Chapter 6: Hazard Identification & Local Risk Assessment

Overview

Presque Isle County is vulnerable to a wide range of natural, technological and human-related hazards. Managing these many varied threats, and protecting life and property, are challenges faced by emergency management officials at all levels of government. In order to attain an effective emergency management capability to mitigate, prepare for, respond to, and recover from all types of hazards, an understanding of the multitude of hazards that confront the County must first be obtained. The first step is to identify potential hazards within a community. Next, the hazards are ranked according to the relative risk to the community. The final step in the process will be to assess the level of vulnerability for each identified hazard.

When coupled with relevant community profile information, hazard identification and vulnerability assessment becomes a powerful planning tool that can enable emergency management officials to set priorities and goals for resource allocation and mitigation and preparedness activities. This process should not be considered a reliable predictor of the occurrence of any hazard. Hazards have always had an uncanny way of occurring when least expected. This section can give communities a realistic base by which to plan for mitigation, preparedness, response and recovery activities.

Natural Hazards Effecting Presque Isle County

Severe Summer Weather Hazards

Severe Winds (Windstorm)
According to the National Weather Service, winds in excess of 58 miles per hour are classified as a windstorm. Windstorms are a fairly common occurrence in many areas in Michigan. Along the Great Lakes shoreline, strong winds occur with regularity, and gusts of over 74 miles per hour (hurricane velocity) do occasionally occur in conjunction with a storm front. Severe windstorms can cause damage to homes and businesses, power lines, trees and agricultural crops, and may require temporary sheltering of individuals without power for extended periods of time. Some severe windstorms that have struck Lower Michigan are summarized in (**Table 6.1).** Although severe wind storms do occur in Presque Isle County independent of thunder storm events, since June 17, 1992 there have been 21 instances of thunderstorm related winds in excess of 50 knots. Of these storms the highest wind speed was recorded at 61 knots.

Table 6.1 – Severe Windstorms in Northern Michigan	
Summary of Impact	
On April 6-7, 1997, an intense early spring low pressure system moving across the Great Lakes brought gale force winds to much of Lower Michigan. Wind gusts of 50-70 miles per hour created 10-15 foot waves on the Lake Michigan shoreline, causing widespread wind damage and lakeshore beach erosion. Private damage was estimated at $5 million, most of that occurring in a handful of West Michigan counties. The winds downed numerous trees and power lines across the region, causing roof damage to many structures and power outages for nearly 200,000 Consumers Energy electrical customers. No deaths or injuries were reported in this severe wind event.	
Lower Michigan	On April 30, 1984 a windstorm struck the entire Lower Peninsula, resulting in widely scattered damage, 1 death, and several injuries. Wind gusts measured up to 91 miles per hour in some areas. Damage was widely scattered, but extensive, with 6,500 buildings, 300 mobile homes, and 5,000 vehicles being damaged. Over 500,000 electrical customers lost power. In addition, 10-16 foot waves on Lake Michigan caused severe shore erosion, collapsing some cottages and driving many boats aground.
Statewide	Nov. 10-11, 1998: One of the strongest storms ever recorded in the Great Lakes moved across Michigan on the 10th and 11th of November, 1998, producing strong, persistent winds that damaged buildings, downed trees and power lines, killed one person, and left over 500,000 electrical customers in the Lower Peninsula without power. Wind gusts of 50-80 miles per hour were common, and a peak gust of 95 miles per hour was reported on Mackinac Island. Damage was widespread but relatively minor for a storm of that intensity. However, there were several pockets of significant damage across the state. The U.S. Forest Service reported that at least $10 million worth of timber was lost in the Ottawa and Hiawatha National Forests.
Northern Lower Michigan	Sept. 26-27, 1998: During the weekend of September 26-27, 1998, severe thunderstorms ravaged northern Lower Michigan, producing strong winds that damaged or destroyed homes, businesses and public facilities, and downed trees and power lines. Otsego County, and specifically the city of Gaylord, was hardest hit, although damage was also reported in Crawford and Charlevoix counties as well. The storm front, which ran along and north of the M-32 corridor from East Jordan to Alpena, was approximately 12 miles wide and 15 miles long. When the front slammed into Gaylord, wind speeds had reached hurricane force of 80-100 miles per hour. The wind was accompanied by brief heavy rainfall and golf ball size hail. The storm lasted only a few minutes in Gaylord, but the damage was tremendous. Thousands of trees were snapped off at waist level, homes and businesses were torn apart, power lines were downed, and several public facilities were substantially damaged – including the Otsego County Courthouse, which lost half of its roof. Approximately 818 homes were damaged throughout Otsego County, including 47 that were destroyed and 92 that incurred major damage. In addition, the storm injured 11 persons – none seriously. Region-wide, about 12,000 electrical customers lost power. A Governor's Disaster Declaration was granted to the county to provide state assistance in the debris cleanup effort
West-Central and Central Michigan	On May 31, 1998, a line of severe thunderstorms passed through west-central and central Michigan, producing in some areas hurricane and tornado-force winds that damaged or destroyed 1,500 homes and 200 businesses, severely damaged numerous public facilities, and downed thousands of trees and power lines throughout the 15 county affected area. The downed power lines left nearly 900,000 electrical customers without power, some for up to one week. The storms directly

	and indirectly caused four fatalities and injured over 140 more. The severe winds were measured at speeds of up to 130 miles per hour in some areas – equivalent to an F2 tornado or strong hurricane. Damage to homes and businesses were estimated at $16 million, while public damage totaled another $36 million. A Presidential Major Disaster Declaration was granted for 13 of the 15 counties, making available both public and hazard mitigation assistance to affected local jurisdictions. In addition, Small Business Administration disaster loans were made available to 11 of the 15counties to help rebuild homes and businesses damaged in the storms.

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Hailstorms:

Hailstorms develop in a condition where atmospheric water particles from thunderstorms form into rounded or irregular lumps of ice that fall to the earth. Hail is a product of the strong thunderstorms that frequently move across the state. As one of these thunderstorms passes over, hail usually falls near the center of the storm, along with the heaviest rain. Sometimes, however, strong winds occurring at high altitudes in the thunderstorm can blow the hailstones away from the storm center, causing an unexpected hazard at places that otherwise might not appear threatened. Hailstones range in size from a pea to a golf ball, but hailstones larger than baseballs have occurred in the most severe thunderstorms. Hail is formed when strong updrafts within the storm carry water droplets above the freezing level, where they remain suspended and continue to grow larger, until their weight can no longer be supported by the winds. They finally fall to the ground, battering crops, denting autos, and injuring wildlife and people. Large hail is a characteristic of severe thunderstorms, and it often precedes the occurrence of a tornado.

The National Weather Service began recording hail activity in Michigan in 1967. Statistics since that time indicate that approximately 50% of the severe thunderstorms that produce hail have occurred during the months of June and July, and nearly 80% have occurred during the prime-growing season of May through August. As a result, the damage to crops from hail is often extensive.

The incidence of hail follows the incidence of severe thunderstorms. Therefore, those areas of the state most prone to severe thunderstorms are also the areas most prone to large and damaging hail. Generally, severe thunderstorms that produce hail occur more frequently in the southern half of the Lower Peninsula than any other area of the state. However, damaging hail has occurred in every part of Michigan. The National Weather Service forecasts of severe thunderstorms usually give sufficient warning time to allow residents to take appropriate action to reduce the effects of hail damage to vehicles and some property. However, little can be done to prevent damage to crops.

The National Climate Data Center reports 23 hail events in Presque Isle County since 1996, or about one storm every two years. Until 2004, the largest diameter hailstone recorded in the County had been 1.75 inches, and was recorded for two events during this period. During the summer of 2004, three communities in Presque Isle County suffered significant hail events. The most violent event took place in Posen on July 13, and officially recorded hail 2.75 inches in diameter. Damage was extensive throughout the community and has been estimated at 3.5 million dollars in property losses and three-hundred thousand dollars in crop damage. There was one injury reported from the Posen storm. This storm also struck Rogers City. On August 2, 2004 another severe hail event struck Hawks and Onaway with hailstones recorded at 1.5 inches.

The Presque Isle County Advance reported the following:

> **07-15-2004 Hail storm causes wide-spread damage in Posen,**
> *Hail as large as two-and-a-half to three inches in diameter rained on Posen Tuesday evening, breaking windows, denting siding on homes, and destroying crops. The storm was part of a wave of severe thunderstorms to roll across northern Michigan. The initial line of storms fired ahead of a cold front just prior to 3 p.m.*

The first thunderstorm warning was issued for Presque Isle County at 3:14 p.m. After the initial line went through, a second round of storms moved across the northern counties and were clearly the most severe of the season, according to a spokesman from the National Weather Service office in Gaylord. Hail was reported from Missaukee to Cheboygan counties with an average size of about an inch.

IT COULDN'T match the size of the hail in Posen, which was two to three sizes larger. Reports of hail as large as a tennis balls were reported to the NWS office. High winds tore branches from trees and heavy rains flooded fields and parking lots.

Many Posen businesses reported broken windows and were still assessing damage early Wednesday. "I'll tell you, I'm 71 years old, (and) I've never seen anything like that," said Leonard Dembny, looking at the hundreds of dents in the siding on the south side of his home. Neighbor Kathy Wirgau was looking for a piece of cardboard in her garage to put over a window that was smashed out by a large hail ball, when the hail came down hard.

"I had to plug my ears it was so loud," said Wirgau, who also will have to replace a windshield . Grand Lake Highway near St. Casimir Church had so many leaves on the road it looked like a late fall evening.

Dennis Chalupniczak of West 634 Highway, who had several leaves stuck to the front of his house, said the winds must have reached 50 to 60 miles per hour. The highest wind gust reported to NWS was 65 m.p.h. in Alcona County. Ann Strzelecki of Posen was thankful she was not home, sparing her vehicle, but windows were broken out of her home and a camper. "My camper is all smashed," said Strzelecki. The vinyl siding of their home had several large holes in it and will have to be replaced.

According to Ken Wozniak of Stanley Wozniak Insurance Agency of Posen, the south side of nearly every home was damaged in a three mile area from Elm Highway to 638 Highway. The area of damage also extended west from the village of Posen toward Leer Road. He said that's where the majority of the 75 phone calls from his company's clients were coming from Tuesday and Wednesday. Wozniak said he wouldn't be surprised if damage estimates from the storm don't reach $1 million

Tornadoes**:**

A tornado is defined as a violently whirling column of air extending downward to the ground from a cumulonimbus cloud. The funnel cloud associated with a tornado may have winds up to 300 miles per hour and an interior air pressure that is 10-20 percent below that of the surrounding atmosphere. The typical length of a tornado path is approximately 16 miles, but tracks much longer than that - some even up to 200 miles - have been reported. Tornado path widths are generally less than one-quarter mile wide. Historically, tornadoes have resulted in the greatest loss of life of any natural hazard, with the mean national annual death toll being 111 persons. Property damage from tornadoes is in the hundreds of millions of dollars every year. Michigan averages approximately 16 tornadoes per year, most occurring in the southern Lower Peninsula.

Michigan is located on the northeast fringe of the Midwest tornado belt. The lower frequency of tornadoes occurring in Michigan may be, in part, the result of the colder water of Lake Michigan during the spring and early summer months, a prime period of tornado activity. Over the past 46 years, seven tornadoes have been recorded in Presque Isle County. Although relatively rare, these tornadoes have caused extensive damage, responsible for $303,000 reported damage and one reported injury.. Two of the severe tornadoes occurring in Presque Isle County two were ranked as F2 on the Fujita Scale, three were F1 and there were two F0.

Lightning:
Lightning is the discharge of electricity from within a thunderstorm. Although lightning is often perceived as a minor hazard, it damages many structures and kills and injures more people in the U.S. per year, on average, than tornadoes or hurricanes. Many lightning deaths and injuries could be avoided if people would have more respect for the threat that lightning presents. ***Michigan ranks second in the nation in both lightning-related deaths and lightning-related injuries.***

The following information is compiled in the Michigan Hazard Analysis Plan: Statistics compiled by the National Oceanic and Atmospheric Administration (NOAA) and the National Lightning Safety Institute (NLSI) for the period 1959-1994 revealed the following about lightning fatalities, injuries and damage in the United States:

Location of Lightning Strikes
40% are at unspecified locations
27% occur in open fields and recreation areas (not golf courses)
14% occur to someone under a tree (not on golf course)
8% are water-related (boating, fishing, swimming, etc.)
5% are golf-related (on golf course or under tree on golf course)
3% are related to heavy equipment and machinery
2.4% are telephone-related

Gender of Victims
84% are male; 16% are female

Months of Most Strikes
July (30%); August (22%); June (21%)

Days of Most Strikes
#1 – Sunday; #2 – Wednesday; #3 – Saturday

Time of Most Strikes
• 2:00 PM – 6:00 PM

Number of Victims
• One victim (91%); two or more victims (9%)

NLSI estimates that 85% of lightning victims are children and young men (ages 10-35) engaged in recreation or work-related activities. Approximately 20% of lightning strike victims die, and 70% of survivors suffer serious long-term after-effects such as memory and attention deficits, sleep disturbance, fatigue, dizziness, and numbness.

Unfortunately, lightning has taken a tremendous toll on Michigan's citizens in terms of injury and loss of life. Since 1959 when the National Weather Service began keeping such records, Michigan has incurred 99 lightning deaths, 693 lightning injuries, and 792 lightning casualties (deaths and injuries combined) – consistently ranking it near the top of the nation in all three categories. During the period 1959-1994 (the last period for which composite statistics are available), Michigan was ranked 2nd nationally (behind Florida) in lightning injuries, 12th

nationally in lightning deaths, and 2nd nationally (again, behind Florida) in lightning casualties. Undoubtedly, the fact that Michigan is an outdoor recreation-oriented state contributes heavily to its high lightning death and injury tolls. As **Table 6.2** indicates, Michigan's lightning deaths and injuries are fairly consistent with the national trends in terms of location of deadly or injury-causing strikes.

There have been two lightening events recorded by NCDC for Presque Isle County since 2001. On August 29, 2003 the following damage report was noted for lightening damage in Onaway.

> *Lightning struck a tree outside a home. The charge moved through the ground and entered the house, splintering joists in the crawl space and starting a small electrical fire. A cluster of severe thunderstorms came onshore from Lake Michigan, producing pockets of wind damage and large hail in northwest Lower Michigan.*

Table 6.2 -- Lightning-Related Deaths in Michigan: 1959-July 2001

Number of Deaths	Location	Percent of Total
28	Open fields, ball fields	28%
26	Under trees (not golf)	27%
11	Boats/water related	11%
10	Golf Course	10%
4	Near tractors/heavy equipment	4%
2	At telephone	2%
18	Other locations/unknown	18%

Source: Storm Data, National Climatic Data Center

Severe Winter Weather

Winter weather hazards consisting of heavy snow from winter storms, freezing rain and blizzards are regular and prevalent natural hazards that occur uniformly across Presque Isle County and can be expected to occur several times every year. Since January 1993, 56 heavy snow or ice events have been recorded in Presque Isle County, which equates to an average of three events per year. The number and intensity of winter weather hazards can fluctuate dramatically from year to year as shown in **Table 6.3**.

Table 6.3, Severe Winter Weather Events Frequency: 1993-2012

Year	Number of Events	Year	Number of Events
1993	8	2003	3
1994	5	2004	2
1995	1	2005	Data missing
1996	1	2006	2
1997	6	2007	5
1998	3	2008	4
1999	0	2009	4
2000	3	2010	1
2001	2	2011	0
2002	4	2012	2

Source: National Climatic Data Center

Ice and Sleet Storms:

Ice and sleet storms are identified as any storm that generates sufficient quantities of ice or sleet to result in hazardous conditions and/or property damage. Sleet storms differ from ice storms in that sleet is similar to hail (only smaller) and can be easily identified as frozen rain drops (ice pellets) that bounce when hitting the ground or other objects. Sleet does not stick to trees and wires, but sleet in sufficient depth does cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with the surface, coating the ground, trees, buildings, overhead wires, etc. with ice, sometimes causing extensive damage. When electric lines are downed, inconveniences are felt in households and economic loss and disruption of essential services is often experienced in affected communities. Michigan has had numerous damaging ice storms over the past few decades.

During the past 11 years Presque Isle County has experienced five freezing rain or ice storm events as recorded by the National Climatic Data Center of the National Oceanic and Atmospheric Administration. A good example of the effect of ice storms to the area occurred on January 4, 1997. NCDC reported the impact as follows:

> *LOW PRESSURE TRACKING NORTHEASTWARD ACROSS WISCONSIN ALLOWED WARM AIR TO OVERRUN A SHALLOW LAYER OF COLD AIR AT THE SURFACE. FREEZING RAIN BEGAN DURING THE MORNING OF THE 4TH AND CONTINUED...HEAVY AT TIMES...INTO THE MORNING OF THE 5TH. ICE ACCUMULATED 1 TO 2 INCHES ON EXPOSED SURFACES IN MOST AREAS...WITH LOCALIZED REPORTS OF IN EXCESS OF 3 INCHES OF ICE. MANY TREES...BRANCHES AND POWERLINES WERE DOWNED. WIDESPREAD POWER OUTAGES ALSO OCCURRED...WITH SOME AREAS REMAINING WITHOUT POWER FOR 2 TO 3 DAYS FOLLOWING THE EVENT. NUMEROUS ACCIDENTS WERE REPORTED DUE TO THE ADVERSE DRIVING CONDITIONS*

Snowstorms:

Snowstorms are defined as a period of rapid accumulation of snow often accompanied by high winds, cold temperatures, and low visibility. Blizzards are the most dramatic and perilous of all snowstorms, characterized by low temperatures and strong winds bearing enormous amounts of snow. Most of the snow accompanying a blizzard is in the form of fine, powdery particles of snow, which are wind-blown in such great quantities that, at times, visibility is reduced to only a few feet. Blizzards have the potential to result in property damage and loss of life. Just the cost of clearing the snow can be enormous. As a result of being surrounded by the Great Lakes, Michigan experiences large differences in snowfall in relatively short distances. The annual mean accumulation ranges from 30 to 170 inches of snow. The highest accumulations are in the northern and western parts of the Upper Peninsula. Since winter storms tend to move from west to east, the western

Table 6.4: Presque Isle County Snowfall Extremes 1991-2010

Month	High (in)	Year*
January	52.7	1982
February	34.0	1985
March	27.4	1989
April	20.2	2003
May	2.0	1984 & 1994
June	0.0	-
July	0.0	-
August	0.0	-
September	0.0	-
October	6.0	2006
November	33.5	1995
December	54.3	2008
Year	169.0	1985

Recorded at Station:6184, Onaway State Park, MI
Source: Midwest Regional Climate Center
* Data missing for 1983, 1984, 1987 & 1988

parts of the state usually have greater amounts of snow than the eastern parts. The highest seasonal snowfall recorded at Rogers City was 169.0 inches during 1985. **(Table 6.4)**

Northern Michigan, with its extensive Great Lakes coastline is also susceptible to lake-effect snow. There are several main ingredients required to produce lake effect snow. The first is a relatively warm body of water supplied by the Great Lakes. The second ingredient is a source of cold air. In the Great Lakes Region, that source comes from the high latitudes of North America where arctic air masses often "spill southward" over those warm bodies of water. Heat and moisture from the warm lakes rises into the "modified" arctic air where it then cools and condenses into snow clouds. The third ingredient is prevailing wind direction, which determines where the snow will occur. Often these blinding local snowfalls called “White-outs” can cause major disruption to automobile traffic along major arteries.

Presque Isle County’s location on eastern shoreline of Northeast Lower Michigan makes it less susceptible to the onshore winds off Lake Michigan and resultant pure lake–effect snow. But in specific situations with generally easterly winds off Lake Huron, lake –effect snow becomes a problem.

As indicated by an analysis conducted by the Gaylord Office of NOAA, winds from a generally easterly flow do not produce pure lake-effect snow. Cold air associated with these flow regimes are generally quite shallow, and low-level flow is generally anti-cyclonic and not favorable to heavy lake effect snow. It is more common to receive heavy lake enhanced snow with these easterly flow patterns off of Lake Huron. When this occurs counties shaded blue **(Figures 6.1, .2 and 6.3**) should be most susceptible to enhanced snowfall.

