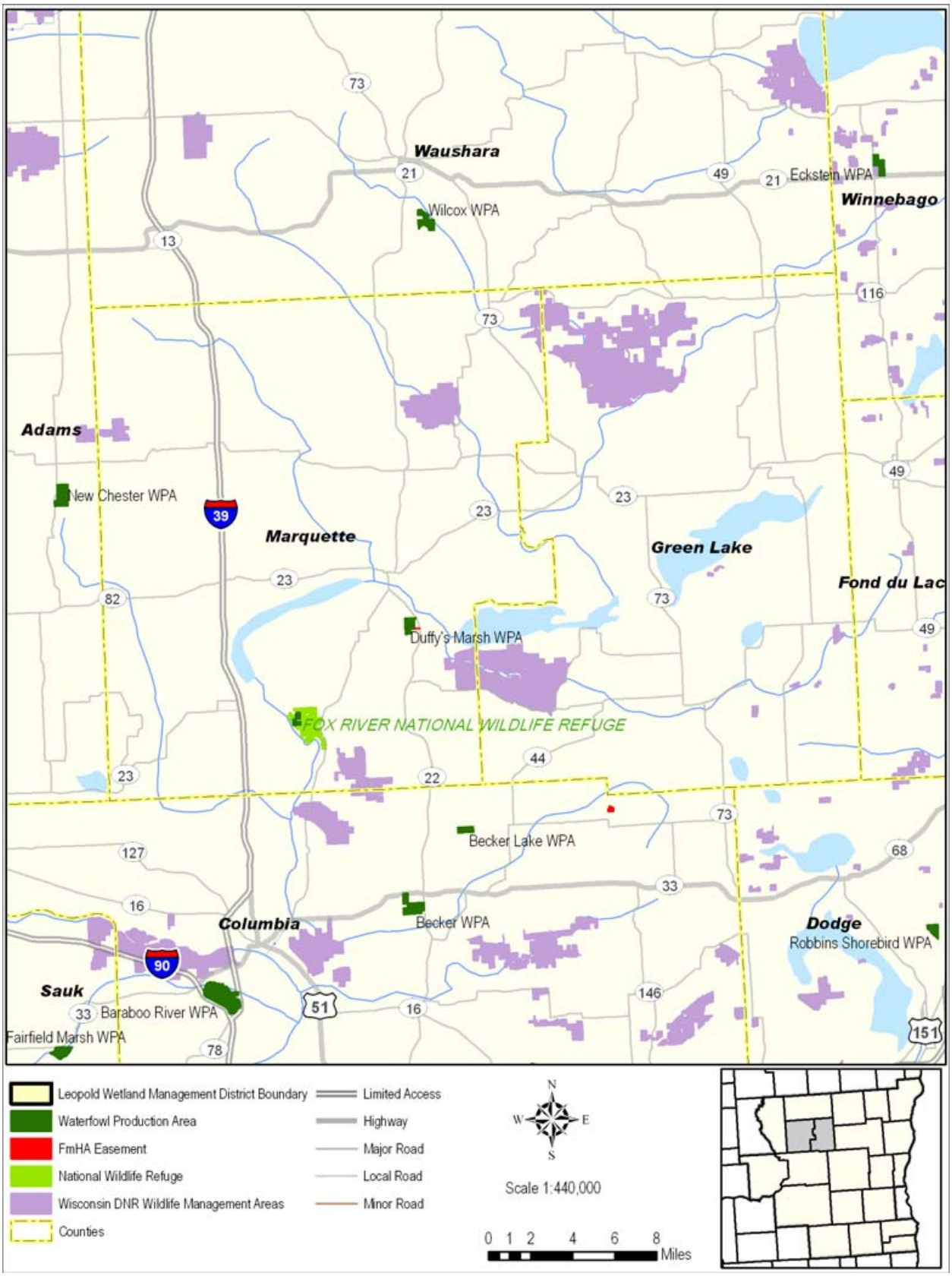


Figure 18: Fond du Lac County, Leopold Wetland Management District

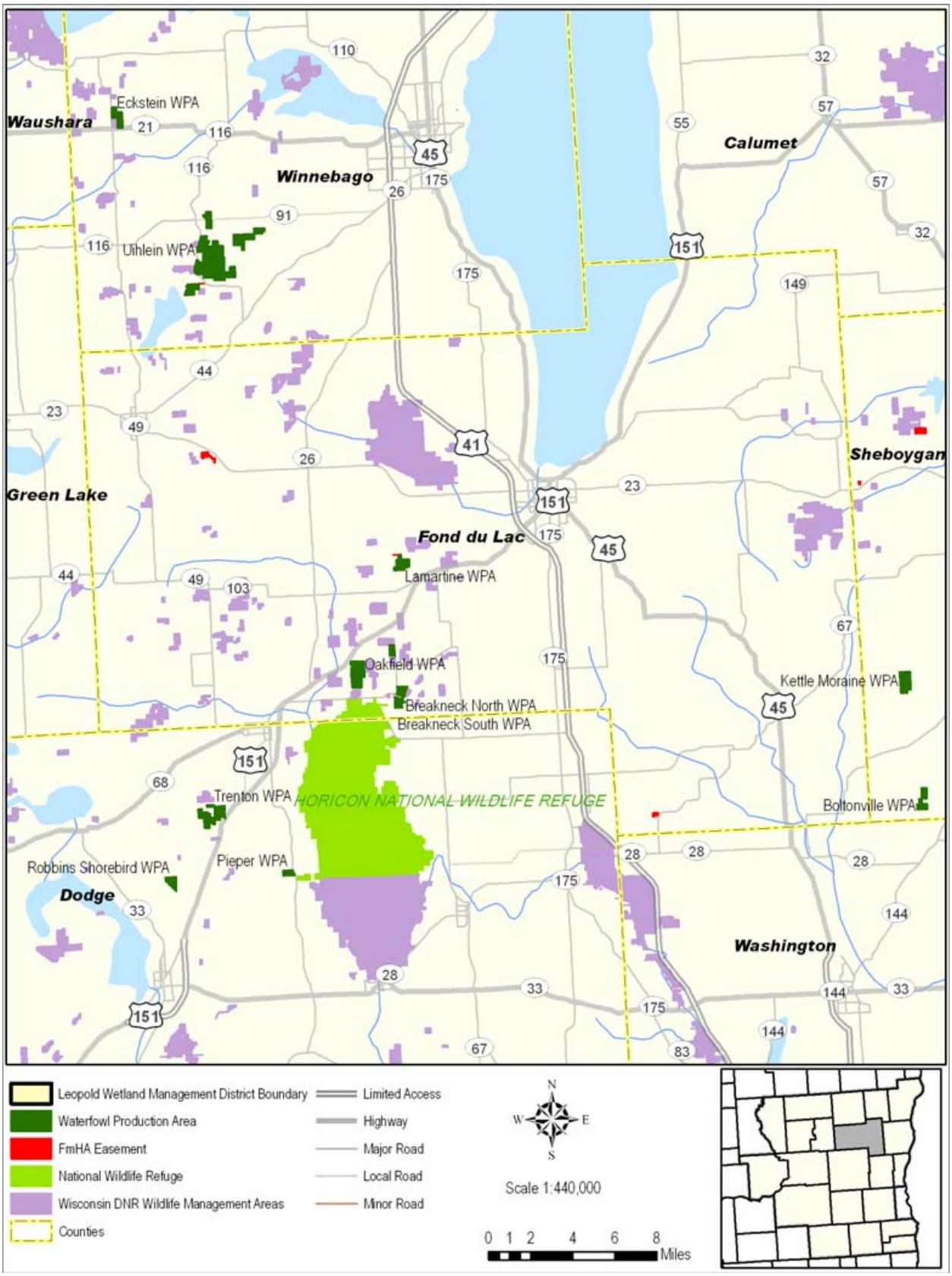


Figure 19: Sheboygan County, Leopold Wetland Management District

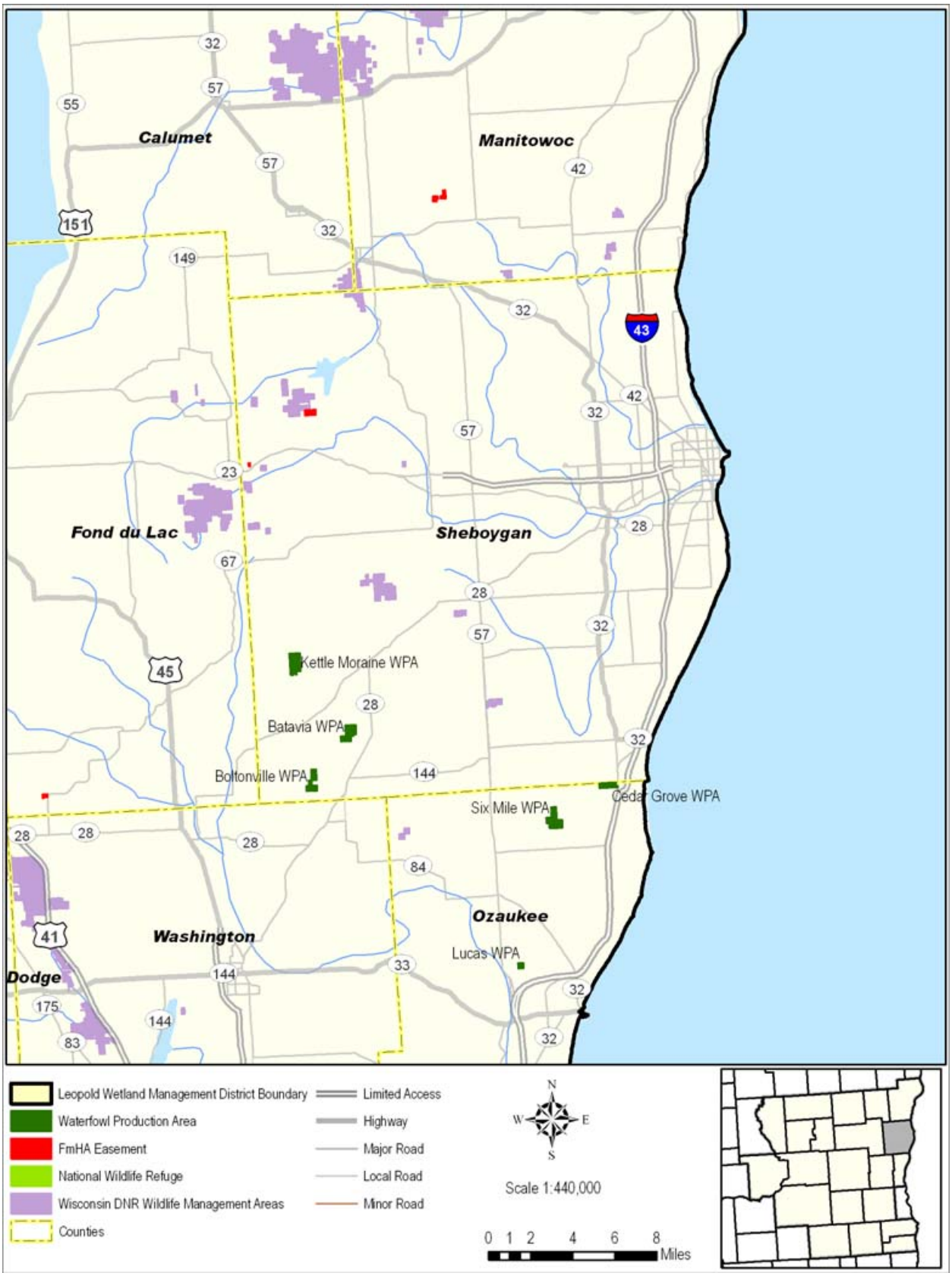


Figure 20: Sauk County, Leopold Wetland Management District