Figure 6.1 East Northeast & East Flow

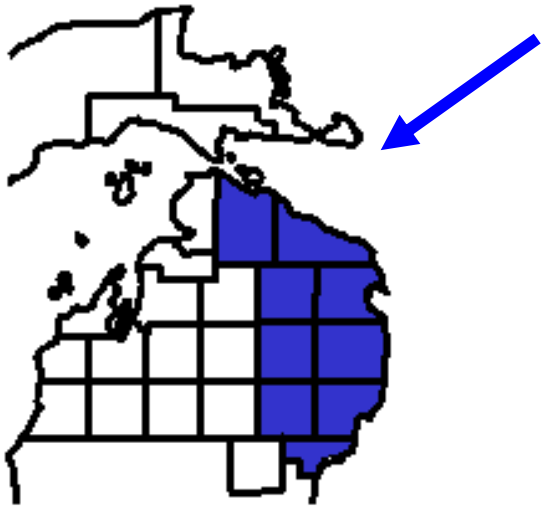


Figure 6.2 East Southeast Flow

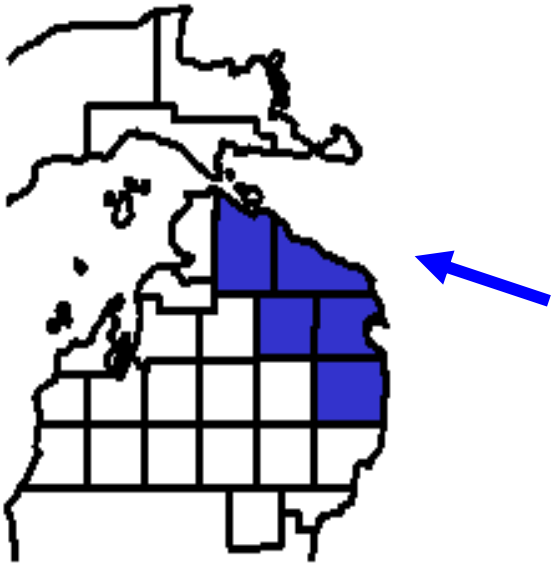
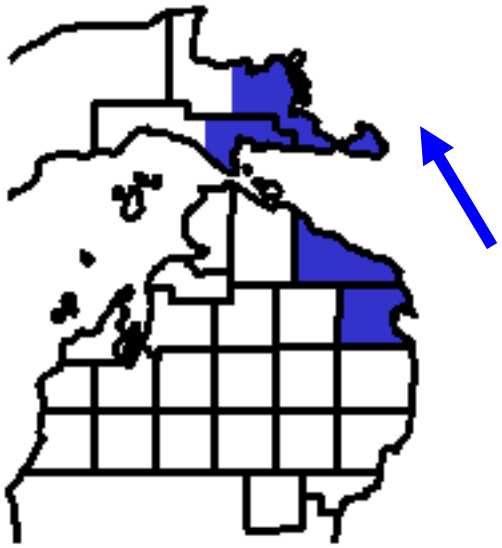


Figure 6.3, Southeast flow



Extreme Temperatures

Extreme temperatures are defined as prolonged periods of very high or very low temperatures, often accompanied by other extreme meteorological conditions such as high humidity, lack of rain (drought), high winds, etc. Extreme temperatures - whether extreme heat or extreme cold - share a commonality in that they both primarily affect the most vulnerable segments of society such as the elderly, children, impoverished individuals, and people in poor health. The major threats of extreme heat are heatstroke (a major medical emergency), and heat exhaustion. Extreme heat is a more serious problem in urban areas, where the combined effects of high temperature and high humidity are more intense. The major threats of extreme cold are hypothermia (also a major medical emergency) and frostbite.

Presque County is subject to both temperature extremes. For the period between 1979 and 2001, the low temperature was recorded on Feb. 27, 2000 of –37F, and high of 100 F, on July 8 & August 3, 1988. Monthly temperature threshold for Rogers City are shown in **Table 6.5.**

Table 6.5 Extreme Temperature Thresholds, Derived from 1970- 2000 averages

Month	*# Days Max ≥ 90°F*	*# Days Max ≤ 32°F*	*# Days Min ≤ 32°F*	*# Days Min ≤ 0°F*
JAN	0.0	21.2	30.5	6.0
FEB	0.0	16.9	27.6	6.0
MAR	0.0	8.9	28.0	1.8
APR	0.0	1.0	17.7	0.0
MAY	0.1	0.0	3.9	0.0
JUN	1.2	0.0	0.2	0.0
JUL	1.9	0.0	0.0	0.0
AUG	0.9	0.0	0.0	0.
SEP	0.3	0.0	1.0	0.0
OCT	0.0	0.0	8.0	0.0
NOV	0.0	3.1	21.2	0.0
DEC	0.0	14.6	29.2	1.5
Annual	4.2	66.7	169.5	15.4
Winter	0.0	52.8	87.3	13.4
Spring	0.1	9.9	49.5	1.8
Summer	4.0	0.0	0.2	0.0
Fall	0.3	3.2	30.5	0.0

Source: Midwest Regional Climate Center

Drought

According to the Michigan Hazard Analysis: Drought is a normal part of the climate of Michigan and of virtually all other climates around the world – including areas with high and low average rainfall. Drought differs from normal arid conditions found in low rainfall areas in that aridity is a permanent characteristic of that type of climate. Drought is the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length. The severity of a drought depends not only on its location, duration, and geographical extent, but also on the water supply demands made by human activities and vegetation. This multi-faceted nature of the hazard makes it difficult to define a drought and assess when and where one is likely to occur.

Droughts can cause many severe impacts on communities and regions, including: 1) water shortages for human consumption, industrial, business and agricultural uses, power generation, recreation and navigation; 2) a drop in the quantity and quality of agricultural crops; 3) decline of water quality in lakes, streams and other natural bodies of water; 4) malnourishment of wildlife and livestock; 5) increase in wildfires and wildfire-related losses to timber, homes and other property; 6) declines in tourism in areas dependent on water-related activities; 7) declines in land values due to physical damage from the drought conditions and/or decreased economic or functional use of the property; 8) reduced tax revenue due to income losses in agriculture, retail, tourism and other economic sectors; 9) increases in insect infestations, plant disease, and wind erosion; and 10) possible loss of human life due to food shortages, extreme heat, fire, and other health-related problems such as diminished sewage flows and increased pollutant concentrations in surface water. Some other drought related economic impacts are reflected in **(Table 6.6).**

The 1976-77 drought in the Great Plains, Upper Midwest, and West also severely impacted Michigan. Extreme drought conditions contributed to wildfire, crop damage and low Great Lakes levels. The 1988 drought / heat wave in the Central and Eastern U.S. (an event that greatly impacted Michigan) caused an estimated $40 billion in damages from agricultural losses, disruption of river transportation, water supply shortages, wildfires, and related economic impacts.

In response to the 1988 drought, Michigan communities instituted temporary water use restrictions. To stem the potential for wildfire in Michigan, the Governor issued (in June, 1988) a statewide outdoor burning ban. The drought / heat wave that struck Michigan during the summer of 2001 damaged or destroyed approximately one-third of the state's fruit, vegetable and field crops, resulting in a U.S. Department of Agriculture Disaster Declaration for 82 of the state's counties.

In addition, the drought / heat wave caused water shortages in many areas in Southeast Michigan, forcing local officials to issue periodic water usage restrictions. In Presque Isle County, impacts from extended drought are reduction in crop and livestock production, increased potential for wildfires, reduction in farm products, reduction in timber production, and loss of tourism and decreased watercraft access to Lake Huron and large inland lakes.

Table 6.6 -- Economic Impact of Drought	
Costs and losses to agricultural producers	Annual and perennial crop losses Damage to crop quality Income loss for farmers due to reduced crop yields Reduced productivity of cropland (wind erosion, long-term loss of organic matter, etc.)

	Insect, disease and wildlifeanimal damage to crops Increased irrigation costs Cost of new or supplemental water resource development (wells, dams, pipelines)
Energy-related effects	Increased energy demand and reduced supply because of drought-related power curtailments Costs to energy industry and consumers associated with substituting more expensive fuels (oil) for hydroelectric power
Costs and losses to livestock producers	Reduced productivity of rangeland Reduced milk production Forced reduction of foundation stock Closure/limitation of public lands to grazing High cost/unavailability of water for livestock Cost of new or supplemental water resource development (wells, dams, pipelines) High cost/unavailability of feed for livestock Increased feed transportation costs High livestock mortality rates Disruption of reproduction cycles (delayed breeding, more miscarriages) Decreased stock weights Increased predation Range fires
Loss from timber production	Wildland fires Tree disease Insect infestation Impaired productivity of forest land Direct loss of trees, especially young ones
Loss from fishery production	Damage to fish habitat Loss of fish and other aquatic organisms due to decreased flows
General economic effects	Decreased land prices Loss to industries directly dependent on agricultural production (e.g., machinery and fertilizer manufacturers, food processors, dairies, etc.) Unemployment from drought-related declines in production Strain on financial institutions (foreclosures, more credit risk, capital shortfalls) Revenue losses to federal, state, and local governments (from reduced tax base) Reduction of economic development Fewer agricultural producers (due to bankruptcies, new occupations) Rural population loss
Loss to recreation and tourism	Loss to manufacturers and sellers of recreational equipment Losses related to curtailed activities: hunting and fishing, bird watching, boating, etc.
Food Production decline	Increase in food prices Increased importation of food (higher costs)
Source: National Drought Mitigation Center, University of Nebraska, Lincoln	

Riverine and Urban Flooding:

Riverine flooding is defined as the periodic occurrence of overbank flows of rivers and streams resulting in partial or complete inundation of the adjacent floodplain. Riverine floods generally caused by prolonged, intense rainfall, snowmelt, ice jams, dam failures, or any combination of these factors. Most riverine flooding occurs in early spring and is the result of excessive rainfall and/or the combination of rainfall and snowmelt. Ice jams also cause flooding in winter and early spring. Severe thunderstorms may cause flooding during the summer or fall, although these are normally localized and have more impact on watercourses with smaller drainage areas. Oftentimes, flooding may not necessarily be directly attributable to a river, stream or lake

overflowing its banks. Rather, it may simply be the combination of excessive rainfall and/or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations – areas that are often not in a floodplain. That type of flooding is becoming increasingly prevalent in Michigan, as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow. Flooding also occurs due to combined storm and sanitary sewers that cannot handle the tremendous flow of water that often accompanies storm events. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns. Riverine flooding is not a common occurrence in Presque Isle County.

Pre-existing homes and businesses, though, could remain as they were. Owners of many of these older properties could obtain insurance at lower, subsidized, rates that did not reflect the property's real risk. In addition, as the initial flood risk identified by the NFIP has been updated over the years, many homes and businesses in areas where the revised risk was determined to be higher have also received discounted rates. This "Grandfathering" approach prevented rate increases for existing properties when the flood risk in their area increased.

In 2012, the U.S. Congress passed the Flood Insurance Reform Act of 2012 which calls on the Federal Emergency Management Agency (FEMA), and other agencies, to make a number of changes to the way the NFIP is run. As the law is implemented, some of these changes have already occurred, and others will be implemented in the coming months. Key provisions of the legislation will require the NFIP to raise rates to reflect true flood risk, make the program more financially stable, and change how Flood Insurance Rate Map (FIRM) updates impact policyholders. The changes will mean premium rate increases for some – but not all -- policyholders over time.

Flood Insurance Rate Maps (FIRM) will not be developed for Presque Isle County. *A review of the State of Michigan database found no incidents of repetitive loss properties in Presque Isle County.*

Earthquakes:
A sudden motion or trembling in the earth caused by an abrupt release of slowly accumulating strain, which results in ground shaking, surface faulting, or ground failures defines earthquakes. Most areas of the United States are subject to earthquakes including parts of Michigan, and they occur literally thousands of times per year. Northeastern Michigan to date has been out of known earthquakes impact areas and Presque Isle County is located in an area with less than a 2%g (peak acceleration) and has a relatively low seismic risk.

Subsidence:
The process of subsidence and related Karst topography is described in Chapter 2 of this plan. Geologic subsidence can cause depressions, cracks, and sinkholes in the ground surface, which can threaten people and property. Subsidence depressions, which normally occur over many days to a few years, may damage structures with low strain tolerances, such as dams, nuclear reactors, and utility infrastructure. The sudden collapse of the ground surface to form sinkholes poses an immediate threat to life and property. Such ground movements may continue for several days, weeks, months or even years, until the walls stabilize.

The population most at risk would be in areas where industrial or residential development has occurred above active or abandoned mines where underground cavities are present near the surface, as well as areas where an extensive amount of groundwater has been withdrawn. The

most prevalent subsidence features in Northern Michigan are Karst sinkholes. Although Collapse of a sink is usually a localized natural hazard **(Figure 6.4)** it can in some circumstances offer a threat of exposing groundwater to rapid contamination across extensive areas. Karst subsidence also offers the threat of exposing groundwater to rapid contamination in certain circumstances.

Technological Hazards in Presque Isle County

Infrastructure Failures
Infrastructure failures are defined as a failure of critical public or private utility infrastructure resulting in a temporary loss of essential functions and/or services. Such interruptions could last for periods of a few minutes to several days or more. Public and private utility infrastructure provides essential life supporting services such as electric power, heating and air conditioning, water, sewage disposal and treatment, storm drainage, communications, and transportation. When one or more of these independent, yet inter-related, systems fails due to disaster or other cause - even for a short period of time - it can have devastating consequences. For example, when power is lost during periods of extreme heat or cold, people can literally die in their homes.

When water or wastewater treatment systems in a community are inoperable, serious public health problems arise that must be addressed immediately to prevent outbreaks of disease. When storm drainage systems fail due to damage or an overload of capacity, serious flooding can occur. All of these situations can lead to disastrous public health and safety consequences if immediate mitigation steps are not taken. Typically, it is the most vulnerable segments of society - the elderly, children, ill or frail individuals, etc., that are most heavily impacted by an infrastructure failure. If the failure involves more than one system, or is large enough in scope and magnitude, whole communities and even regions can be negatively impacted.

Dam Failures
Dam failure is the result of collapse or failure of an impoundment resulting in downstream flooding. Dam failures can result in loss of life and extensive property or natural resource damage for miles downstream from the dam. Failure of a dam does not only occur during flood events, which may cause overtopping of a dam. Failure can also result from mis-operation, lack of maintenance and repair, and vandalism. Such failures can be catastrophic because they occur unexpectedly, with no time for evacuation. Michigan has experienced over 260 dam failures in its history.

Presque Isle County has several dams, but no are rated as high hazards on the National Inventory of Dams. All dams are located in areas of relatively low population, **see Figure 6.5**.

Air, Land and Water Transportation Accidents
Transportation accidents are defined as a crash or accident involving an air, land or water-based commercial passenger carrier resulting in death or serious injury. Vulnerable areas would include: 1) communities with, or near, an airport offering commercial passenger service; 2) communities with railroad tracks on which commercial rail passenger service is provided; 3) communities in which commercial intercity passenger bus or local transit bus service is provided; 4) communities with school bus service; and 5) communities in which commercial marine passenger ferry service is provided. A serious accident involving any of the above modes of passenger transportation could result in a mass casualty incident, requiring immediate

life-saving community response. In addition, a marine transportation accident would require a water rescue operation, possibly under dangerous conditions on the Great Lakes.
In terms of commercial passenger transportation service, Michigan has: 1) approximately 19 airports that offer commercial air passenger service; 2) 130 certified intercity passenger bus carriers providing service to 220 communities; 3) 72 local bus transit systems serving 85 million passengers; 4) 19 marine passenger ferry services; and 5) 3 intercity rail passenger routes operating on 568 miles of track, along 3 corridors, serving 22 communities. Presque Isle County does not have regular commercial air service or passenger rail service, or commercial marine passenger service, but does have scheduled bus service. School bus transportation and specialized public transit service do exist in the county. The transportation system is described in Chapter 5 of this plan. Accidents on either system could result in injuries and loss of life.

There is a significant volume of both private and commercial marine activity along Presque Isle county's Lake Huron coastline. The industrial ports of Calcite and Stoneport create considerable large vessel traffic. Recreational boat marinas at Hammond Bay, Presque Isle Harbor and Rogers City are sources of substantial private pleasure boat activity throughout the summer months. Conditions on Lake Huron can and do change rapidly and maintenance of communication between boaters and emergency network is important and should be constantly reviewed and upgraded

Hazardous Material Incident – Transportation
Transportation of hazardous material provides hazard potential through an uncontrolled release of hazardous materials during transport, capable of posing a risk to health, safety, property or the environment. All modes of transportation - highway, railroad, seaway, airway, and pipeline - are carrying thousands of hazardous material shipments on a daily basis through local communities. A transportation accident involving any one of those hazardous material

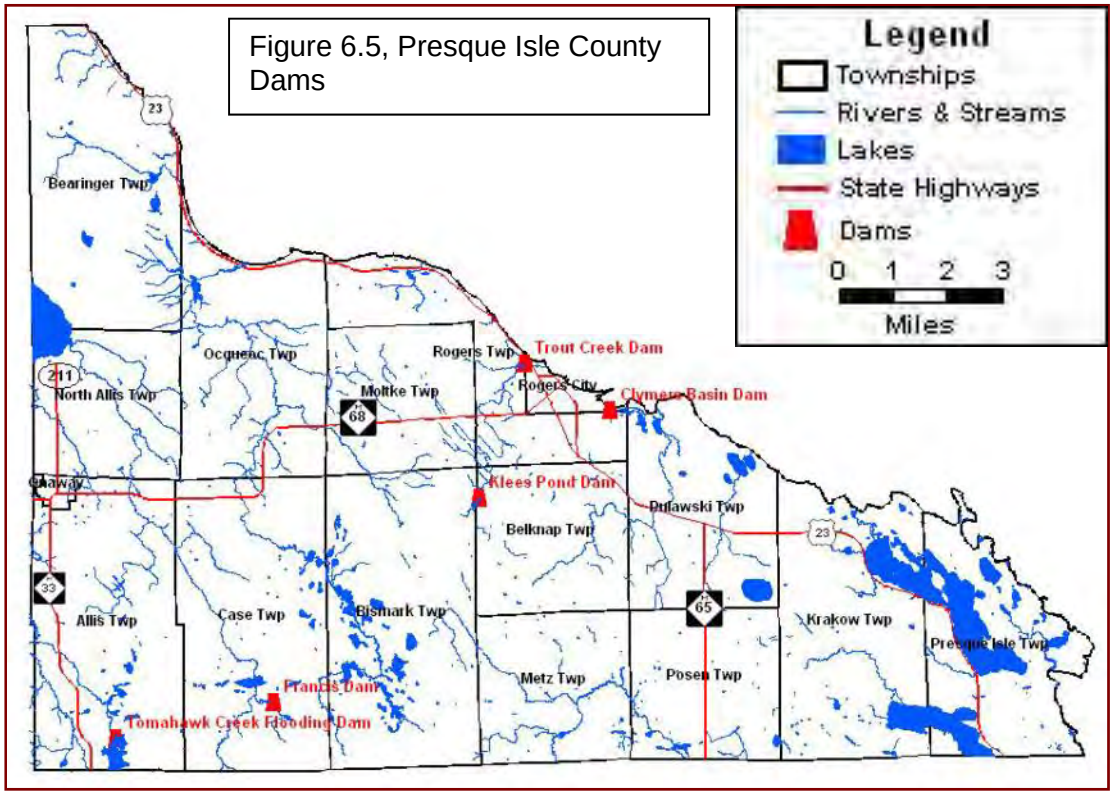


Figure 6.5, Presque Isle County Dams

shipments could cause a local emergency affecting many people. The U.S. Department of Transportation regulates the transportation and shipping of over 18,000 different materials. Areas most at risk are within a 1-5 mile radius of a major transportation route along which hazardous material shipments move. All areas in Michigan are potentially vulnerable to a hazardous material transportation incident, although the heavily urbanized and industrialized areas in southern Michigan are particularly vulnerable due to the highly concentrated population.

M-65, M-33, US 23, and marine transport travel in and around Presque Isle County present an risk of a hazardous material incident transportation incident . Routine shipment of hazardous materials provides a constant potential for hazard related accidents to occur. This always increasing potential for hazardous incidents demands continuous oversight and reaction preparedness.

Hazardous Material Incident - Fixed Site
Hazardous material can also experience uncontrolled released from a fixed site, and are capable of posing a risk to health, safety, property and the environment. Hazardous materials are present in quantities of concern in business and industry, agriculture, universities, hospitals, utilities, and other community facilities. Hazardous materials are materials or substances, which, because of their chemical, physical, or biological nature, pose a potential threat to life, health, property and the environment if they are released. Examples of hazardous materials include corrosives, explosives, flammable materials, radioactive materials, poisons, oxidizers, and dangerous gases.

The world's deadliest hazardous material incident occurred on December 4, 1984, in Bhopal, India. A cloud of methyl isocyanate gas, an extremely toxic chemical, escaped from a Union Carbide chemical plant, killing 2,500 people and injuring tens of thousands more. This incident triggered historical Federal legislation intended to minimize such disasters from occurring in the United States.

Hazardous materials are highly regulated by the government to reduce risk to the general public, property and the environment. Despite precautions taken to ensure careful handling during the manufacture, transport, storage, use and disposal of these materials, accidental releases are bound to occur. Areas at most risks are within a 1-5 mile radius of identified hazardous material sites. Many communities have detailed plans and procedures in place for responding to incidents at these sites, but releases can still cause severe harm to people, property and the environment if proper mitigative action is not taken in a timely manner.

Oil and Gas Well and Pipeline Accidents:
Oil and gas pipeline accidents are defined as uncontrolled release of oil or gas or the poisonous by-product hydrogen sulfide, from a pipeline. As a major oil and gas consumer in the United States, vast quantities of oil and natural gas are transported through and stored in Michigan. Though often overlooked as a threat because much of the oil and gas infrastructure in the state is located underground, oil and gas pipelines can leak, erupt or explode causing property damage, environmental contamination, injuries and loss of life.

In addition, there is also a danger of hydrogen sulfide release. Hydrogen sulfide is an extremely poisonous gas that is also explosive when mixed with air temperatures of 500 degrees or above. In addition to pipelines, these dangers can be found around oil and gas wells, pipeline terminals, storage facilities, and transportation facilities where the gas or oil has a high sulfur content.