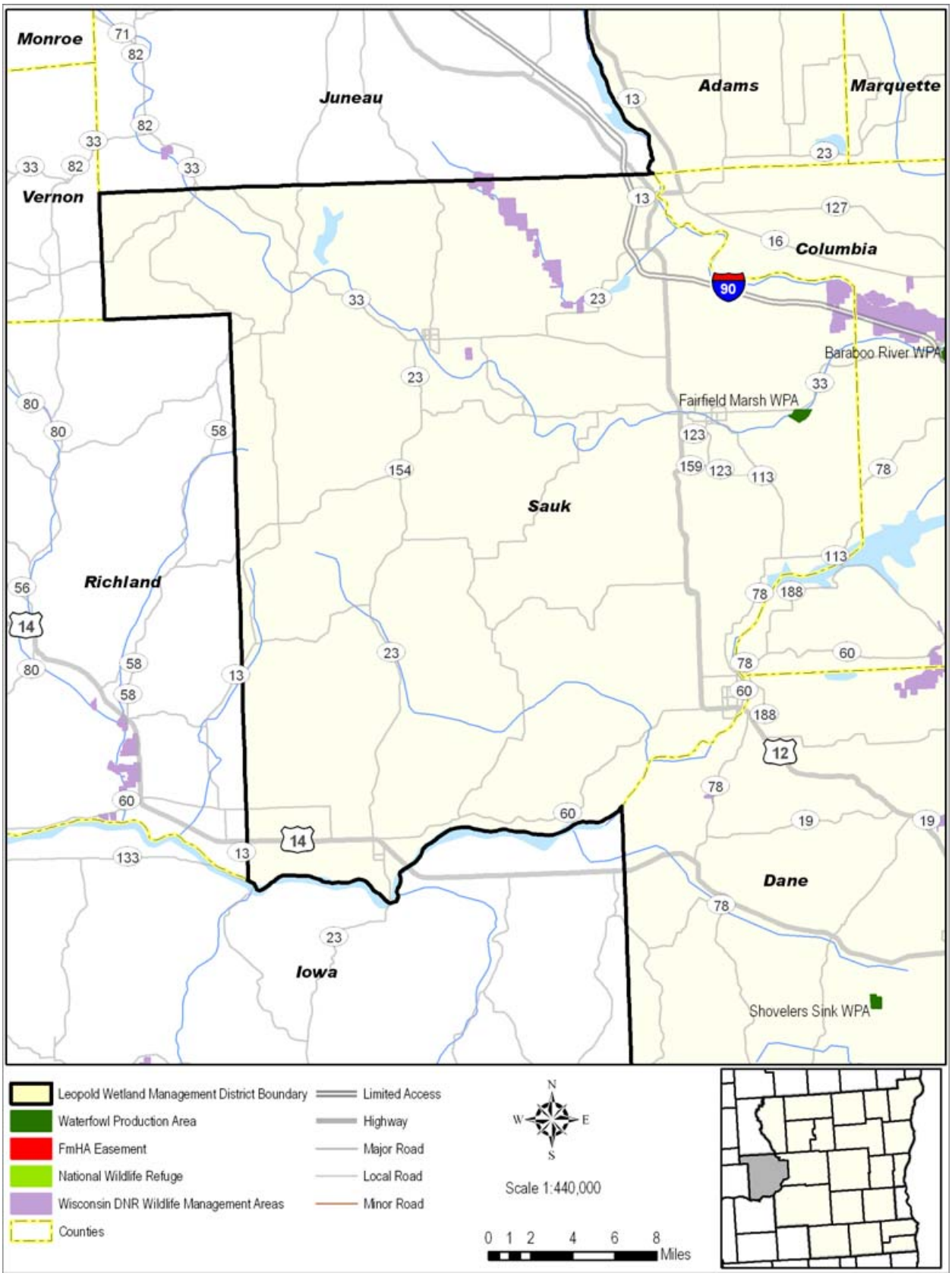


Figure 21: Columbia County, Leopold Wetland Management District

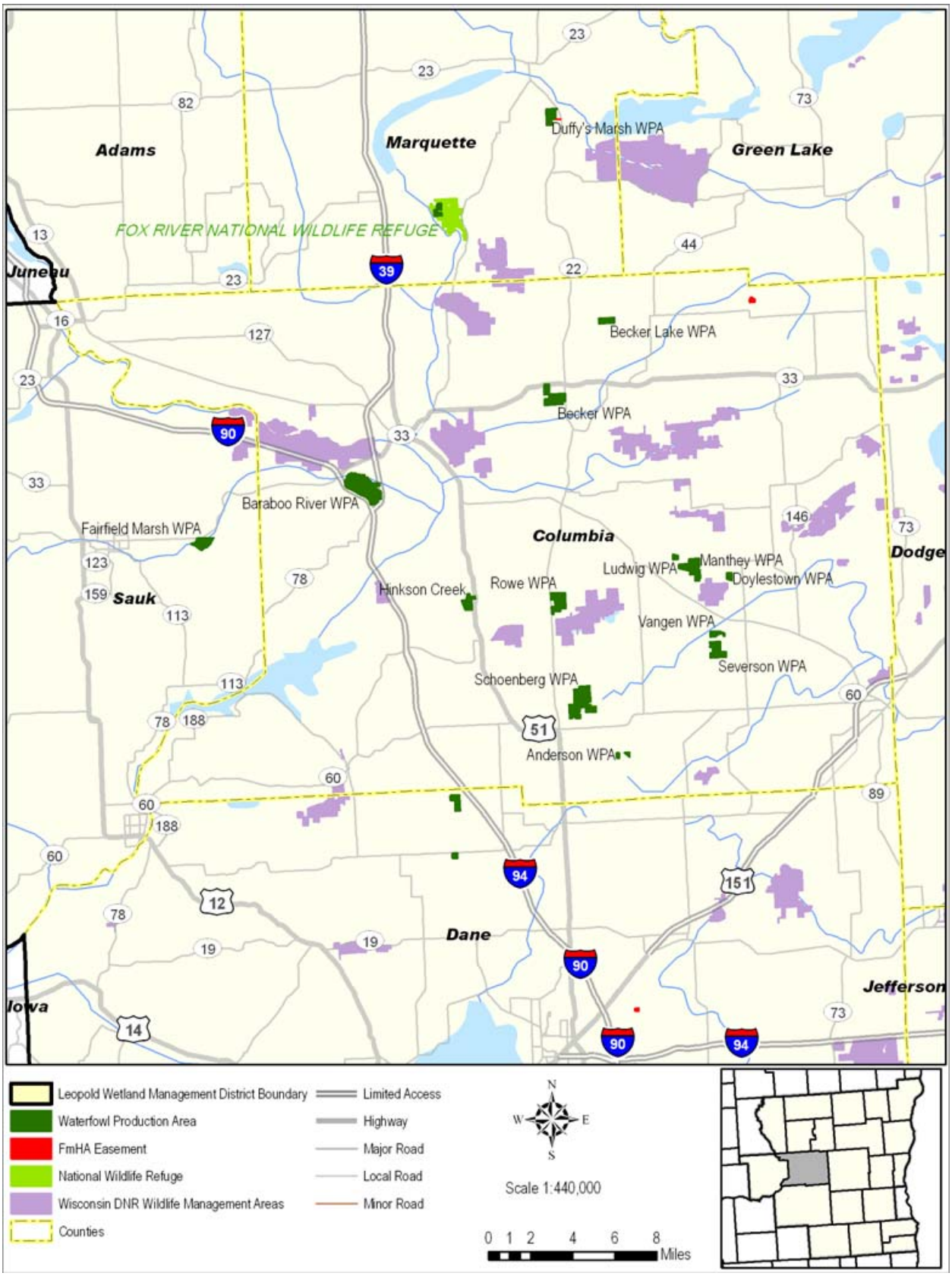


Figure 22: Dodge County, Leopold Wetland Management District

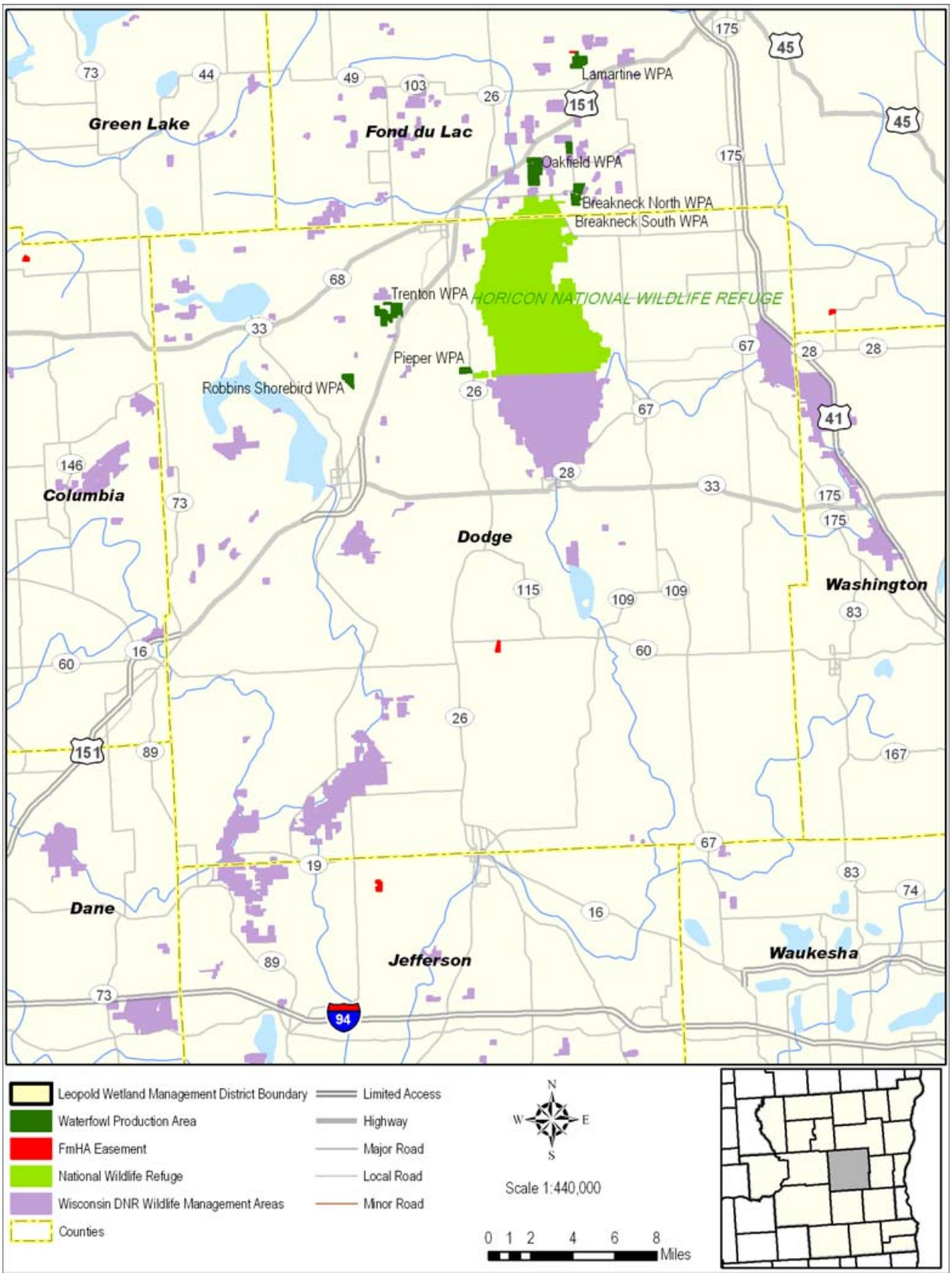


Figure 23: Washington and Ozaukee Counties, Leopold Wetland Management District