The threat related to hydrogen sulfide exposure is reflected in the following incident, which occurred on June 7, 1994, in Otsego County (five miles east of Gaylord) at the site of a West Bay Exploration Company gas well. During maintenance operation, crew intentionally released H2S. Poison gas that filled a nearby home, injuring husband & wife who suffered severe burning of the eyes, difficulty breathing, and disorientation. Both sought medical treatment. Wife, whose hands and arms turned purple, was unable to continue working after incident.

There is always a potential for an uncontrolled release of oil or gas or the poisonous by-product hydrogen sulfide from the wells themselves. Oil and gas are produced from fields in over 60 counties in the Lower Peninsula. Over 40,000 wells have been drilled in these counties. Of that total, approximately one-half (20,000) have produced oil or gas. Over 1.1 billion barrels of crude oil and 3.6 trillion cubic feet of gas have been withdrawn from these wells. There has been 9.286 gas wells drilled in Northeast Lower Michigan. As of January 2012, over 570 oil and gas wells have been drilled in Presque Isle County. Oil is the predominant resource being extracted and 37 of the wells in the county are currently producing oil. There is one producing gas well and the remainder of the wells are dry holes that are plugged or in the process of being plugged. The majority of the wells are located in the south and west area of the county. Most of the wells are located in Allis, Case, Bismark and Belknap Townships. **Figure 6.6** depicts the distribution of Oil & Gas wells in Presque Isle County

The combination of oil or gas wells, and buried pipeline connecting each well to centralized processing facilities, provides a very significant hazard potential. Although this threat is intensified by the fact that wells, especially in southwestern Presque Isle County, are located in areas very susceptible to wildfire. **(See Figure 6.6)**., most of the susceptible areas are located on public land holdings.

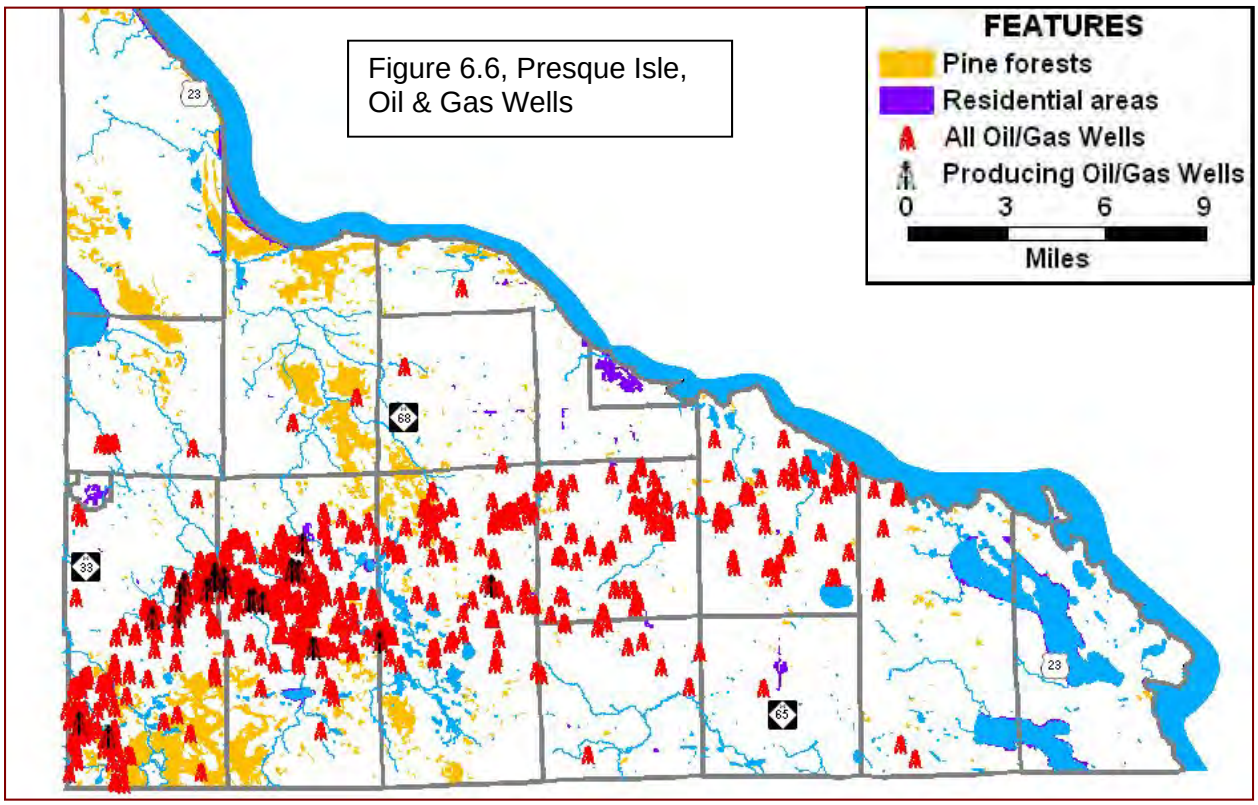


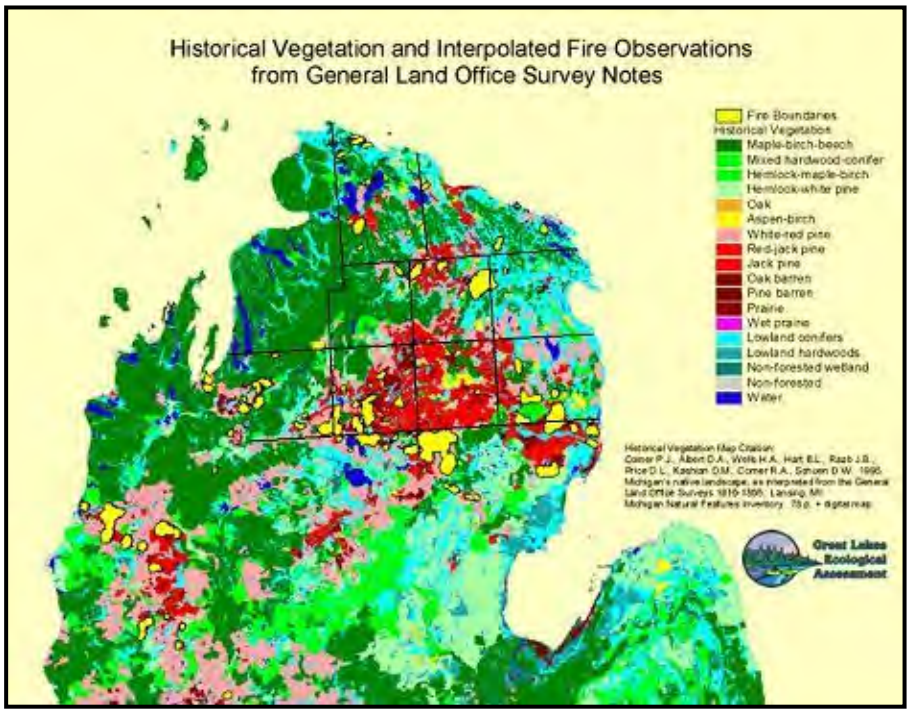
Figure 6.6, Presque Isle, Oil & Gas Wells

Fire Hazards

Wildfire

Wildfire is defined as an uncontrolled fire in grass, brushlands, or forested areas. The most immediate dangers from wildfires are the destruction of homes and timber, wildlife, and injury or loss of life to persons who live in the affected area or who are using recreational facilities in the area. Long-term effects can be numerous and include scorched and barren land, soil erosion, landslides/mudflows, water sedimentation, and loss of recreational opportunities. Forests cover approximately one-half of Michigan's total land base. As a result, much of the state is vulnerable to wildfire. In addition, development in and around forests and grasslands is increasing rapidly, making public safety a primary consideration in wildfire mitigation and suppression efforts.

Figure 6.7, Historic Vegetation/ Fire Observations



Almost 65 percent of Presque Isle County is forested. Forest types vary depending upon the soils, moisture and past activities such as logging, fires and land clearing. The common forest types are Beech/maple and Aspen forest types. According to the MIRIS Land Cover/Use Inventory, the combined jack pine and oak/hickory types cover about 12% of the county's surface area. The draughty, low fertility sandy soils, found in outwash plains and channels, supported pre-settlement jack pine forests that for thousands of years were perpetuated by wildfires. A review of the pre-settlement vegetation of Presque Isle County **(Figure 6.7)** and individual community hazard maps show that wildfire prone areas are concentrated in Bismark, Allis, North Allis, Ocqueoc, Bearinger, and case townships.

Table 6.7
Number of Wildfires by County in Northeast Michigan, 2001-May of 2012
(MDNR jurisdiction only)

County	Number of Wildfires	Acres Burned
Otsego	231	329
Alcona	135	376
Alpena	135	303
Cheboygan	136	328
Crawford	224	11,819
Montmorency	110	416
Oscoda	61	256
Presque Isle	74	424

Source: Michigan Department of Natural Resources, Forest Management Division

Information from the Michigan Department of Natural Resources show there have been 169 wildfires of over 200 acres recorded in Presque Isle County. There have been 74 wildfires recorded from 2001 to 2012 in the county. **(Table 6.7)** It should be noted that the figures shown on the maps do not include those wildfires suppressed by local volunteer fire departments or the U.S. Forest Service. If records from those sources were readily available, and broken down by county, the statistics would be effected. Presque Isle County ranks seventh among the eight Northeast Michigan counties. The relatively low number of wildfire occurrences in Presque Isle County during this time may be explained by the relatively low fire susceptible forest acres. To a large extent wildfire prone forest types are restricted to southern Allis Township and in Ocqueoc Township. In both cases these areas of wildfire prone forest types are located primarily on State Owned property and are occupied by few residences. Some of the more prominent recent wildfires in Michigan are noted in **(Table 6.8).** The frequency of major wildfires in Northeast Lower Michigan should be noted.

Contrary to popular belief, lightning strikes are not the primary cause of wildfires in Michigan. Today, only about 2% of all wildfires in Michigan are caused by lightning strikes; the rest are caused by human activity. Outdoor burning is the leading cause of wildfires in Michigan. Most Michigan wildfires occur close to where people live and recreate, which puts both people and property at risk. The immediate danger from wildfires is the destruction of property, timber, wildlife, and injury or loss of life to persons who live in the affected area or who are using recreational facilities in the area.

Although Michigan's landscape has been shaped by wildfire, the nature and scope of the wildfire threat has changed. Michigan's landscape has changed substantially over the last several decades as residential development continues to expand into the same historic wildfire prone areas. A 60% increase in the number of rural homes since the 1980's has increased the potential for loss of life and property from wildfires. There are simply not enough fire suppression forces available in rural areas to protect every structure from wildfire. The large number of permanent and seasonal homes in northeastern Michigan, coupled with increased tourism during driest, and therefore most vulnerable, times of the year greatly increases the risk from wildfires.

Scrap Tire Fires

Any instance of uncontrolled burning scrap tire storage or recycling site. Each year in the U.S., an estimated 250 million vehicle tires have to be disposed of. Michigan alone generates 7.5-9 million scrap tires annually. Many of these scrap tires end up in disposal sites (legal or illegal), some of which may have several hundred thousand tires. Michigan currently has more than 24 million scrap tires at disposal sites scattered across the state. Tire disposal sites can be fire hazards due to the large quantity of "fuel" onsite, coupled with the fact that the shape of a tire allows air to flow into the interior of a tire pile, rendering standard firefighting practices nearly useless. Flowing burning oil released by the burning tires spreads the fire to adjacent areas. Some scrap tire fires have burned for months, creating acrid smoke and an oily residue that can leach into the soil, creating long-term environmental problems. Scrap tire fires differ from conventional fires in several respects: 1) even relatively small scrap tire fires can require significant resources to control and extinguish; 2) the costs of fire management are often far beyond that which local government can absorb; 3) the environmental consequences of a major tire fire can be significant; and 4) the extreme heat from the fire converts a standard passenger vehicle tire into about two gallons of oily residue, which can then leach into the soil or migrate to streams. There are no known tire storage sites in Presque Isle County.

Table 6.8
Major Wildfires in Michigan: 1980 - 2000

Date of Fire	Summary of Impacts
May 1980	In May 1980, a wildfire in Oscoda County (known as the Mack Lake fire) destroyed 44 homes and buildings, forced the evacuation of 1,500 people, and killed one firefighter. A total of 24,000 acres were burned, resulting in a total property and timber loss of $2 million.
May 1990	In May 1990, a wildfire near Grayling in Crawford County (known as the Stephan Bridge Road fire) burned 76 homes and 125 other structures, 37 vehicles and boats, and over 5,900 acres of forestland, resulting in property losses of $5.5 million. The timber losses totaled another $700,000. The fire originated from a controlled burning of a pile of brush and timber accumulated from recently cleared land. The burning was initiated while snow covered the ground, and it was presumed the fire was completely extinguished. However, the pile rekindled approximately 7 weeks later, and on May 8, ignited the Stephan Bridge Road fire. Strong winds and dry conditions helped spread the fire at a rate beyond that which could be controlled by human intervention. At one point in the fire, the rate of spread was an astonishing 277 feet per minute. Fortunately, the combination of human fire suppression and a passing weather front that produced rainfall finally contained the fire before it could do any additional damage. There were no fatalities as a result of this fire, and only one firefighter was injured from smoke inhalation. However, the property losses were significant.
May 1999	In early May 1999, a wildfire near the village of Champion in Marquette County (known as the Tower Lake fire) burned a total of 5,625 acres of forestland, destroyed at least 8 structures, and forced the evacuation of over 400 At the request of the Governor, the Federal/State Forest Fire Suppression Agreement was activated by the Federal Emergency Management Agency (FEMA) to provide financial assistance to the State and eligible local agencies to cover some of the firefighting costs incurred. At about the same time as the Tower Lake fire, major wildfires were also being fought in several other locations across Northern Michigan. An 850-acre fire burned in the Huron-Manistee National Forest in Oscoda County. In the Northern Lower Peninsula alone during that first week of May, MDNR forces fought nearly 40 wildfires. All of the wildfires were fueled by the same dry conditions that set the stage for the Tower Lake fire.
May-June 2000	A wildfire that began on April 30 near Mio and was fed by extremely dry conditions consumed nearly 5,200 acres in the Huron-Manistee National Forest before being contained a week later. Nearly 300 firefighters and two aerial water tankers were deployed to suppress the fire. The fire prompted the evacuation for a short time of approximately 30 persons. Fortunately, the fire did not cause any injuries or structural damage.

Structural Fires

A structural fire occurs with any instance of uncontrolled burning which results in structural damage to residential, commercial, industrial, institutional, or other properties in developed areas. In terms of average annual loss of life and property, structural fires - often referred to as the “universal hazard” because they occur in virtually every community - are by far the most prevalent hazard facing most communities in Michigan and across the country. Each year in the U.S., fires result in approximately 5,000 deaths and 300,000 injuries requiring medical

treatment. According to some sources, structural fires cause more loss of life and property damage than all types of natural disasters combined. Particularly devastating are large urban conflagrations in which multiple structures are damaged or destroyed. Not surprisingly, Michigan's structural fire experience mirrors the national figures. The State Fire Marshal estimates that a structural fire occurs every 24 minutes in Michigan.. During 2003, there were 36 fires recorded in Presque Isle County, with a total property/contents loss of $70,450.

Like many of the surrounding rural counties in Northeast Michigan, Presque Isle County relays on a combination of staff and volunteer fire department personnel. **(Table 6.9)** This provides the county with an excellent array of firefighting services available to the respective communities. Lack of full-time professional fire fighters in outlying rural townships means less time available to conduct fire inspections and take other preventive measures necessary to lessen structural fire threat. Out of necessity, efforts in these communities are directed more at fire suppression. This typical scenario in rural areas of the state poses great challenges for maintaining a sustainable fire prevention and inspection program.

Another major challenge facing Michigan fire service is the lack of a state-mandated fire safety code and code enforcement program for all occupancies. The State enforces fire safety codes in schools, dormitories, health care facilities, and correctional facilities, plus some businesses; the remainder of the job is left to local officials. Since there is no uniform, mandated fire safety code at the state level, a variety of local ordinances have emerged. Some communities may not have fire safety codes. This problem manifests itself more seriously in rural areas and small towns, which typically have few, if any, paid full-time fire fighters. Even if a mandated fire safety code were instituted statewide, it wouldn't totally solve the problem of structural fire prevention because the costs of compliance in existing buildings would often be prohibitive for business owners. Such a measure would, however, help ensure that new construction doesn't compound the problem.

Table 6.9
Presque County Fire Staffing

Department	Sq. Miles	Population	Staff & Volunteers
East Grand Lake FD	50	1200	15
Case Township. FD	120	1742	35
Onaway FD	110	2646	18
Posen Area Fire/Rescue	166	2284	20
Rogers City FD	180	5885	26
Presque Isle FD	70	1000	12
Ocqueoc-Bearinger FD	100	963	8
MDNR, Onaway Field Office	NA	NA	NA
Totals			

Societal Hazards

Public Health Emergencies

A widespread and/or severe epidemic, incident of contamination, or other situation that presents a danger to or otherwise negatively impacts the general health and well-being of the public. Public health emergencies can take many forms: 1) disease epidemics; 2) large-scale incidents of food or water contamination; 3) extended periods without adequate water and sewer services; 4) harmful exposure to chemical, radiological or biological agents; or 5) large-scale

infestations of disease-carrying insects or rodents. Public health emergencies can occur as primary events by themselves, or they may be secondary events another disaster or emergency, such as a flood, tornado, or hazardous material incident. The common characteristic of most public health emergencies is that they adversely impact, or have the potential to adversely impact, a large number of people. Public health emergencies can be statewide, regional, or localized in scope and magnitude.

A public health consideration in any community experiencing significant growth or expansion has to do with stresses on exiting sewer and water system capacities. It is important to balance extension of services with the capacity of existing systems to absorb new loads.

Perhaps the greatest emerging public health threat would be the intentional release of a radiological, chemical or biological agent with the potential to adversely impact a large number of people. Such a release would most likely be an act of sabotage aimed at the government or a specific organization or segment of the population. Fortunately, to date Michigan has not experienced such a release aimed at mass destruction. However, Michigan has experienced hoaxes and it is probably only a matter of time before an actual incident of that nature and magnitude does occur. If and when it does, the public health implications – under the right set of circumstances – could be staggering.

Another social situation, specific to Northeast Lower Michigan and apparently initiating in Montmorency County is related to the impact of Bovine TB and resultant governmental regulations and enforcement impact. For about a decade the Bovine TB situation in Northeastern Michigan as had a significant impact on personal, social and economic health Various quarantines have had a direct effect on the agriculture and hunting industries across Northeast Lower Michigan. The stress from this situation has not only had economic ramifications, but also introduced social and psychological stress across the community.

Nuclear Attack:
Any hostile attack against the United States, using nuclear weapons, which results in destruction of military and/or civilian targets. All areas of the United States are conceivably subject to the threat of nuclear attack. However, the strategic importance of military bases, population centers and certain types of industries place these areas at greater risk than others. The nature of the nuclear attack threat against the U.S. has changed dramatically with the end of the “Cold War” and the conversion of previous adversaries to more democratic forms of government. Even so, the threat still exists for a nuclear attack against this country. Despite the dismantling of thousands of nuclear warheads aimed at U.S. targets, there still exists in the world a large number of nuclear weapons capable of destroying multiple locations simultaneously. In addition, controls on nuclear weapons and weapons components are sporadic at best in the former Soviet Union, and the number of countries capable of developing nuclear weapons continues to grow despite the ratification of an international nuclear non-proliferation treaty. It seems highly plausible that the threat of nuclear attack will continue to be a hazard in this country for some time in the future.