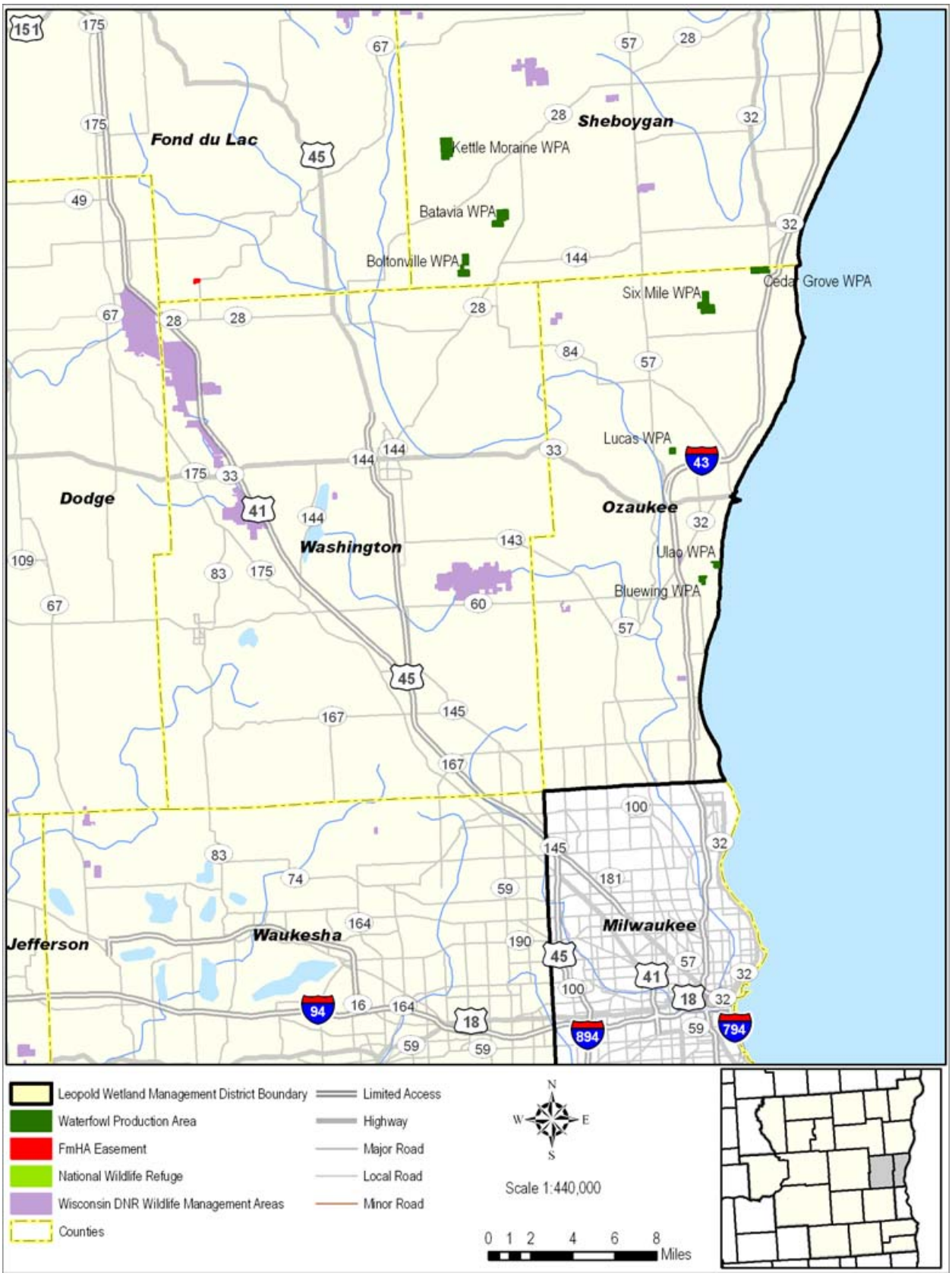


Figure 24: Dane County, Leopold Wetland Management District

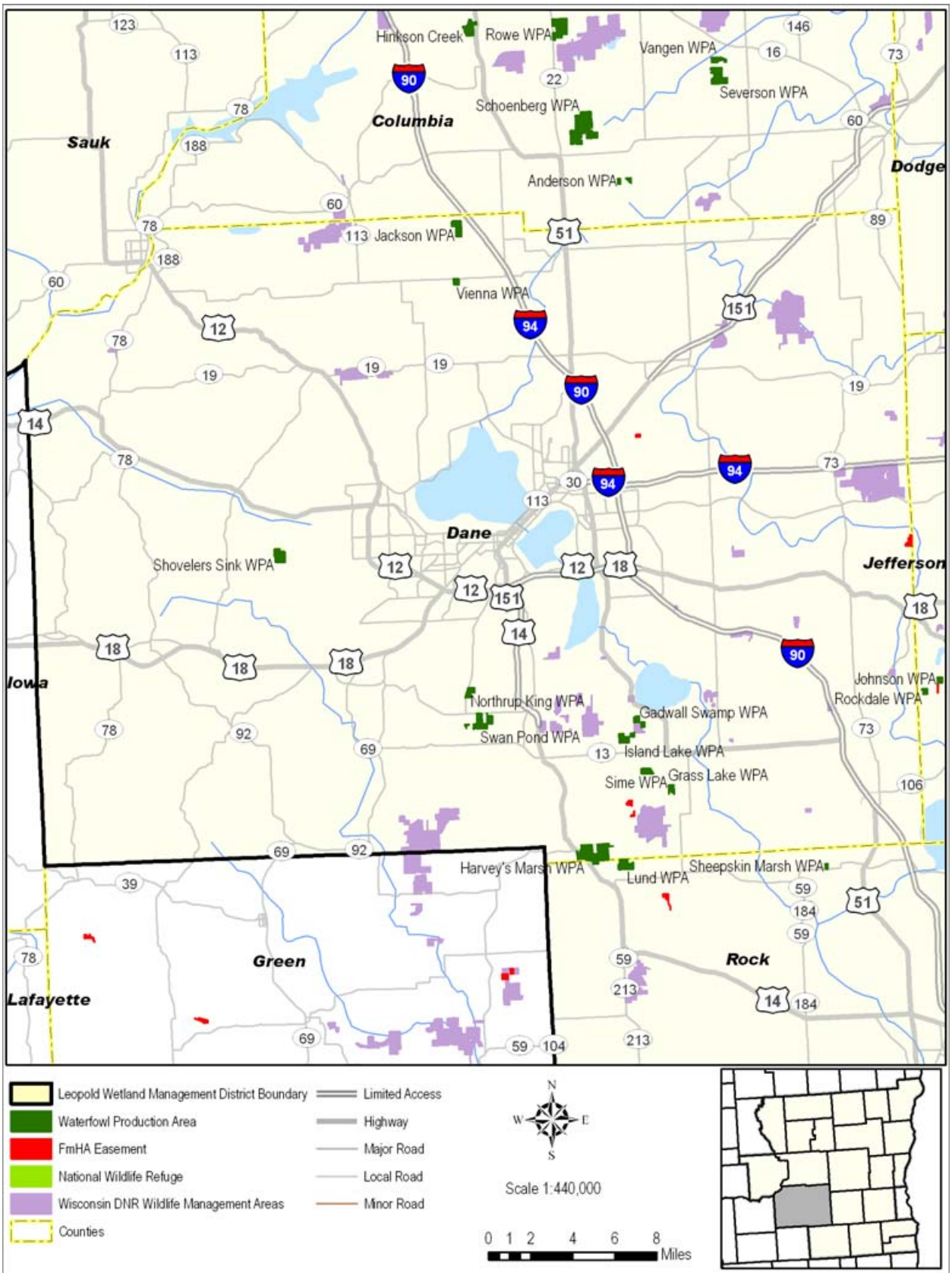


Figure 25: Jefferson County, Leopold