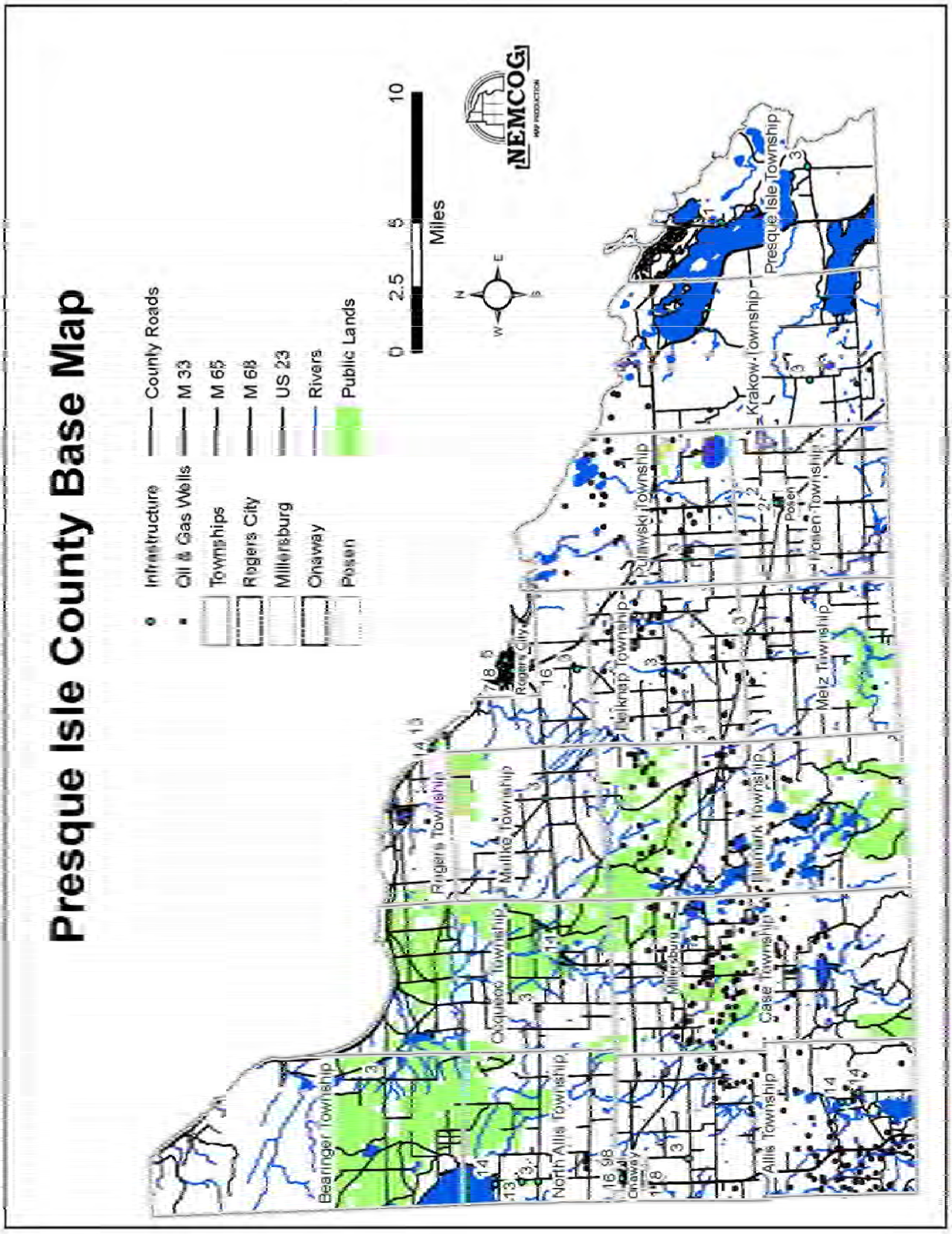
Civil Disturbances
A public demonstration or gathering (such as a sports event), or a prison uprising, that results in a disruption of essential functions, rioting, looting, arson or other unlawful behavior. Large-scale civil disturbances rarely occur, but when they do they are usually an offshoot or result of one or more of the following events: 1) labor disputes where there is a high degree of animosity between the two dissenting parties; 2) high profile/controversial judicial proceedings; 3) the implementation of controversial laws or other governmental actions; 4) resource shortages

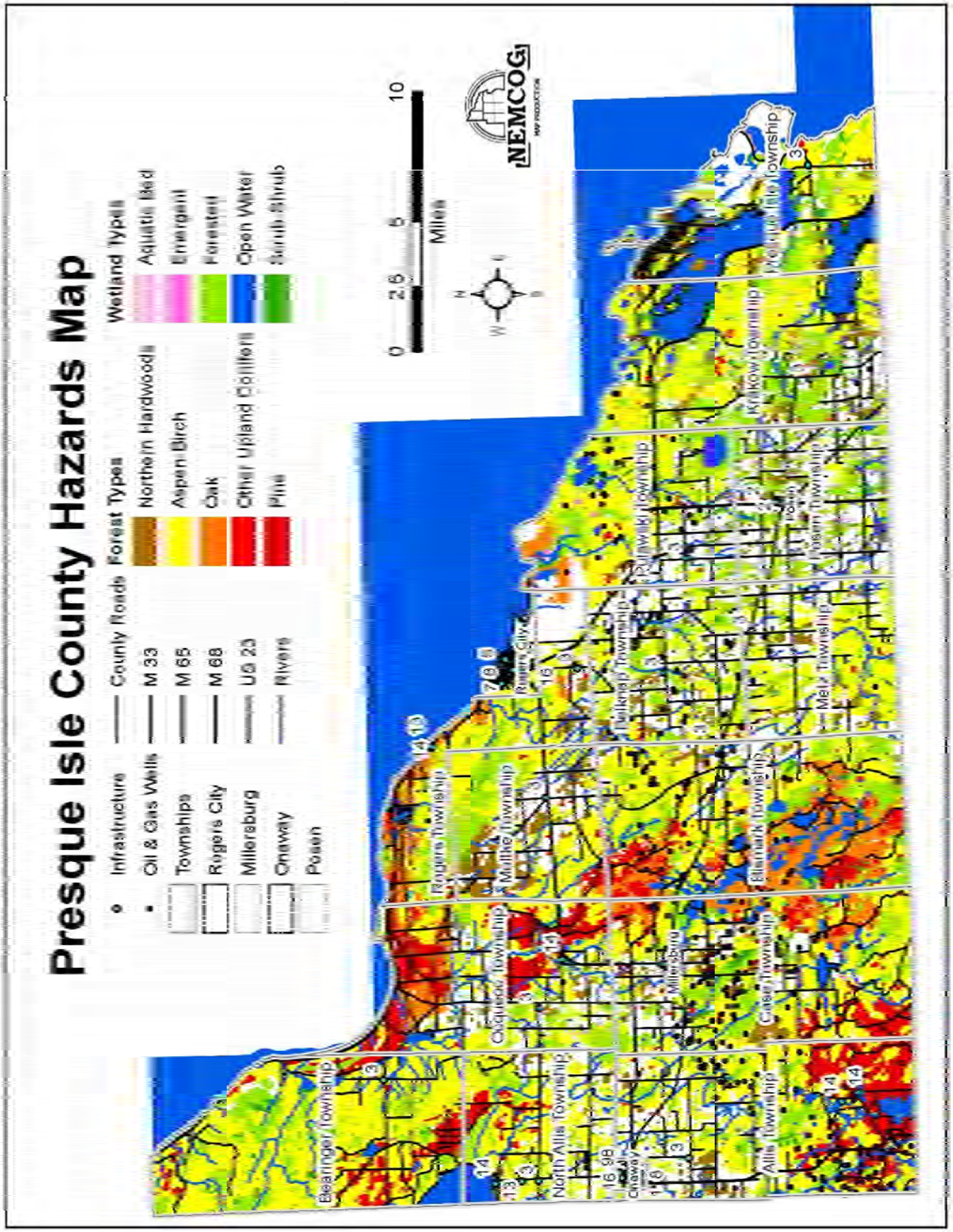
caused by a catastrophic event; 5) disagreements between special interest groups over a particular issue or cause; or 6) a perceived unjust death or injury to a person held in high esteem or regard by a particular segment of society.

Areas subject to civil disturbances may encompass large portions of a community. Types of facilities that may be subject to or adversely impacted by civil disturbances may include government buildings, military bases, Community College, businesses, and critical service facilities such as our hospital, police and fire facilities. Civil disturbances (including jail uprisings) often require the involvement of multiple community agencies in responding to and recovering from the incident. There have been no recorded incidences of civil disturbances in recent history.

Nuclear Power Plant Accidents

An actual or potential release of radioactive material at a commercial nuclear power plant or other nuclear facility, in sufficient quantity to constitute a threat to the health and safety of the off-site population. Such an occurrence, though not probable, could affect the short and long-term health and safety of the public living near the nuclear power plant, and cause long-term environmental contamination around the plant. As a result, the construction and operation of nuclear power plants are closely monitored and regulated by the Federal government. Communities with a nuclear power plant must develop detailed plans for responding to and recovering from such an incident, focusing on the 10 mile Emergency Planning Zone (EPZ) around the plant, and a 50 mile Secondary EPZ that exists to prevent the introduction of radioactive contamination into the food chain. Michigan has 3 active and 1 in-active commercial nuclear power plants, in addition to 4 small nuclear testing/research facilities located at 3 state universities and within the City of Midland. Presque Isle County does not have a Nuclear power plant.


Presque Isle County Base Map
Infrastructure
Oil & Gas Wells
Townships
Rogers City
Millersburg
Onaway
Posen
County Roads
M 33
M 65
M 68
US 23
Rivers
Public Lands
0
2.5
5
10
Miles
NEMCOG
Bearinger Township
Rogers Township
Metz Township
Belknap Township
Pulawski Township
Krakow Township
Presque Isle Township
North Allis Township
Millersburg
Denmark Township
Posen
Posen Township
Allis Township
Onaway


Presque Isle County Hazards Map
Infrastructure
Oil & Gas Wells
Townships
Rogers City
Millersburg
Onaway
Posen
County Roads
M 33
M 65
M 68
US 23
Rivers
Forest Types
Northern Hardwoods
Aspen Birch
Oak
Other Upland Conifers
Pine
Wetland Types
Aquatic Bed
Emergent
Forested
Open Water
Scrub Shrub
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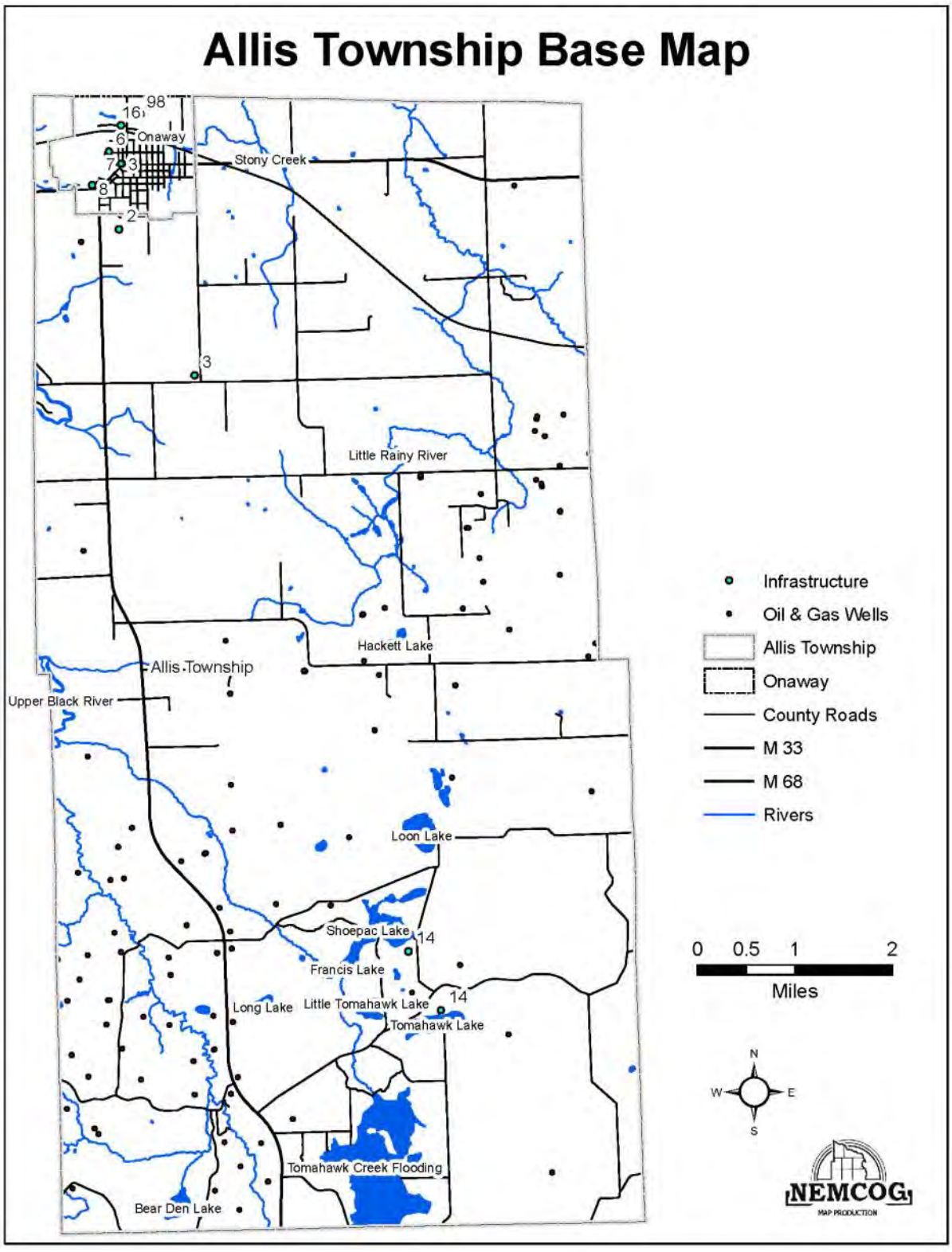
Allis Township Base Map
98
16
Onaway
6
7
3
8
2
Stony Creek
3
Little Rainy River
Hackett Lake
Allis Township
Upper Black River
Loon Lake
Shoepac Lake
14
Francis Lake
Long Lake
Little Tomahawk Lake
14
Tomahawk Lake
Tomahawk Creek Flooding
Bear Den Lake
Infrastructure
Oil & Gas Wells
Allis Township
Onaway
County Roads
M 33
M 68
Rivers
0 0.5 1 2
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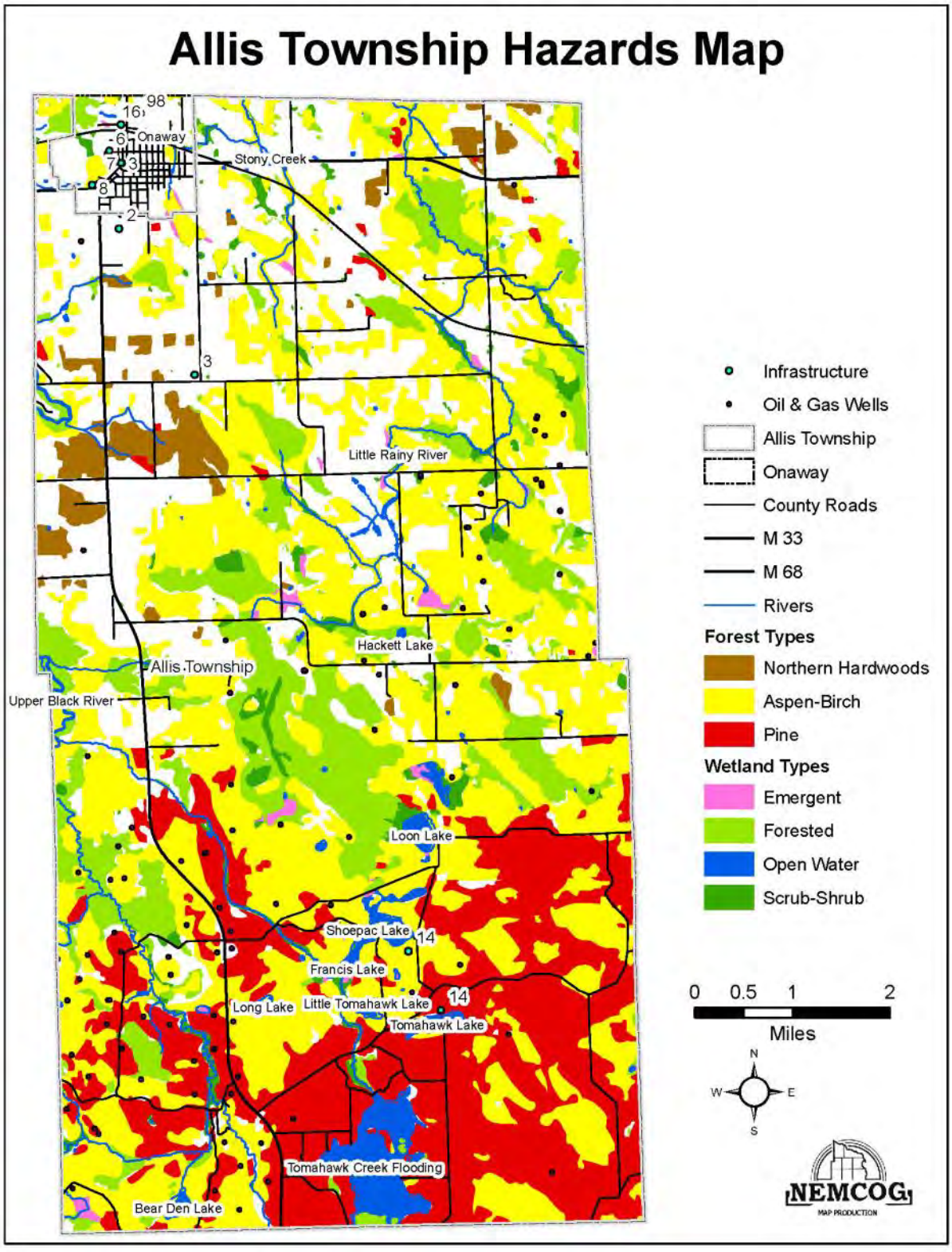
MAP PRODUCTION


Allis Township Hazards Map
Onaway
Stony Creek
Little Rainy River
Hackett Lake
Allis Township
Upper Black River
Loon Lake
Shoepac Lake
Francis Lake
Long Lake
Little Tomahawk Lake
Tomahawk Lake
Tomahawk Creek Flooding
Bear Den Lake
Infrastructure
Oil & Gas Wells
Allis Township
Onaway
County Roads
M 33
M 68
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Pine
Wetland Types
Emergent
Forested
Open Water
Scrub-Shrub
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Miles
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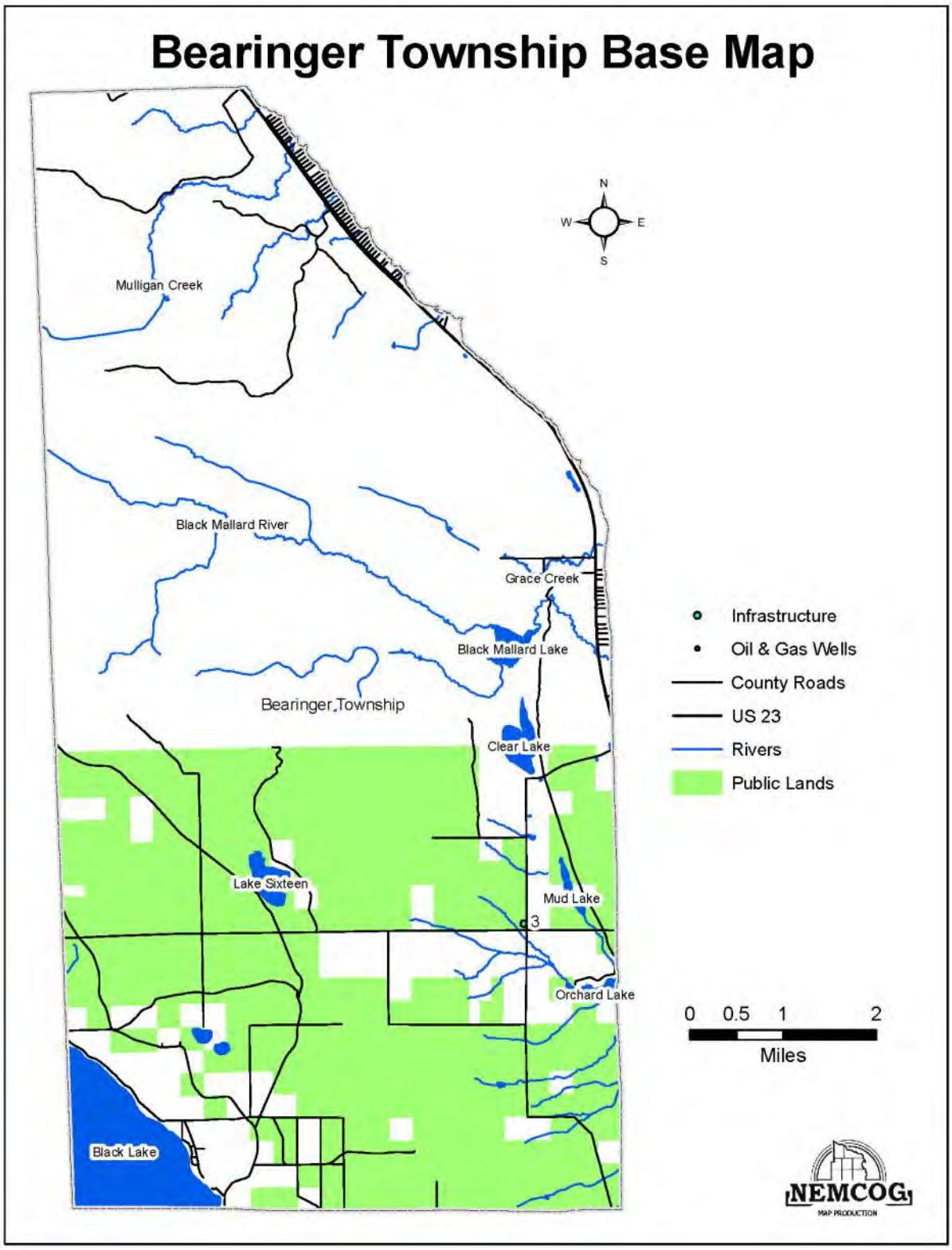
MAP PRODUCTION


Bearinger Township Base Map
N
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Mulligan Creek
Black Mallard River
Grace Creek
Black Mallard Lake
Bearinger Township
Clear Lake
Lake Sixteen
Mud Lake
3
Orchard Lake
Black Lake
Infrastructure
Oil & Gas Wells
County Roads
US 23
Rivers
Public Lands
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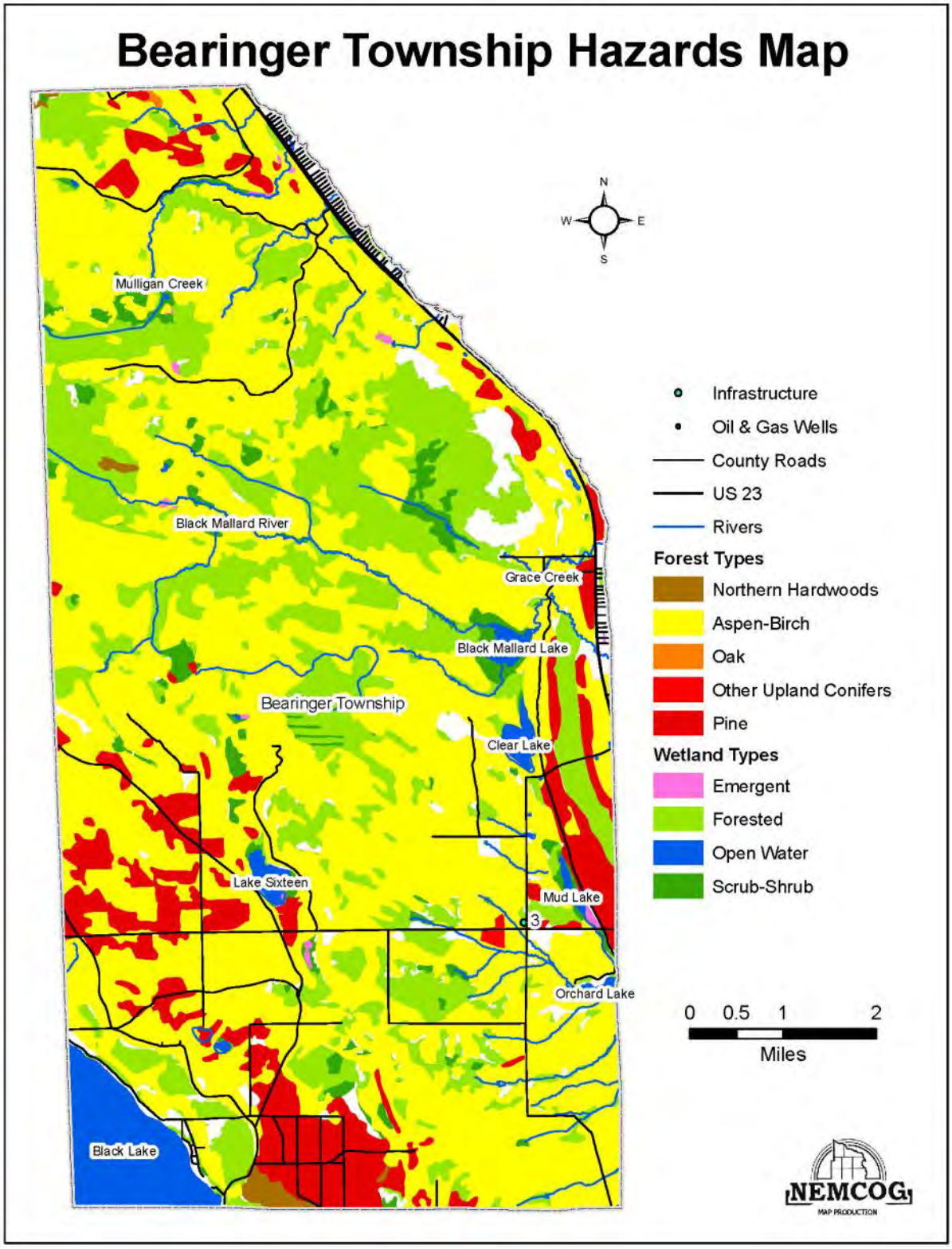
MAP PRODUCTION


Bearinger Township Hazards Map
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Mulligan Creek
Black Mallard River
Grace Creek
Black Mallard Lake
Bearinger Township
Clear Lake
Lake Sixteen
Mud Lake
3
Orchard Lake
Black Lake
Infrastructure
Oil & Gas Wells
County Roads
US 23
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Oak
Other Upland Conifers
Pine
Wetland Types
Emergent
Forested
Open Water
Scrub-Shrub
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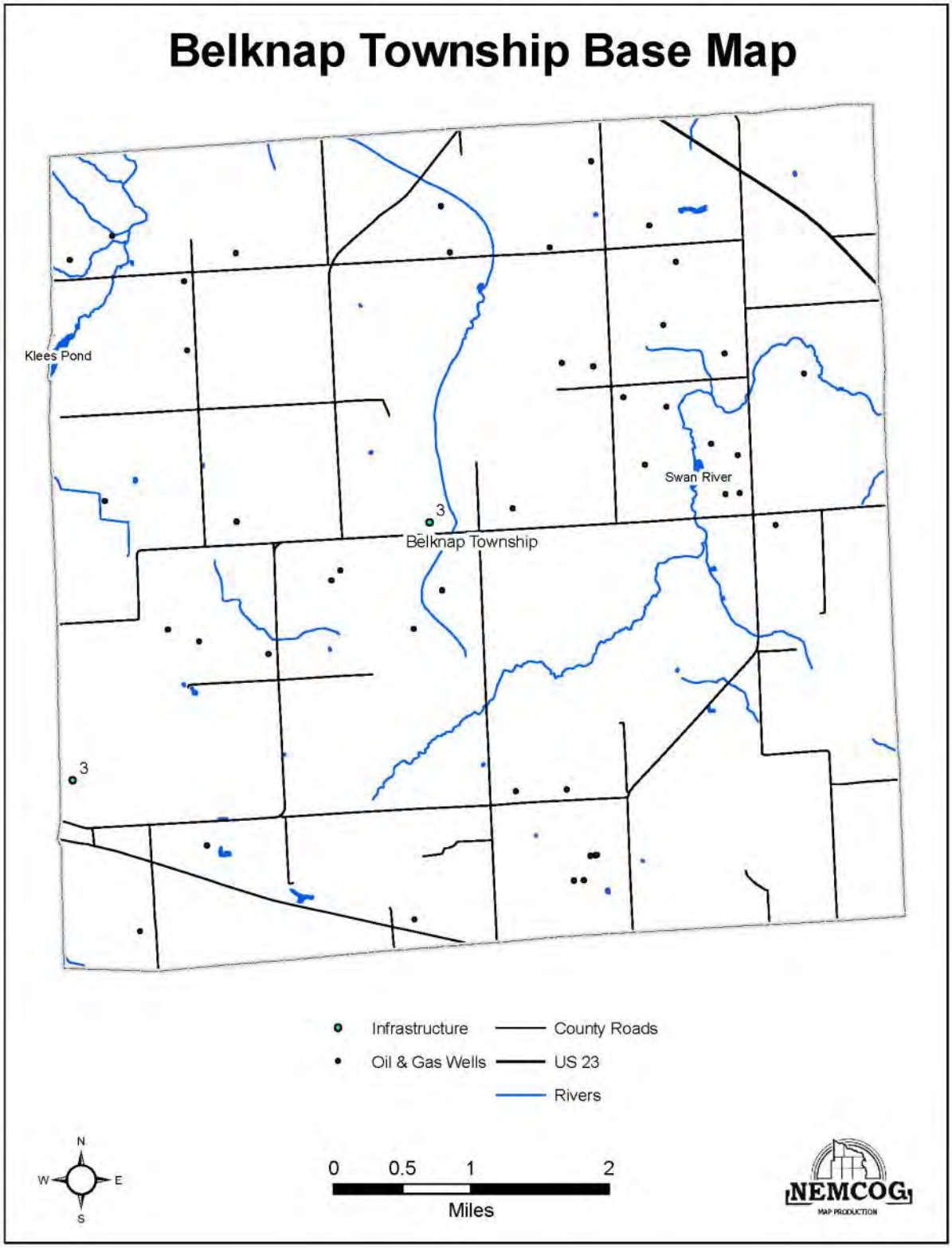
MAP PRODUCTION


Belknap Township Base Map
Klees Pond
Swan River
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Belknap Township
3
Infrastructure
Oil & Gas Wells
County Roads
US 23
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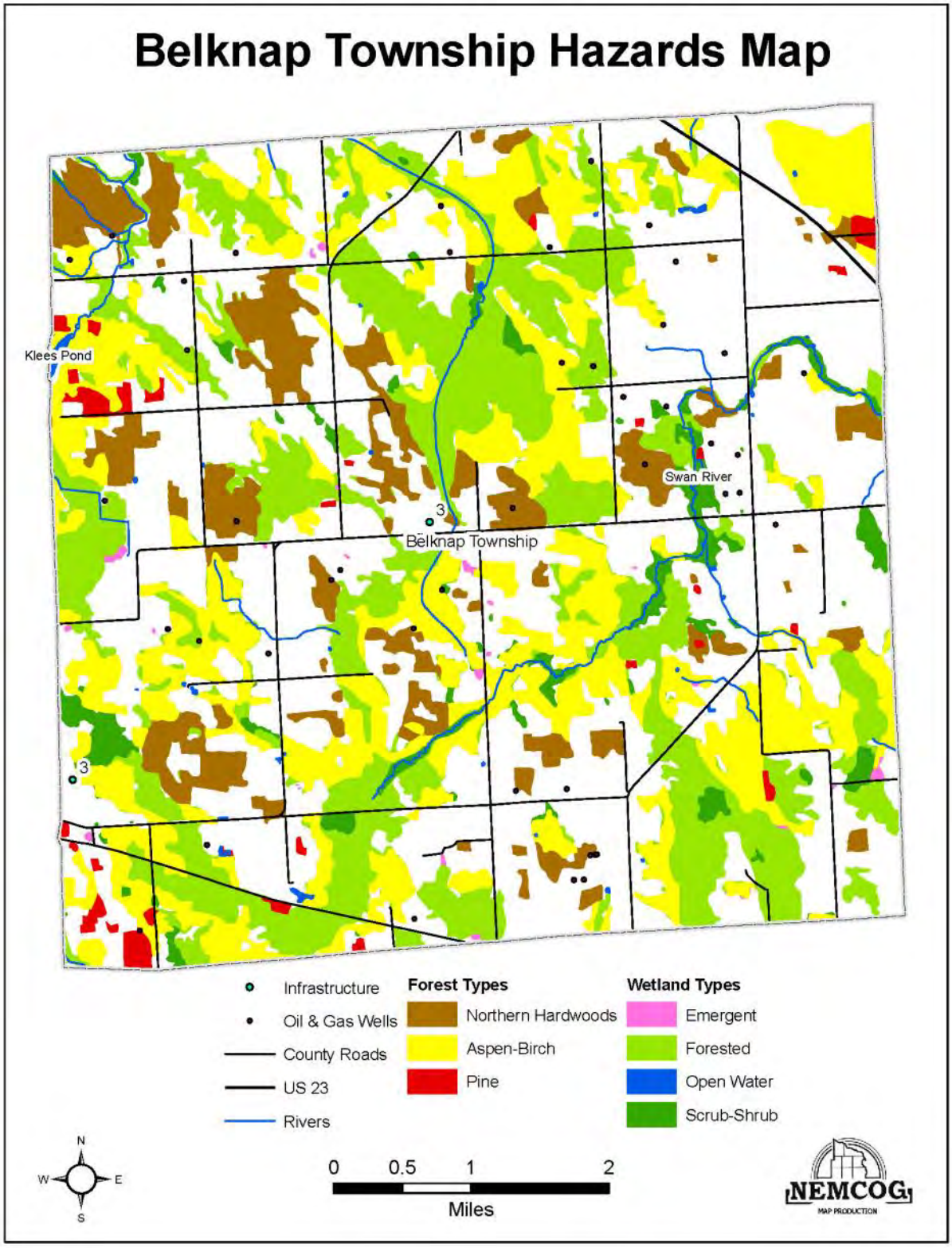
MAP PRODUCTION


Belknap Township Hazards Map
Klees Pond
Swan River
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Belknap Township
3
Infrastructure
Oil & Gas Wells
County Roads
US 23
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Pine
Wetland Types
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Forested
Open Water
Scrub-Shrub
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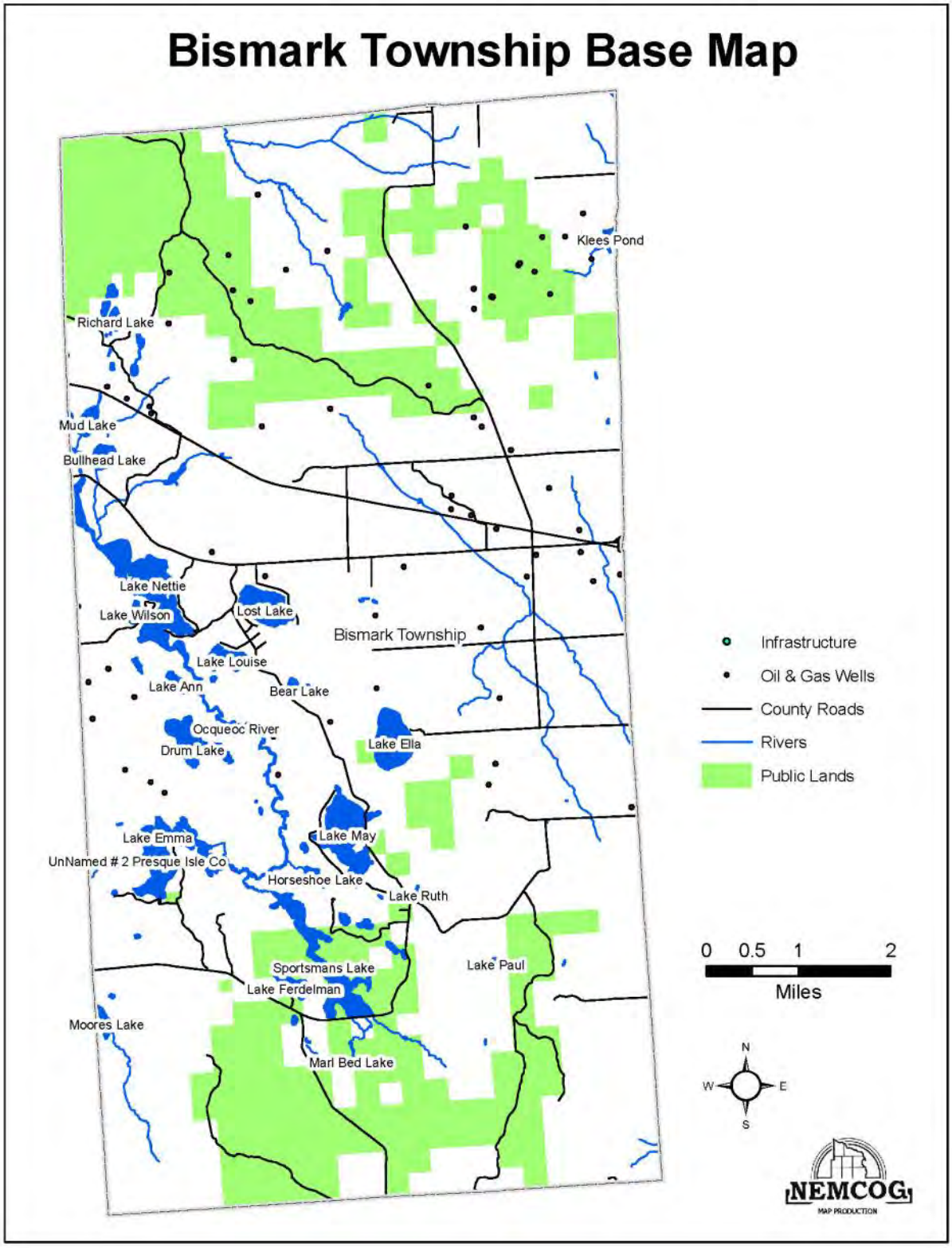
NEMCOG
MAP PRODUCTION


Bismark Township Base Map
Klees Pond
Richard Lake
Mud Lake
Bullhead Lake
Lake Nettie
Lake Wilson
Lost Lake
Bismark Township
Lake Louise
Lake Ann
Bear Lake
Ocqueoc River
Drum Lake
Lake Ella
Lake Emma
Lake May
UnNamed # 2 Presque Isle Co
Horseshoe Lake
Lake Ruth
Sportsmans Lake
Lake Ferdelman
Lake Paul
Moores Lake
Marl Bed Lake
Infrastructure
Oil & Gas Wells
County Roads
Rivers
Public Lands
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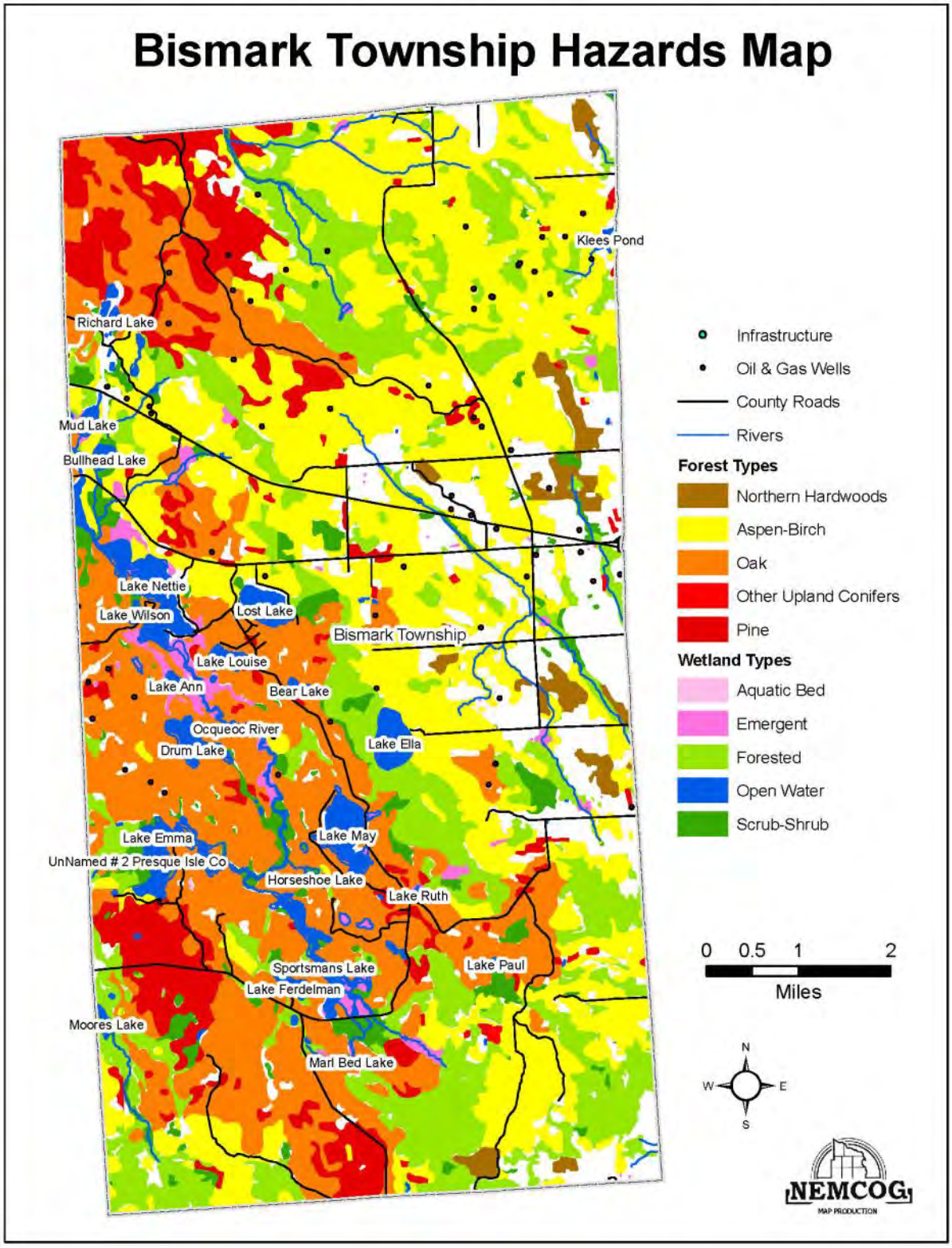
NEMCOG
MAP PRODUCTION