Wetland Management District

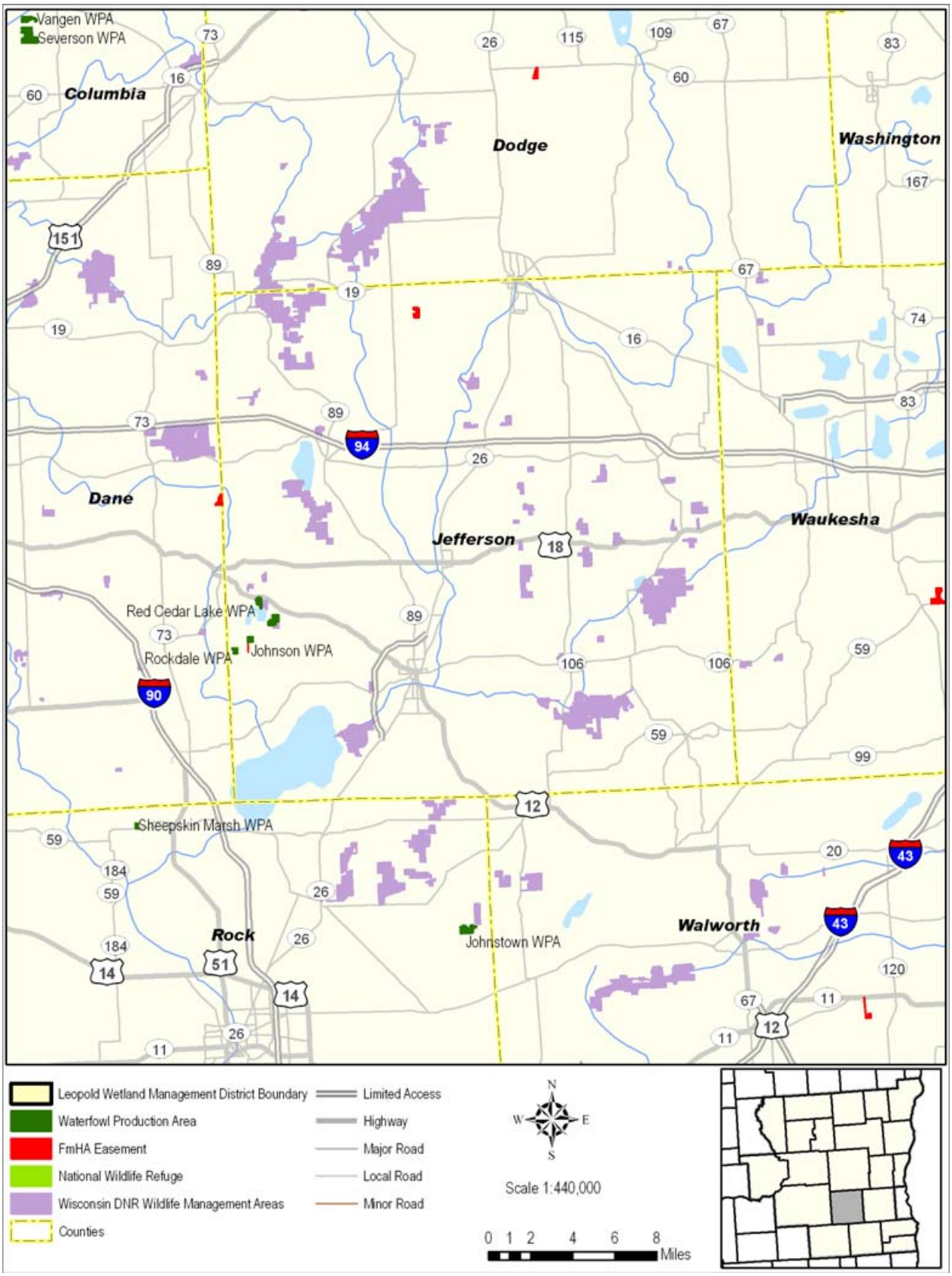


Figure 26: Waukesha County, Leopold Wetland Management District

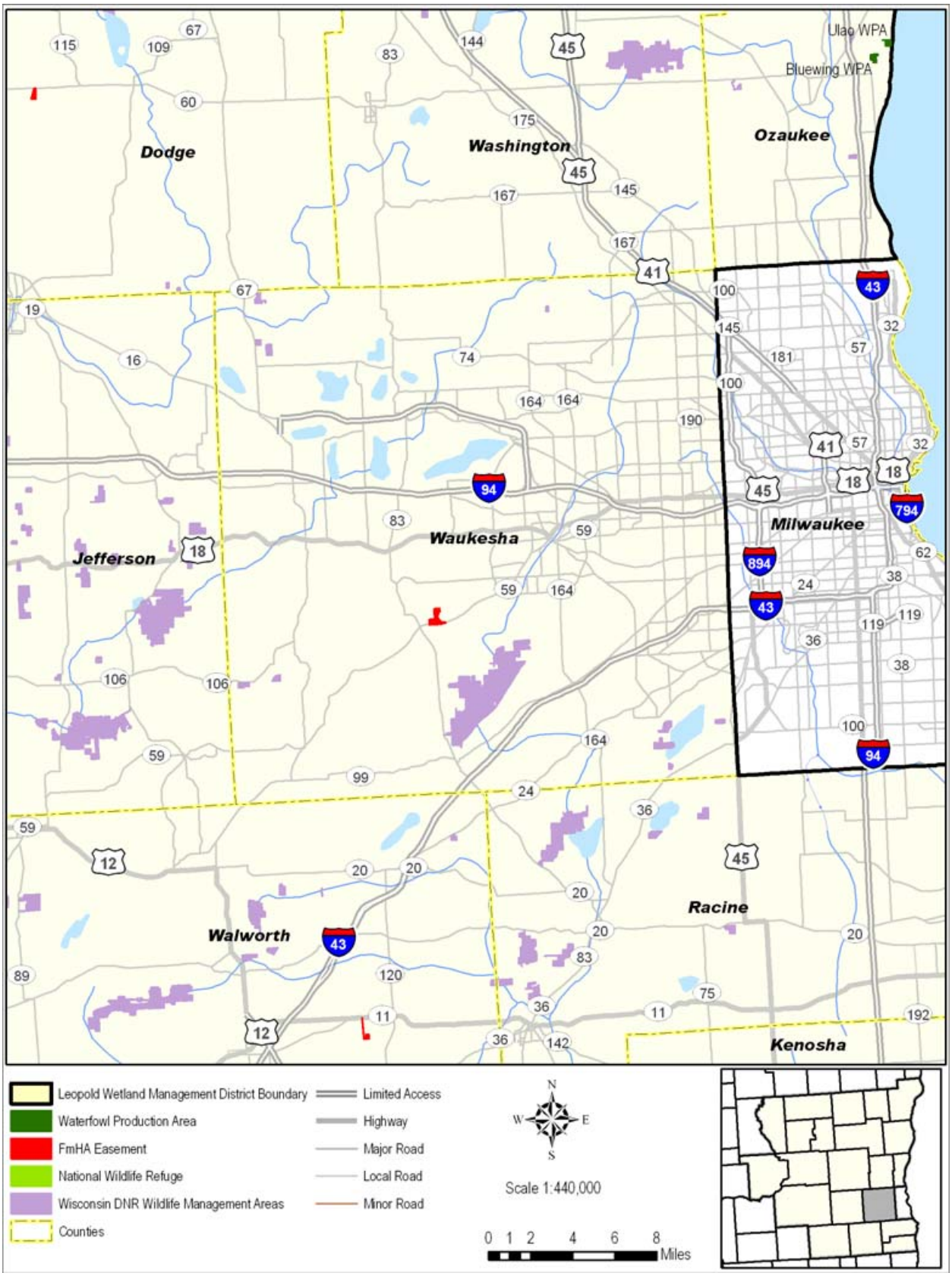