Bismark Township Hazards Map
Klees Pond
Richard Lake
Mud Lake
Bullhead Lake
Lake Nettie
Lake Wilson
Lost Lake
Bismark Township
Lake Louise
Lake Ann
Bear Lake
Ocqueoc River
Drum Lake
Lake Ella
Lake Emma
Lake May
UnNamed # 2 Presque Isle Co
Horseshoe Lake
Lake Ruth
Sportsmans Lake
Lake Ferdelman
Lake Paul
Moores Lake
Marl Bed Lake
Infrastructure
Oil & Gas Wells
County Roads
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Oak
Other Upland Conifers
Pine
Wetland Types
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
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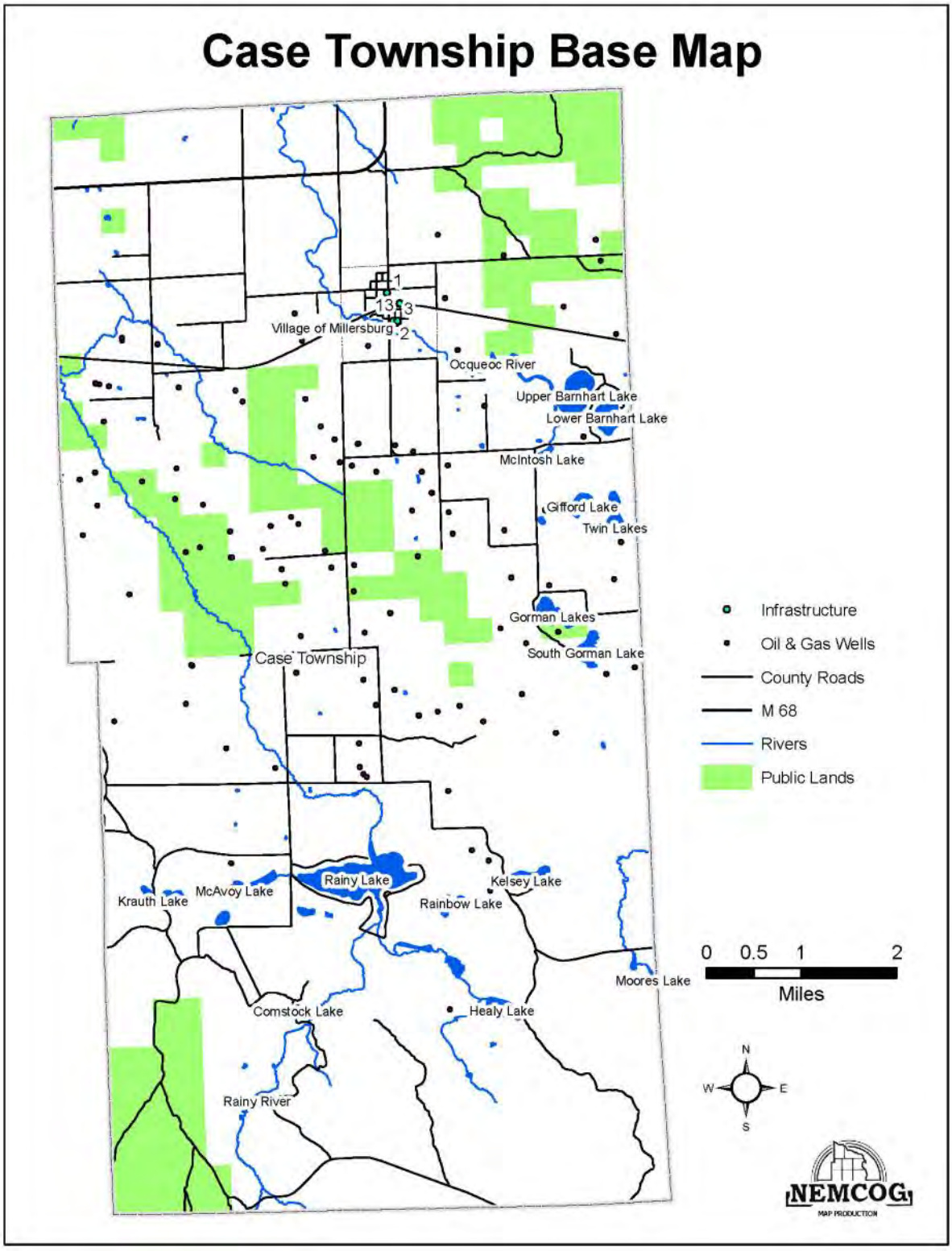
MAP PRODUCTION


Case Township Base Map
Village of Millersburg
Ocqueoc River
Upper Barnhart Lake
Lower Barnhart Lake
McIntosh Lake
Gifford Lake
Twin Lakes
Gorman Lakes
South Gorman Lake
Case Township
Rainy Lake
Kelsey Lake
Krauth Lake
McAvoy Lake
Rainbow Lake
Moores Lake
Comstock Lake
Healy Lake
Rainy River
Infrastructure
Oil & Gas Wells
County Roads
M 68
Rivers
Public Lands
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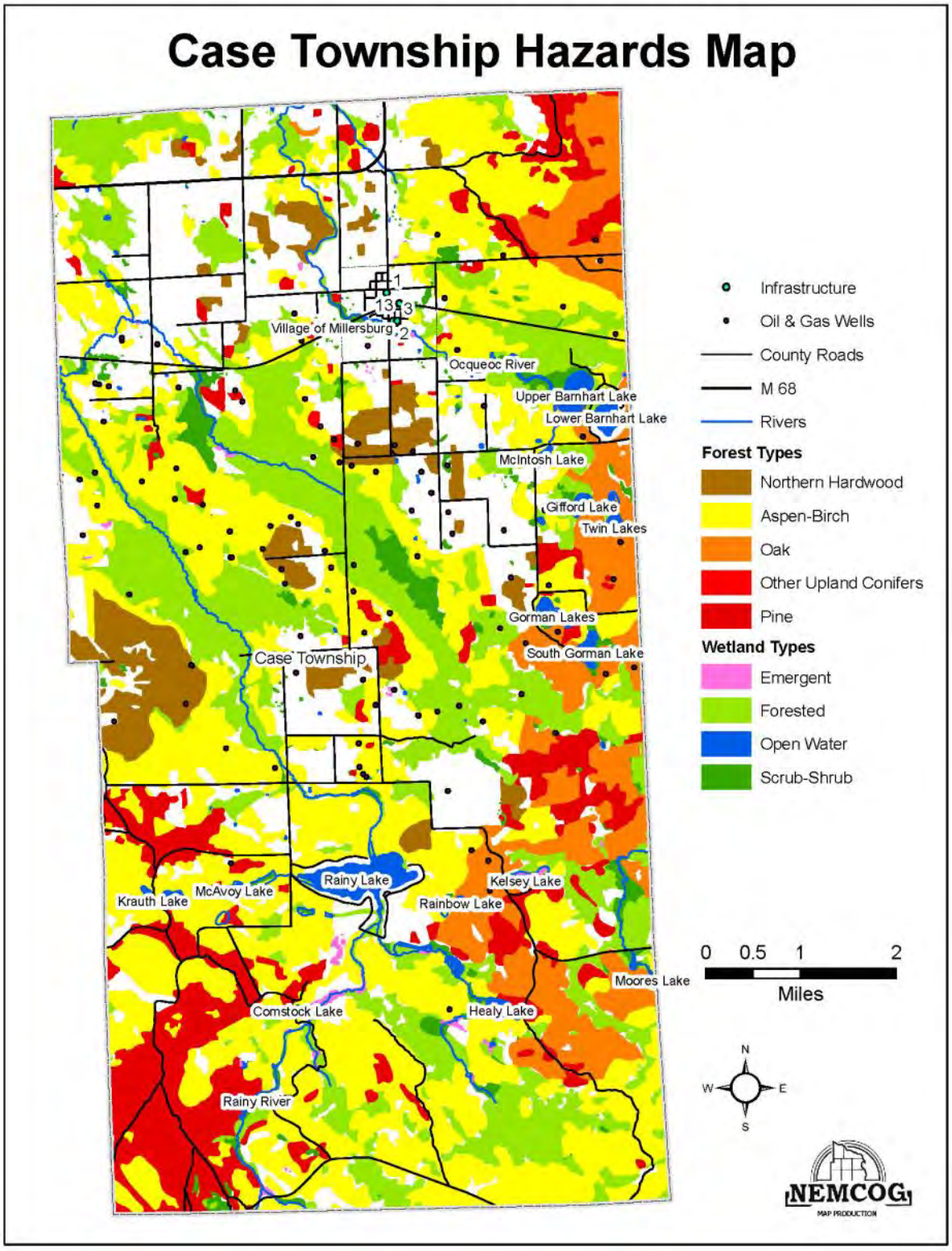
NEMCOG
MAP PRODUCTION


Case Township Hazards Map
Village of Millersburg
Ocqueoc River
Upper Barnhart Lake
Lower Barnhart Lake
McIntosh Lake
Gifford Lake
Twin Lakes
Gorman Lakes
South Gorman Lake
Case Township
Rainy Lake
Kelsey Lake
Krauth Lake
McAvoy Lake
Rainbow Lake
Moores Lake
Comstock Lake
Healy Lake
Rainy River
Infrastructure
Oil & Gas Wells
County Roads
M 68
Rivers
Forest Types
Northern Hardwood
Aspen-Birch
Oak
Other Upland Conifers
Pine
Wetland Types
Emergent
Forested
Open Water
Scrub-Shrub
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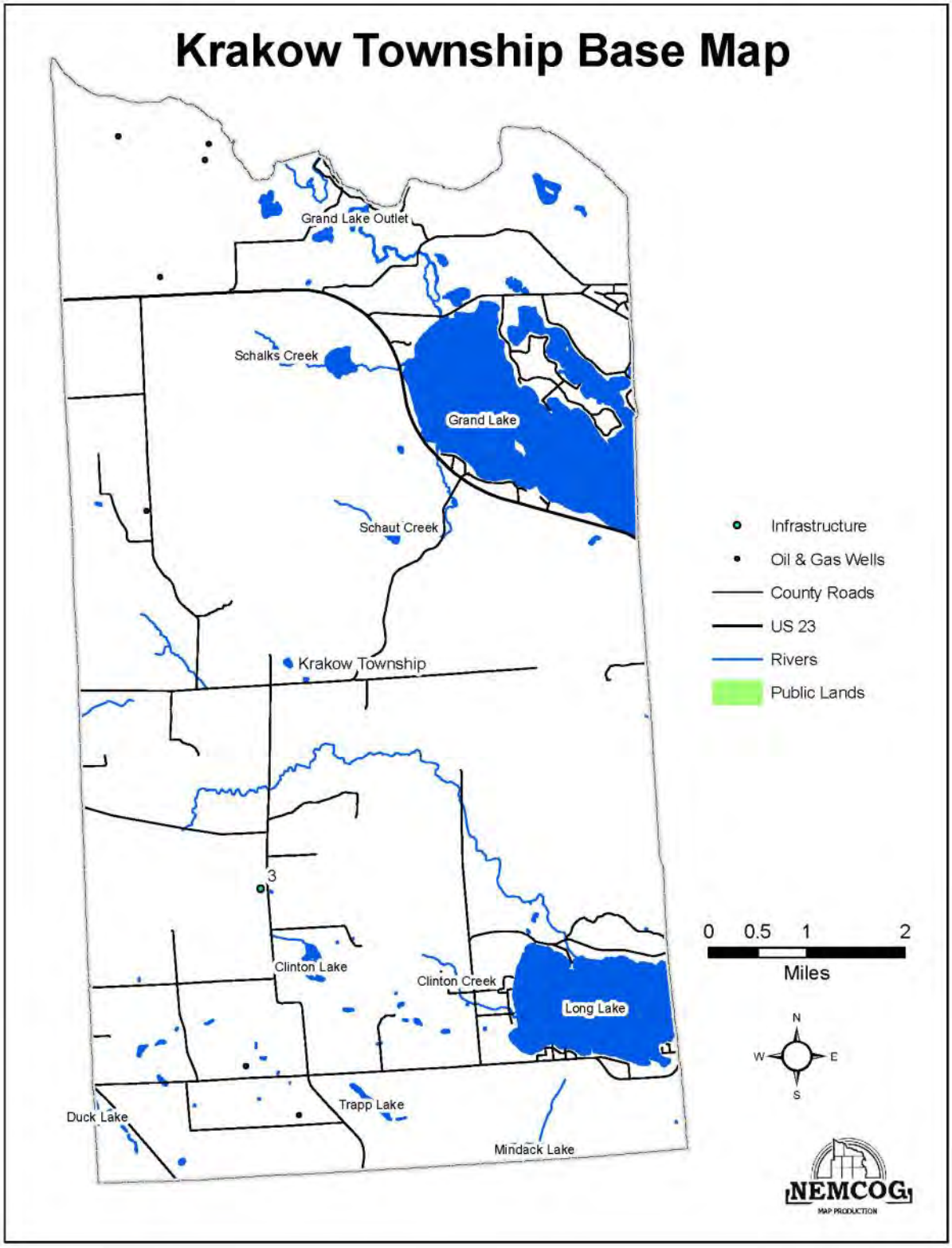
MAP PRODUCTION


Krakow Township Base Map
Grand Lake Outlet
Schalks Creek
Grand Lake
Schaut Creek
Krakow Township
3
Clinton Lake
Clinton Creek
Long Lake
Trapp Lake
Duck Lake
Mindack Lake
Infrastructure
Oil & Gas Wells
County Roads
US 23
Rivers
Public Lands
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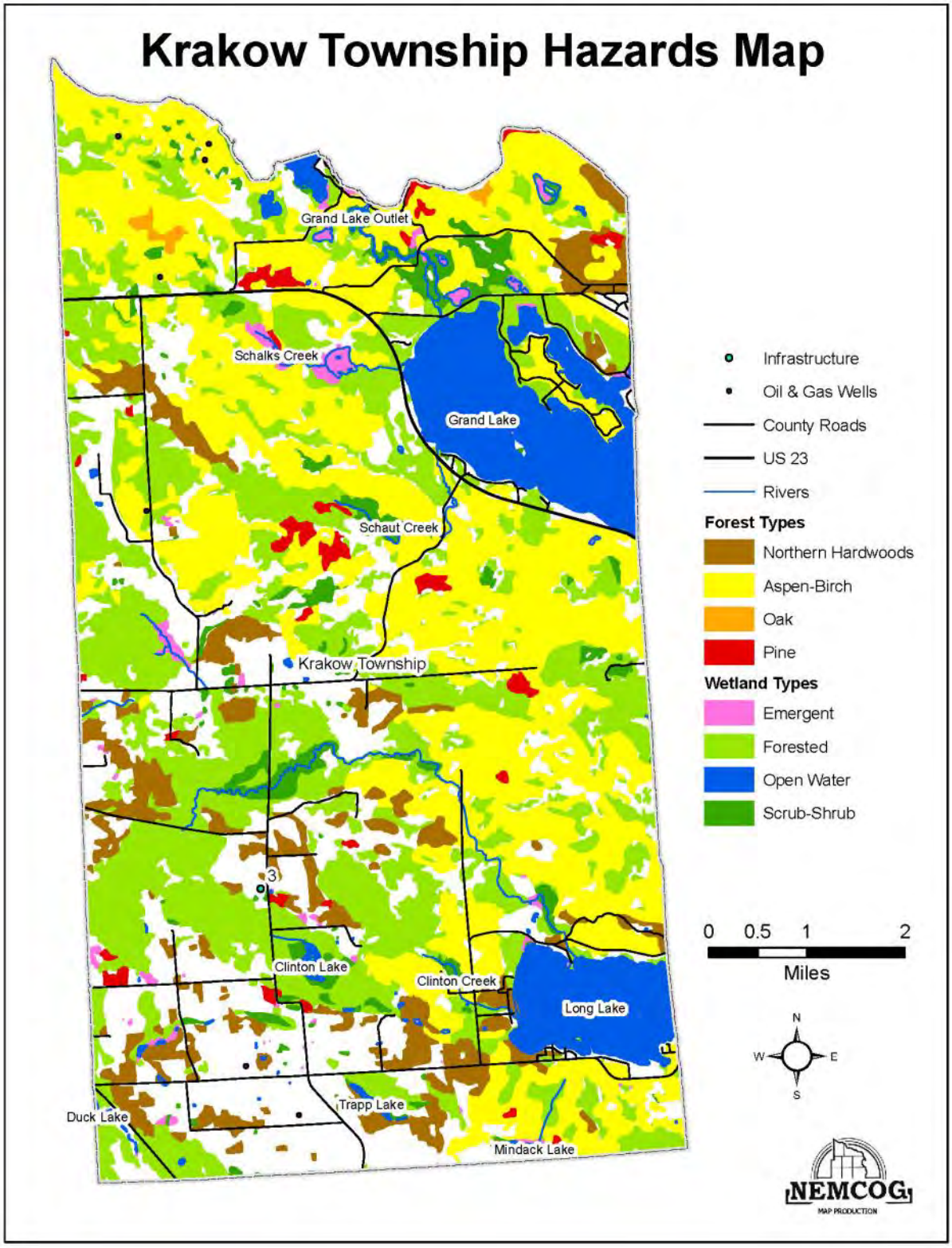
MAP PRODUCTION


Krakow Township Hazards Map
Grand Lake Outlet
Schalks Creek
Grand Lake
Schaut Creek
Krakow Township
Clinton Lake
Clinton Creek
Long Lake
Trapp Lake
Duck Lake
Mindack Lake
Infrastructure
Oil & Gas Wells
County Roads
US 23
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Oak
Pine
Wetland Types
Emergent
Forested
Open Water
Scrub-Shrub
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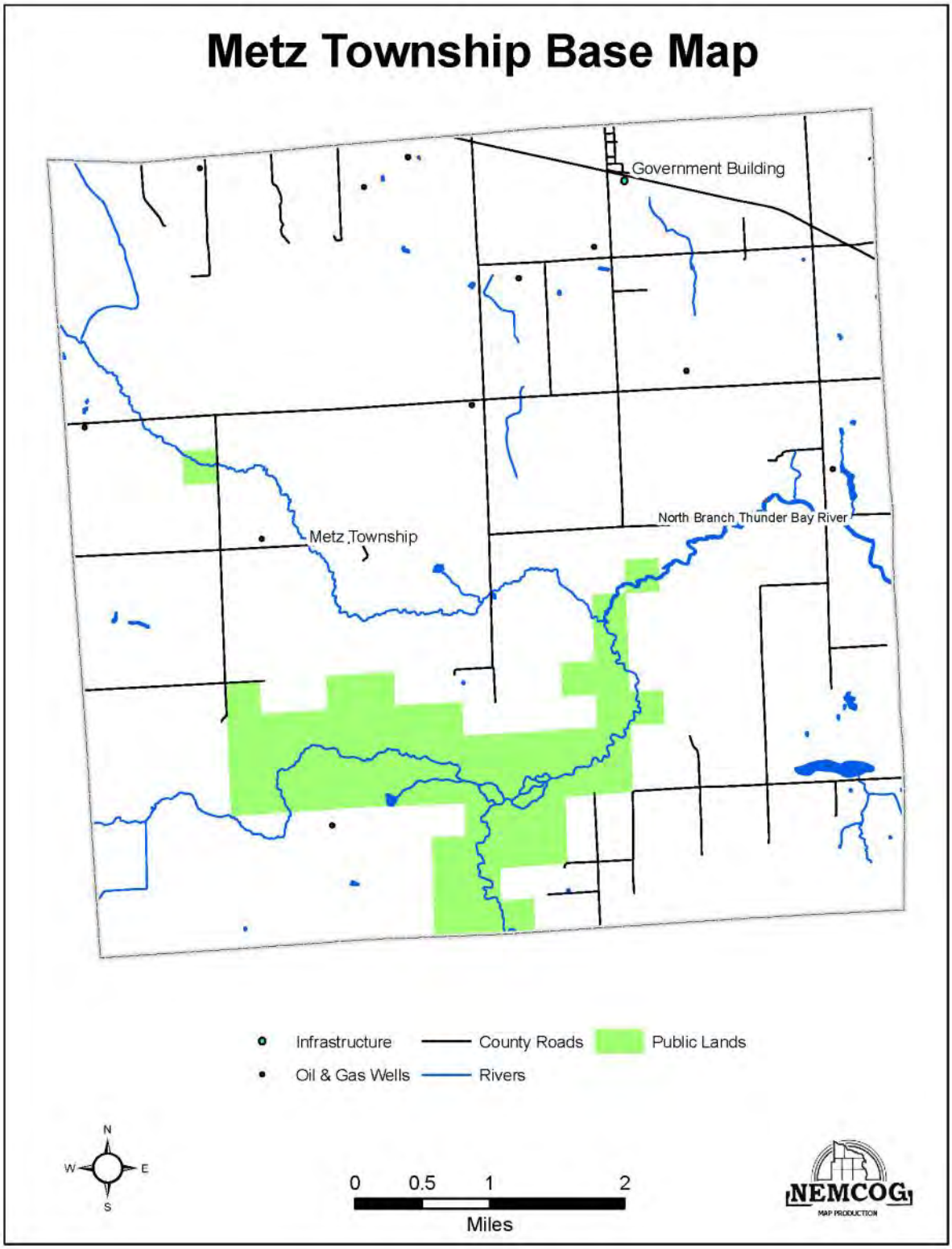
MAP PRODUCTION


Metz Township Base Map
Government Building
Metz Township
North Branch Thunder Bay River
Infrastructure
County Roads
Public Lands
Oil & Gas Wells
Rivers
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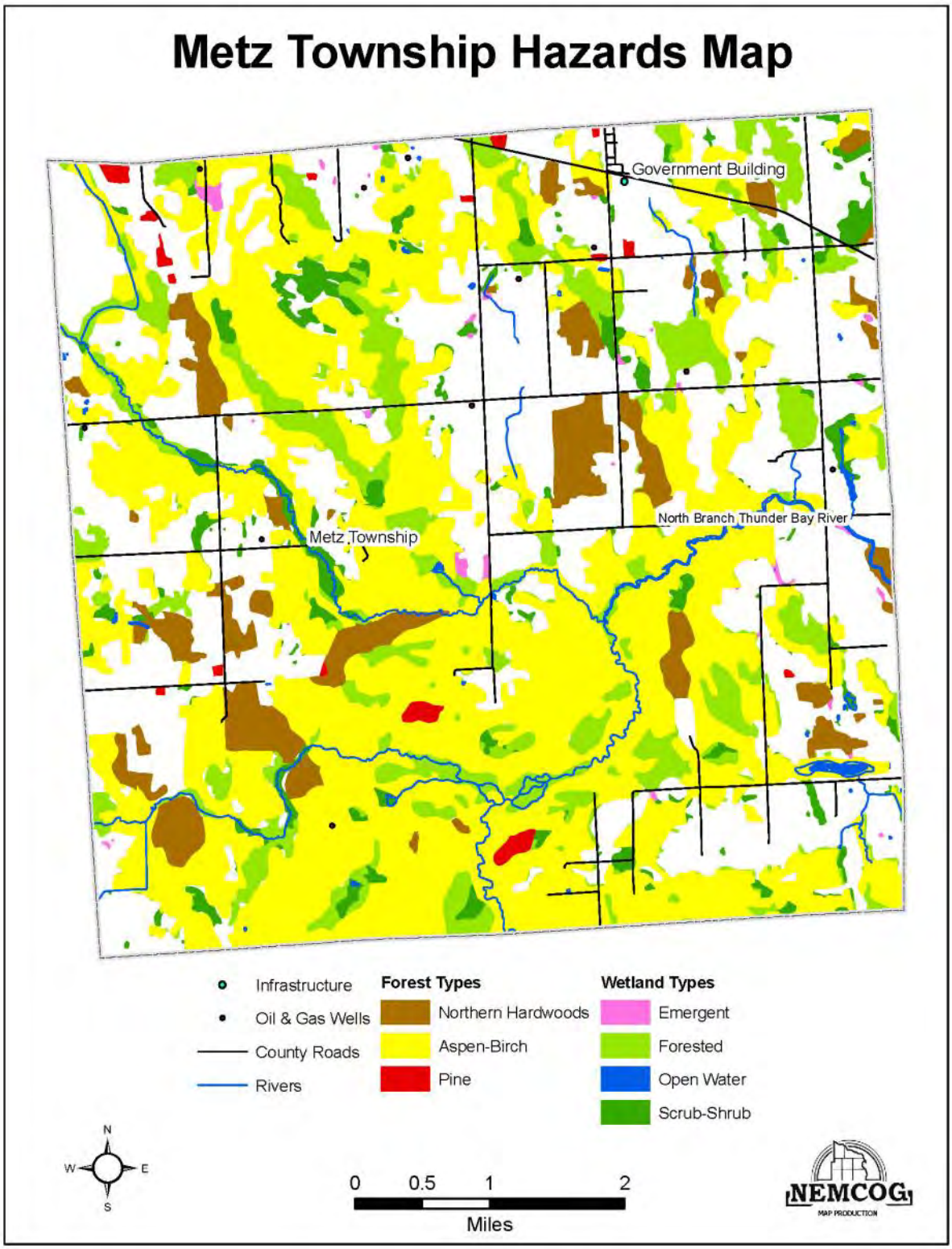
NEMCOG
MAP PRODUCTION


Metz Township Hazards Map
Government Building
North Branch Thunder Bay River
Metz Township
Infrastructure
Oil & Gas Wells
County Roads
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Pine
Wetland Types
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Forested
Open Water
Scrub-Shrub
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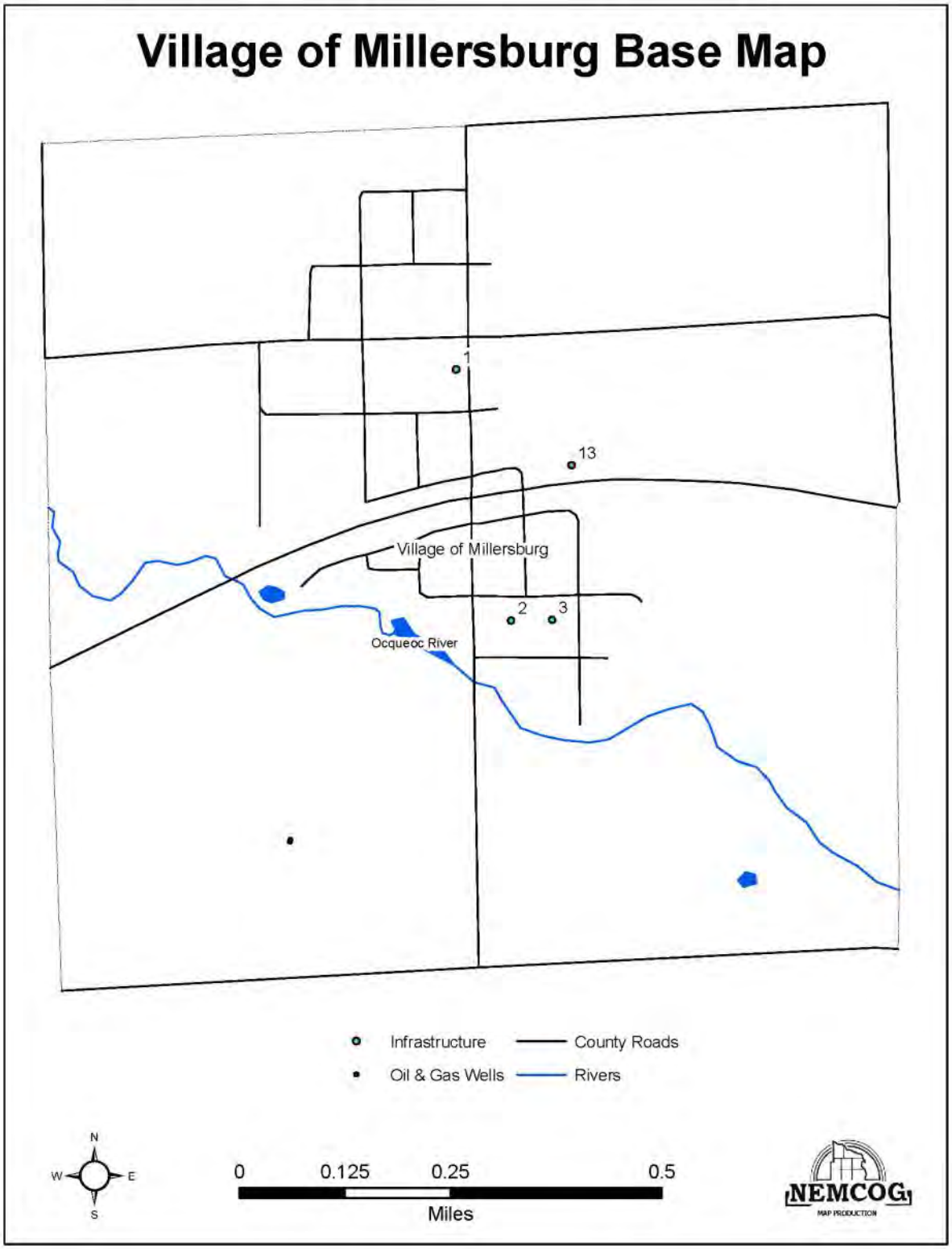
NEMCOG
MAP PRODUCTION


Village of Millersburg Base Map
1
13
Village of Millersburg
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3
Ocqueoc River
Infrastructure
County Roads
Oil & Gas Wells
Rivers
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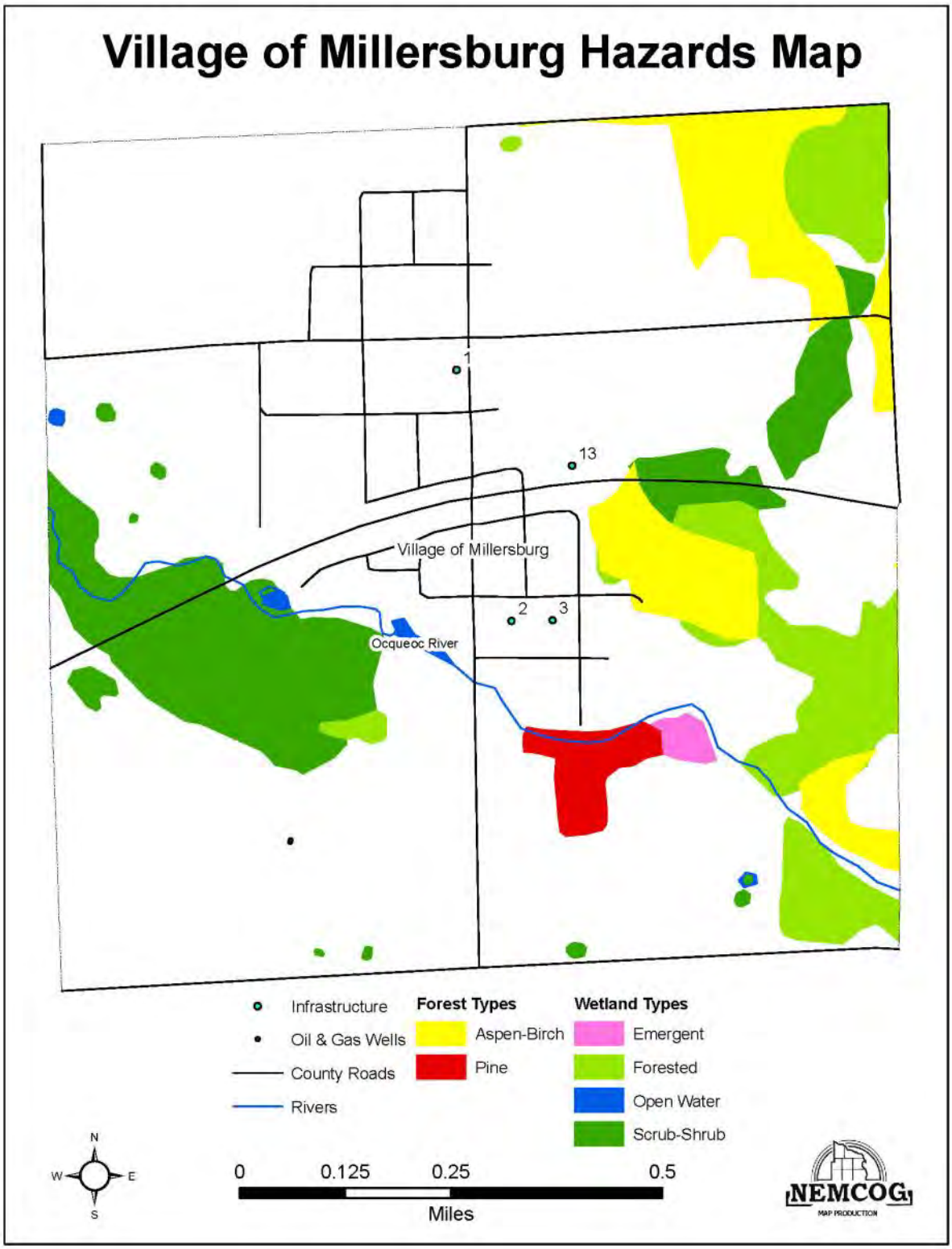
MAP PRODUCTION


Village of Millersburg Hazards Map
1
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Village of Millersburg
2
3
Ocqueoc River
Infrastructure
Oil & Gas Wells
County Roads
Rivers
Forest Types
Aspen-Birch
Pine
Wetland Types
Emergent
Forested
Open Water
Scrub-Shrub
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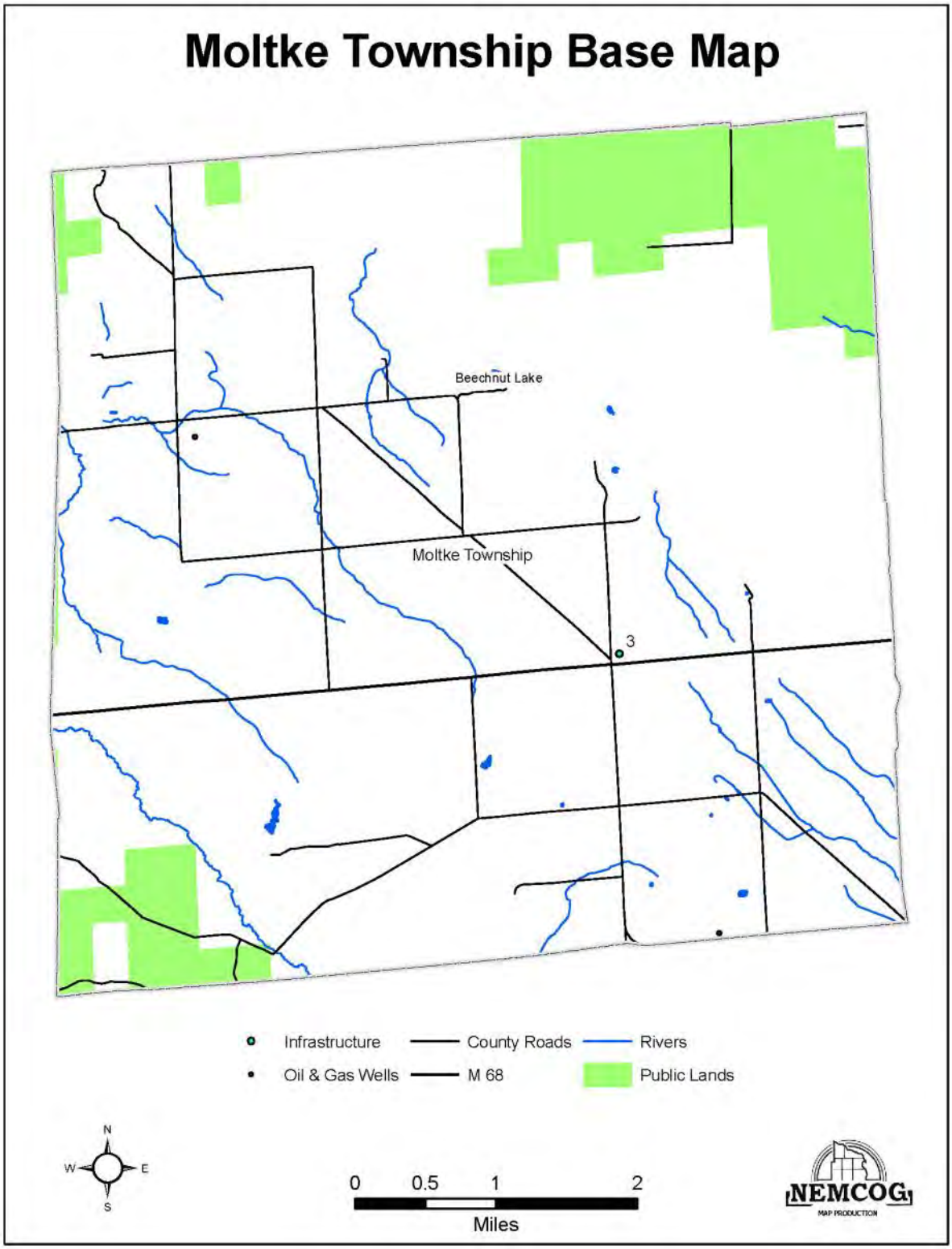
MAP PRODUCTION


Moltke Township Base Map
Beechnut Lake
Moltke Township
3
Infrastructure
County Roads
Rivers
Oil & Gas Wells
M 68
Public Lands
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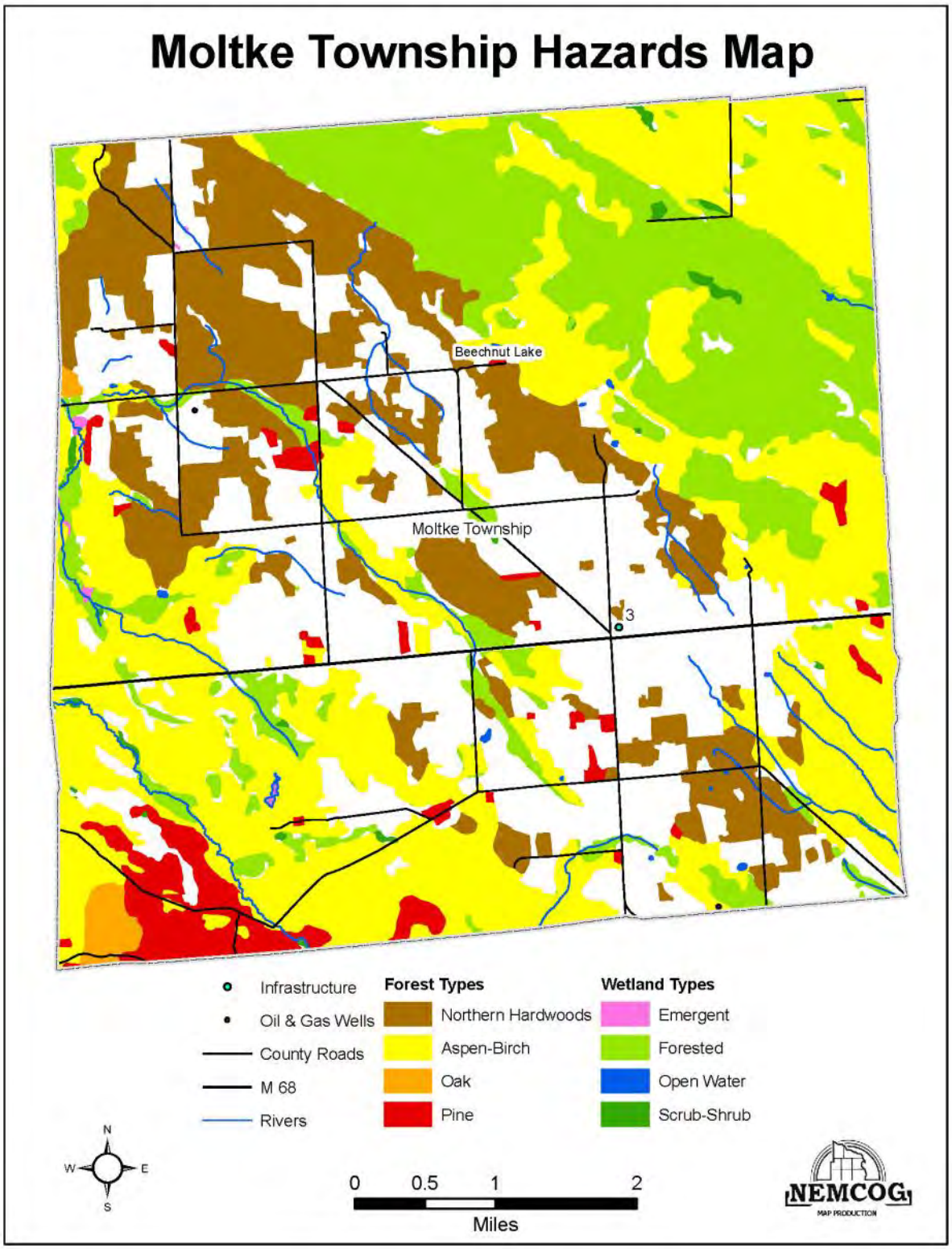
Miles
NEMCOG
MAP PRODUCTION


Moltke Township Hazards Map
Beechnut Lake
Moltke Township
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Infrastructure
Oil & Gas Wells
County Roads
M 68
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Oak
Pine
Wetland Types
Emergent
Forested
Open Water
Scrub-Shrub
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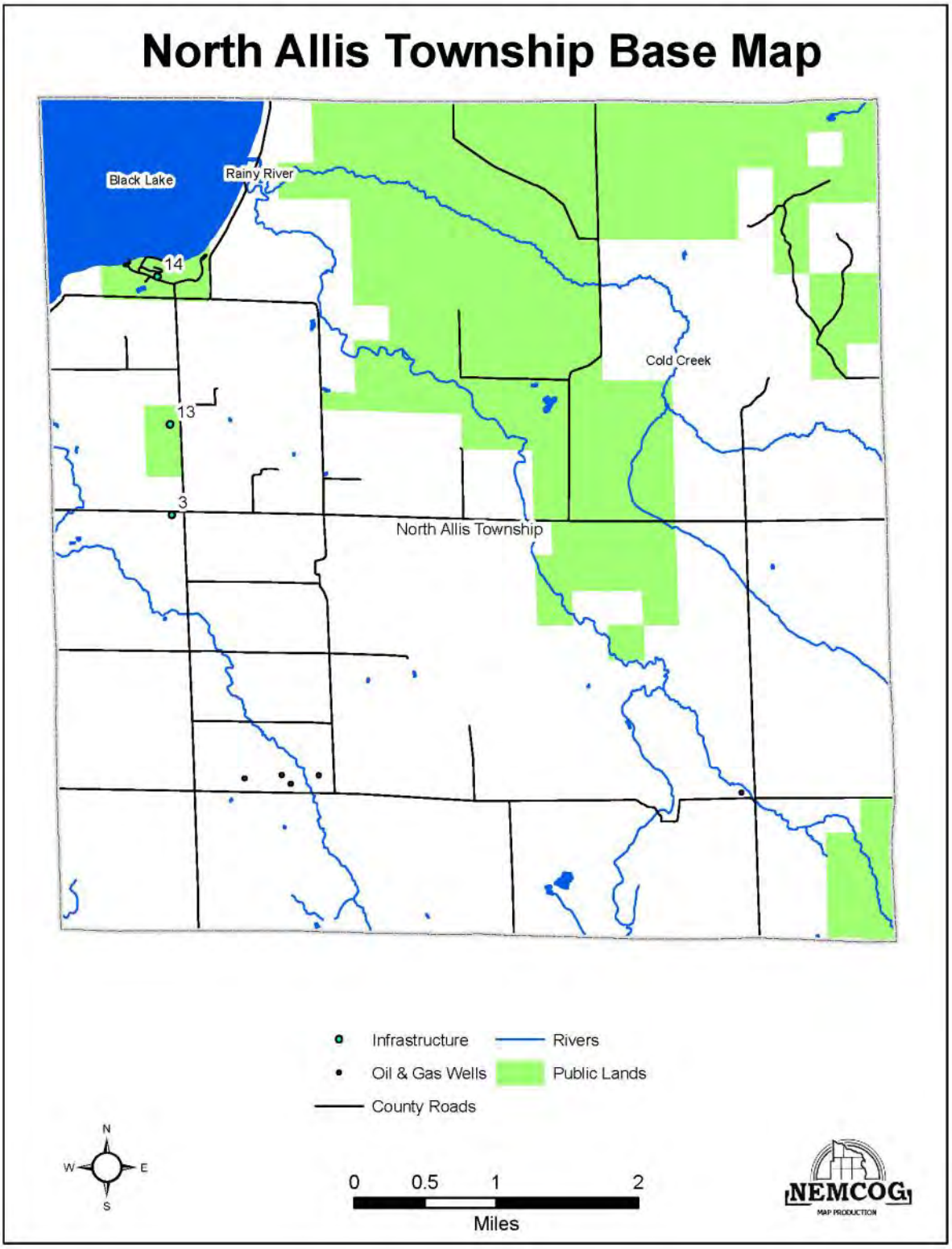
MAP PRODUCTION