Figure 27: Rock County, Leopold Wetland Management District

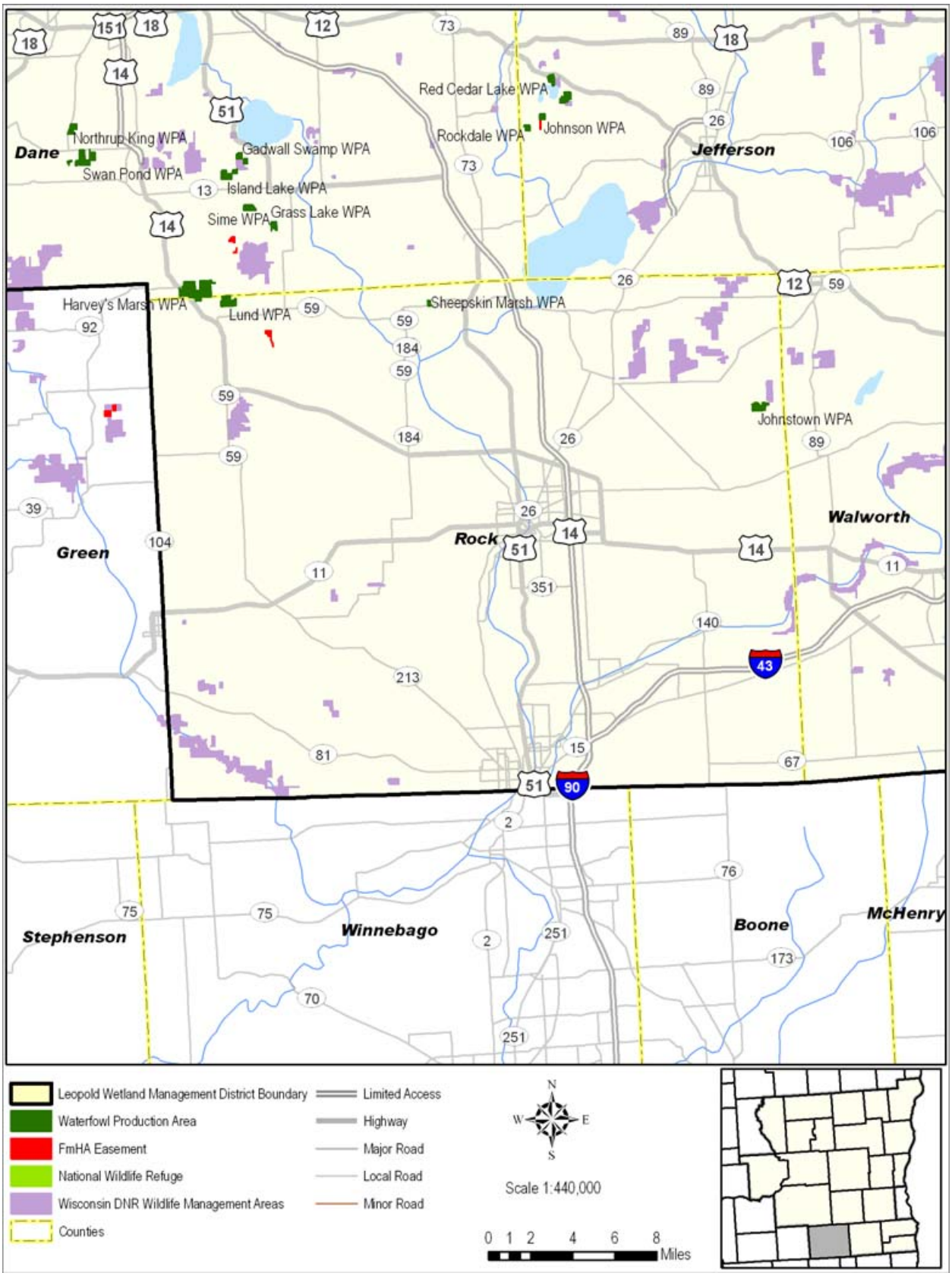


Figure 28: Walworth County, Leopold Wetland Management District

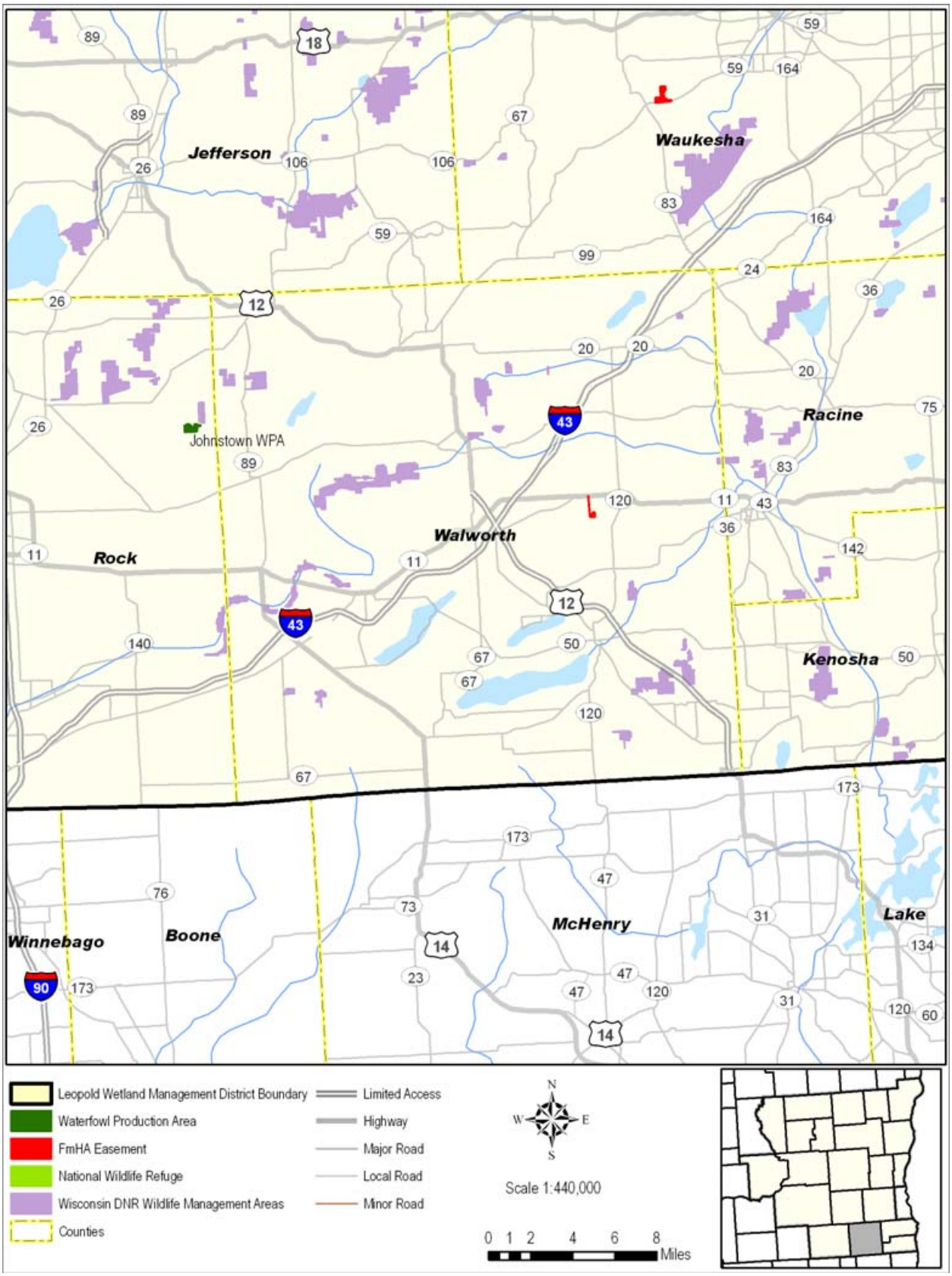
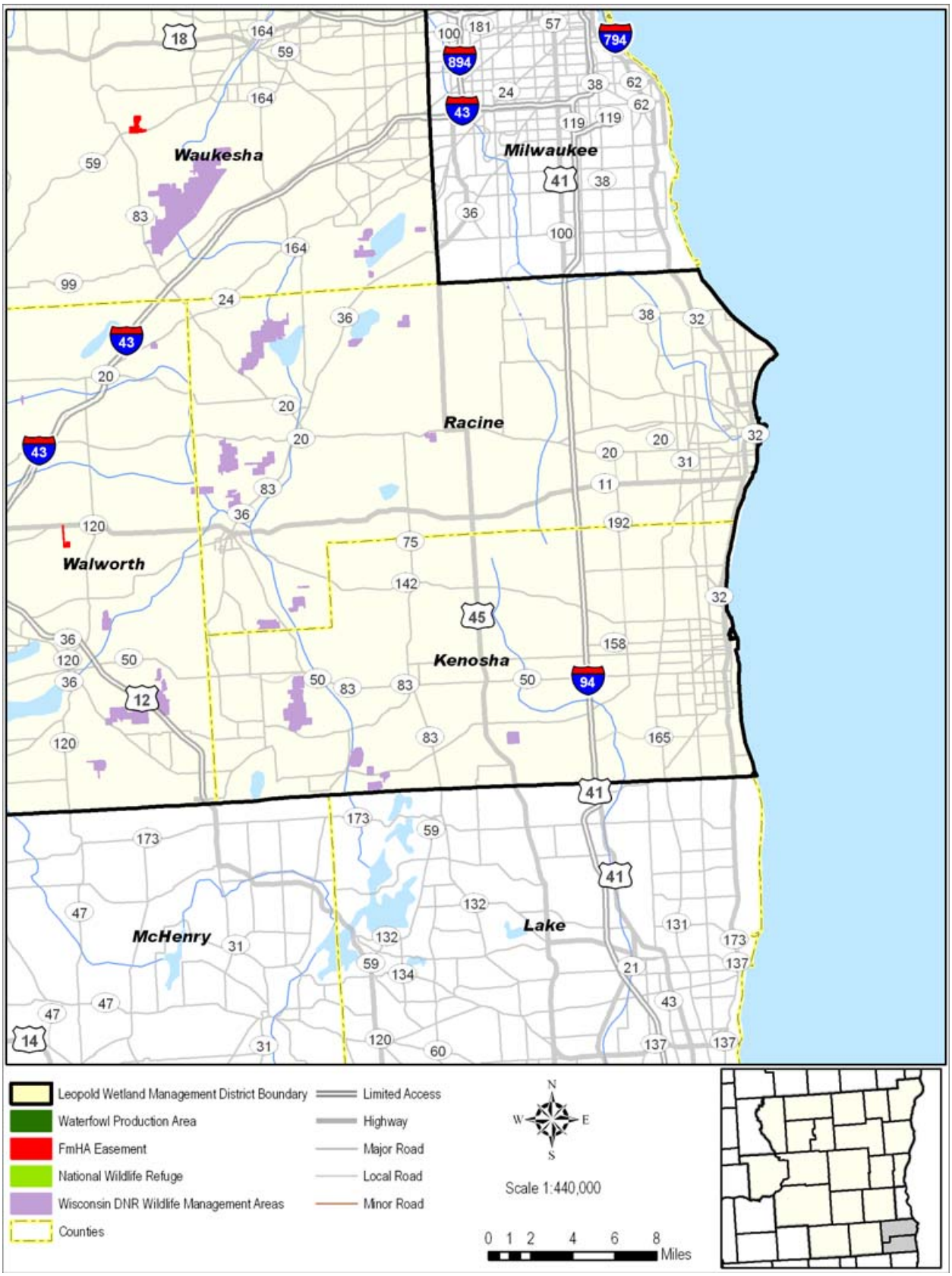



Figure 29: Racine and Kenosha Counties, Leopold Wetland Management District