North Allis Township Base Map
Black Lake
Rainy River
14
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Cold Creek
North Allis Township
Infrastructure
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County Roads
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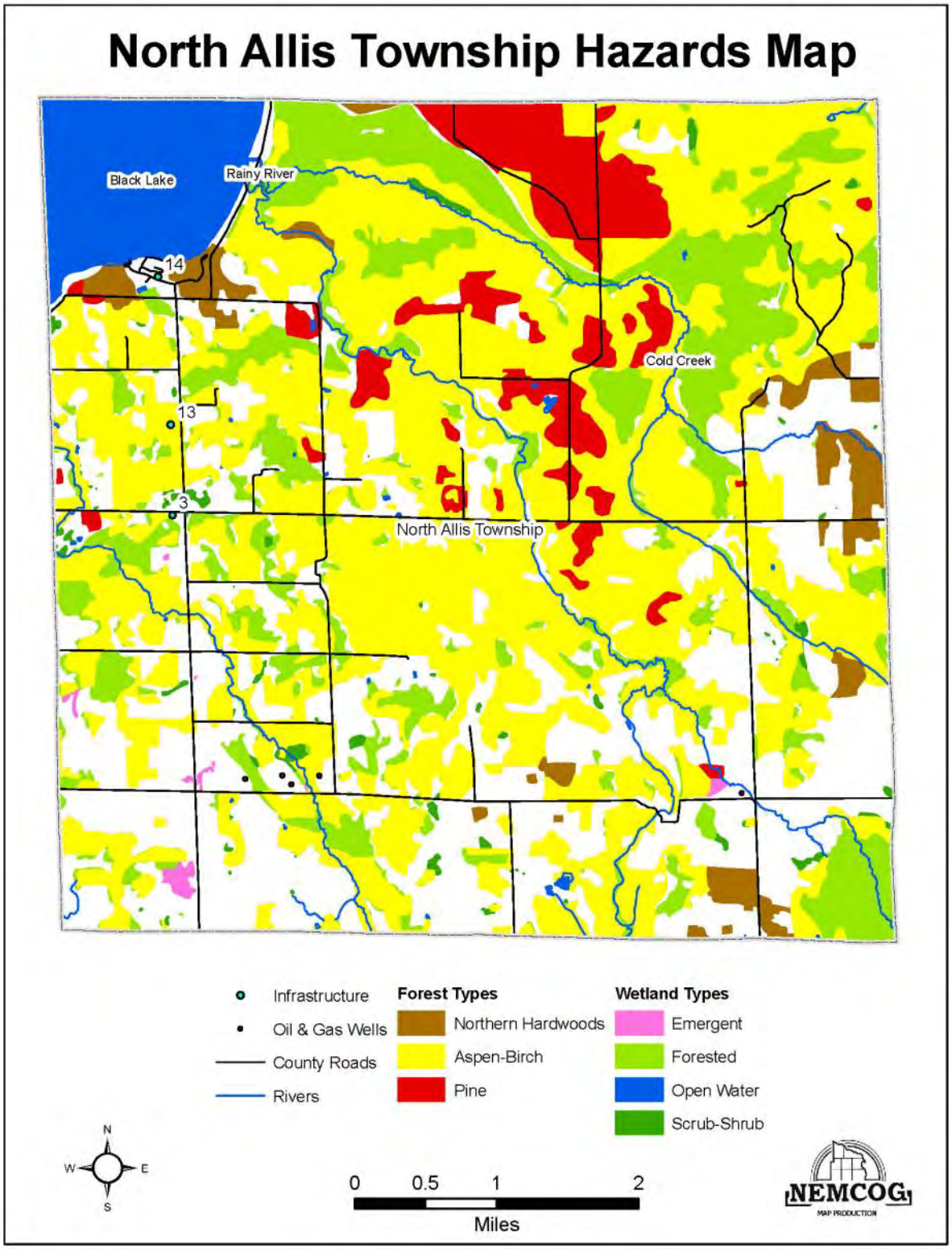
MAP PRODUCTION


North Allis Township Hazards Map
Black Lake
Rainy River
14
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Cold Creek
North Allis Township
Infrastructure
Oil & Gas Wells
County Roads
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Pine
Wetland Types
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Forested
Open Water
Scrub-Shrub
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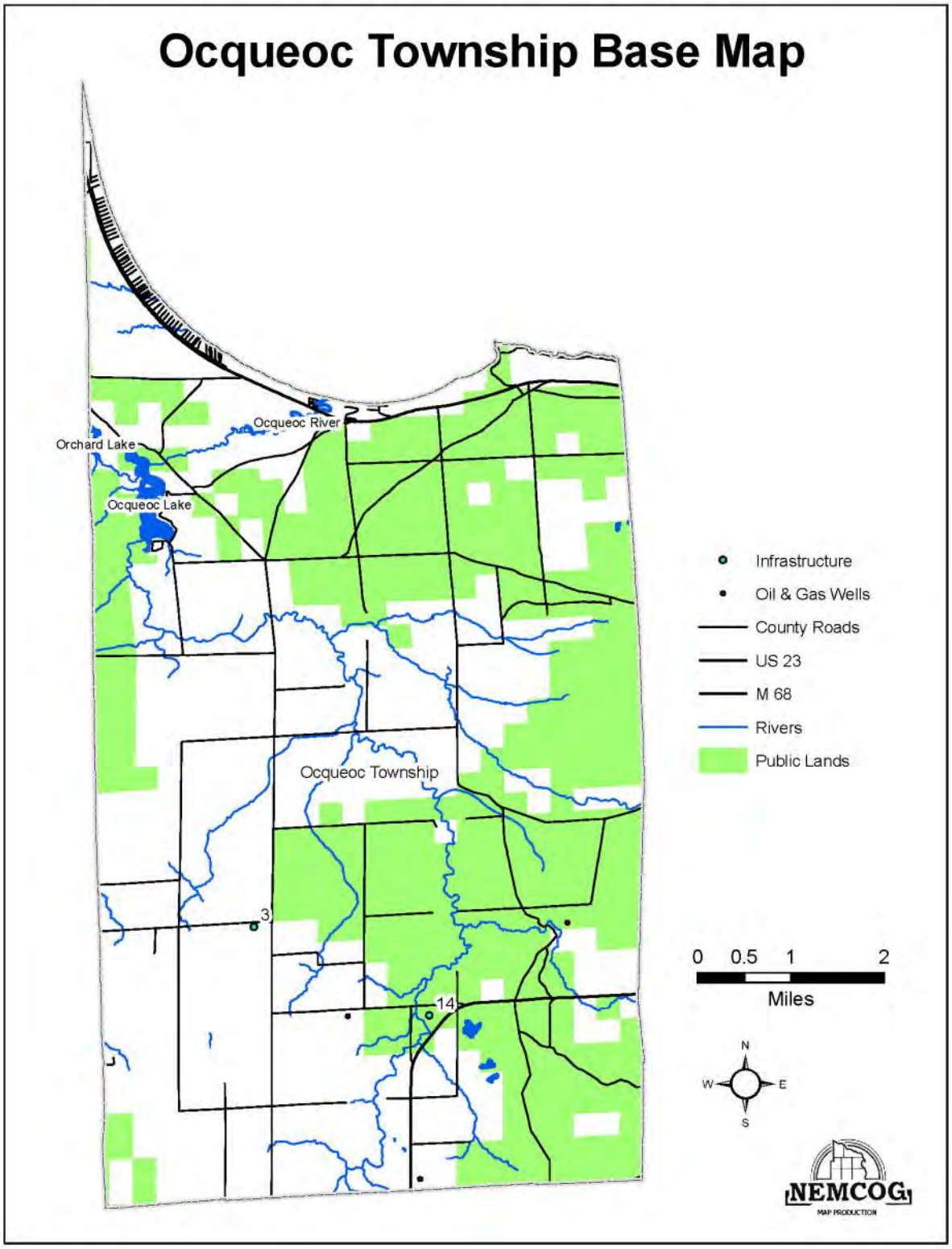
MAP PRODUCTION


Ocqueoc Township Base Map
Ocqueoc River
Orchard Lake
Ocqueoc Lake
Ocqueoc Township
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14
Infrastructure
Oil & Gas Wells
County Roads
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M 68
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Public Lands
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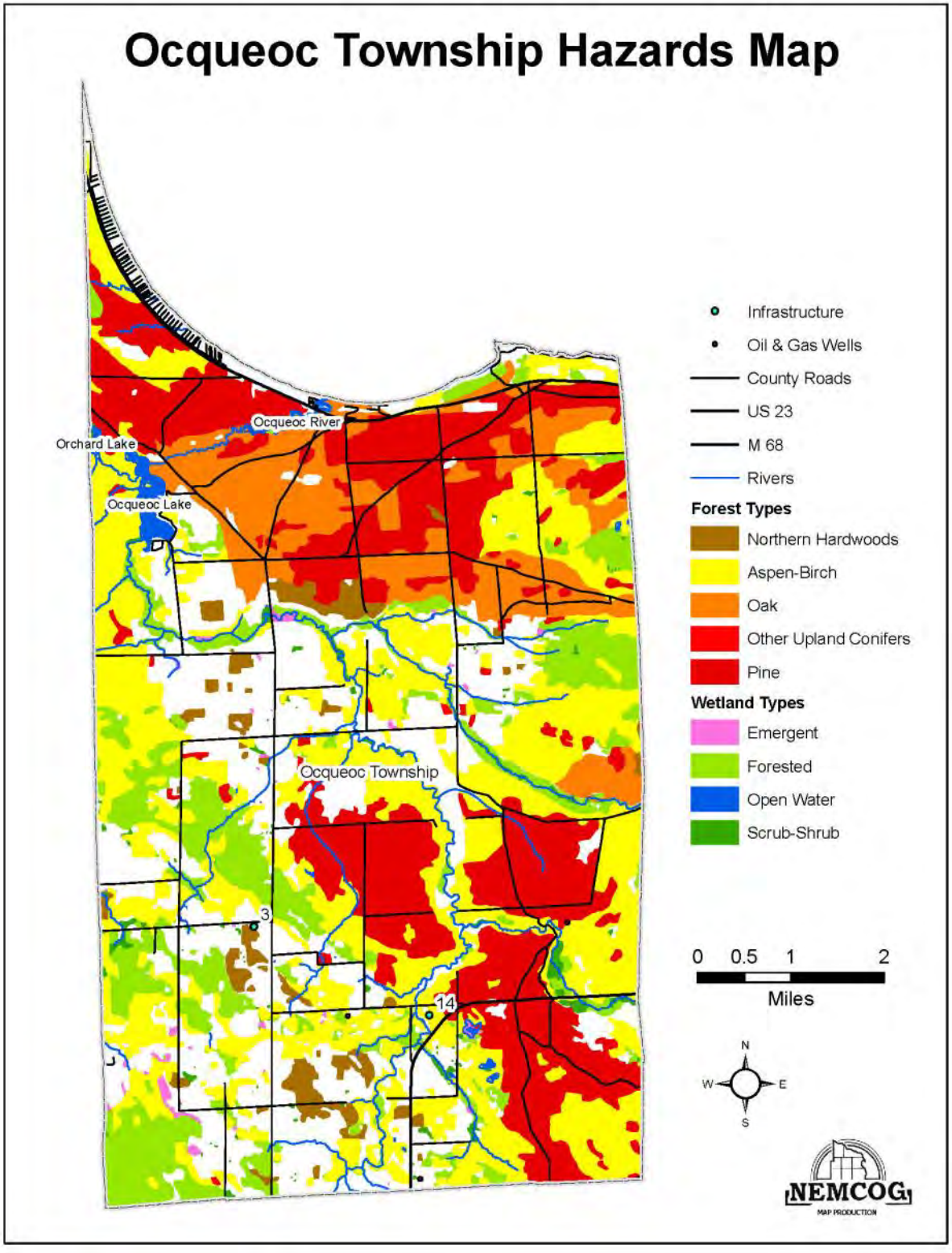
MAP PRODUCTION


Ocqueoc Township Hazards Map
Ocqueoc River
Orchard Lake
Ocqueoc Lake
Ocqueoc Township
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Infrastructure
Oil & Gas Wells
County Roads
US 23
M 68
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Oak
Other Upland Conifers
Pine
Wetland Types
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Forested
Open Water
Scrub-Shrub
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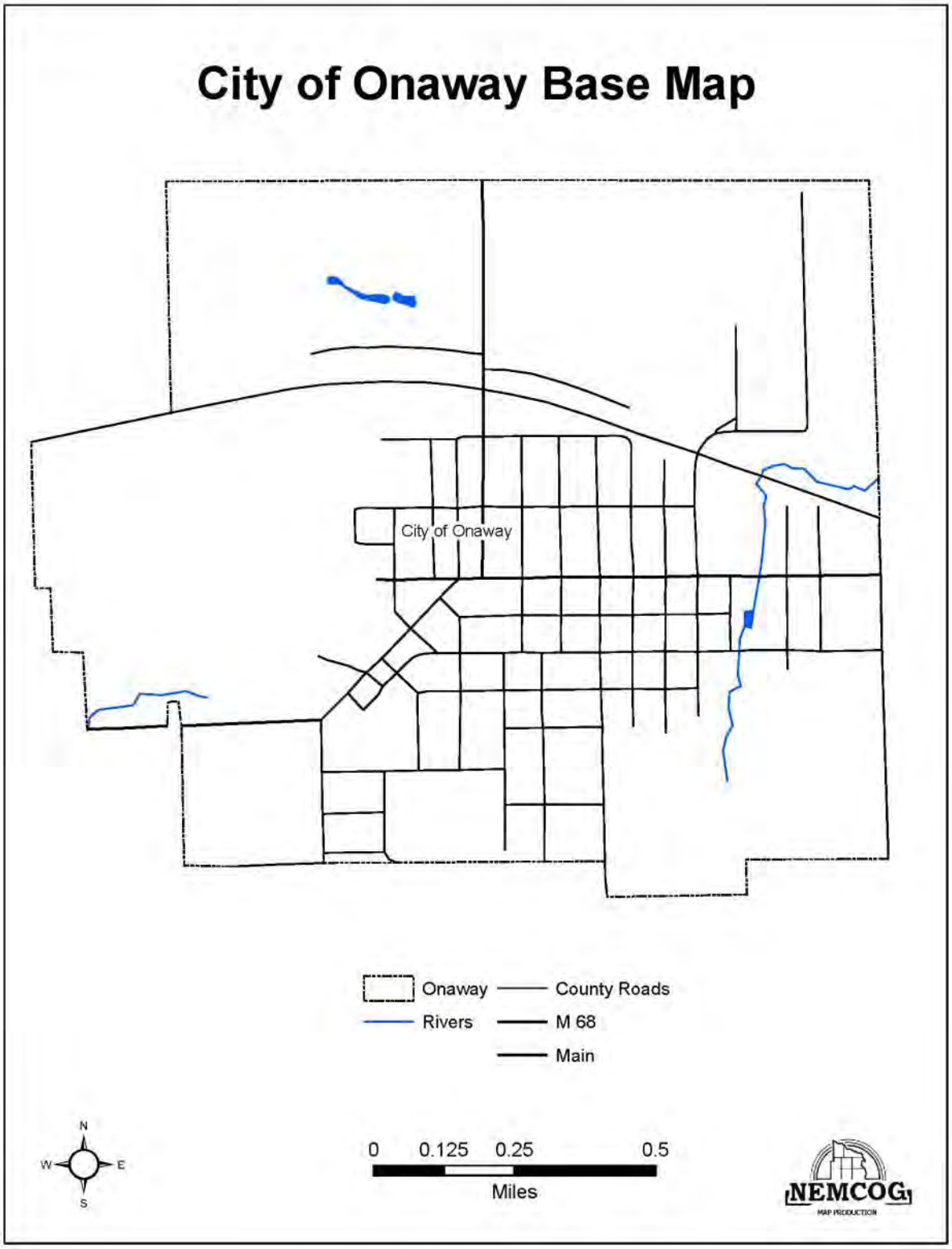
MAP PRODUCTION


City of Onaway Base Map
City of Onaway
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County Roads
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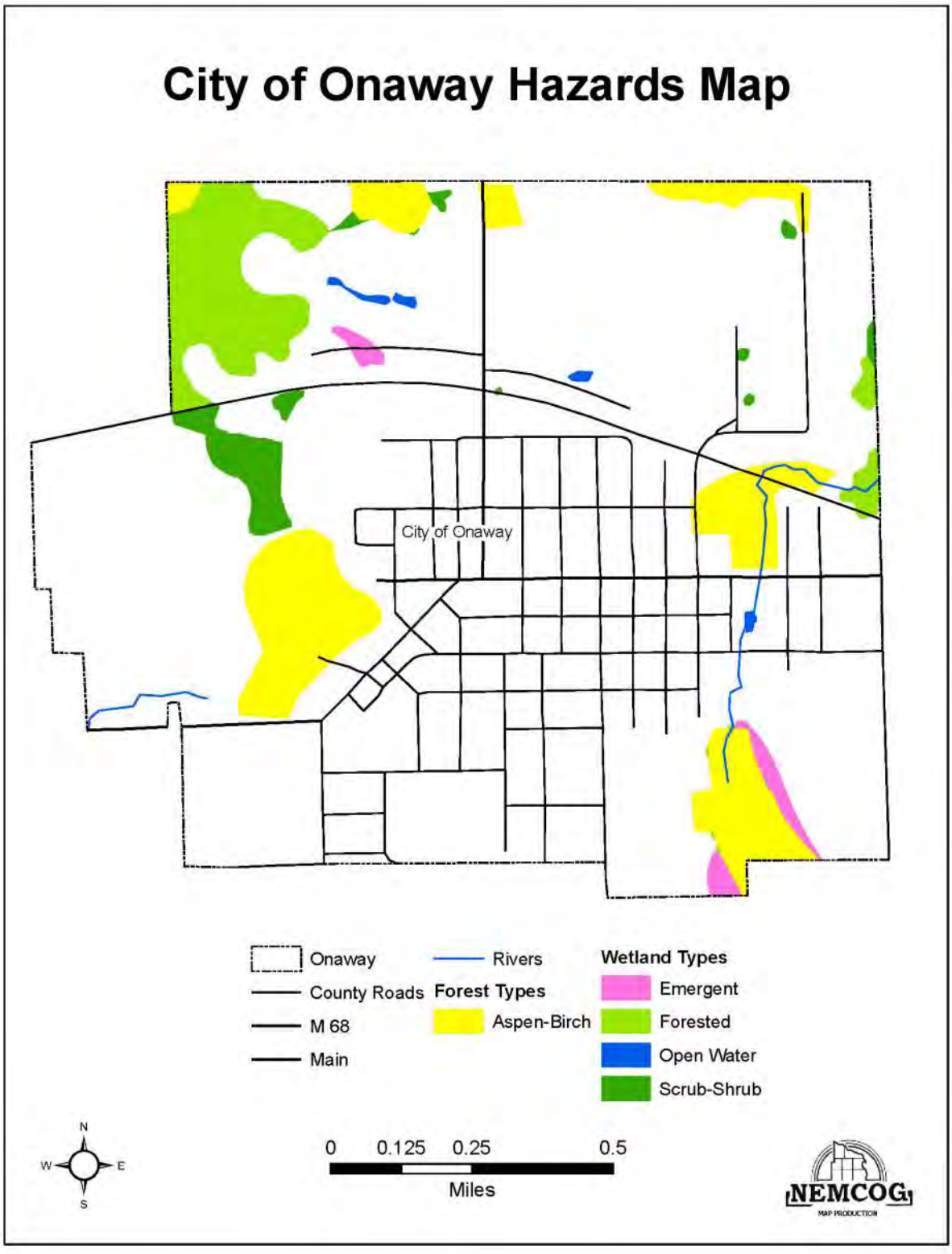
Miles
NEMCOG


City of Onaway Hazards Map
City of Onaway
Onaway
County Roads
M 68
Main
Rivers
Forest Types
Aspen-Birch
Wetland Types
Emergent
Forested
Open Water
Scrub-Shrub
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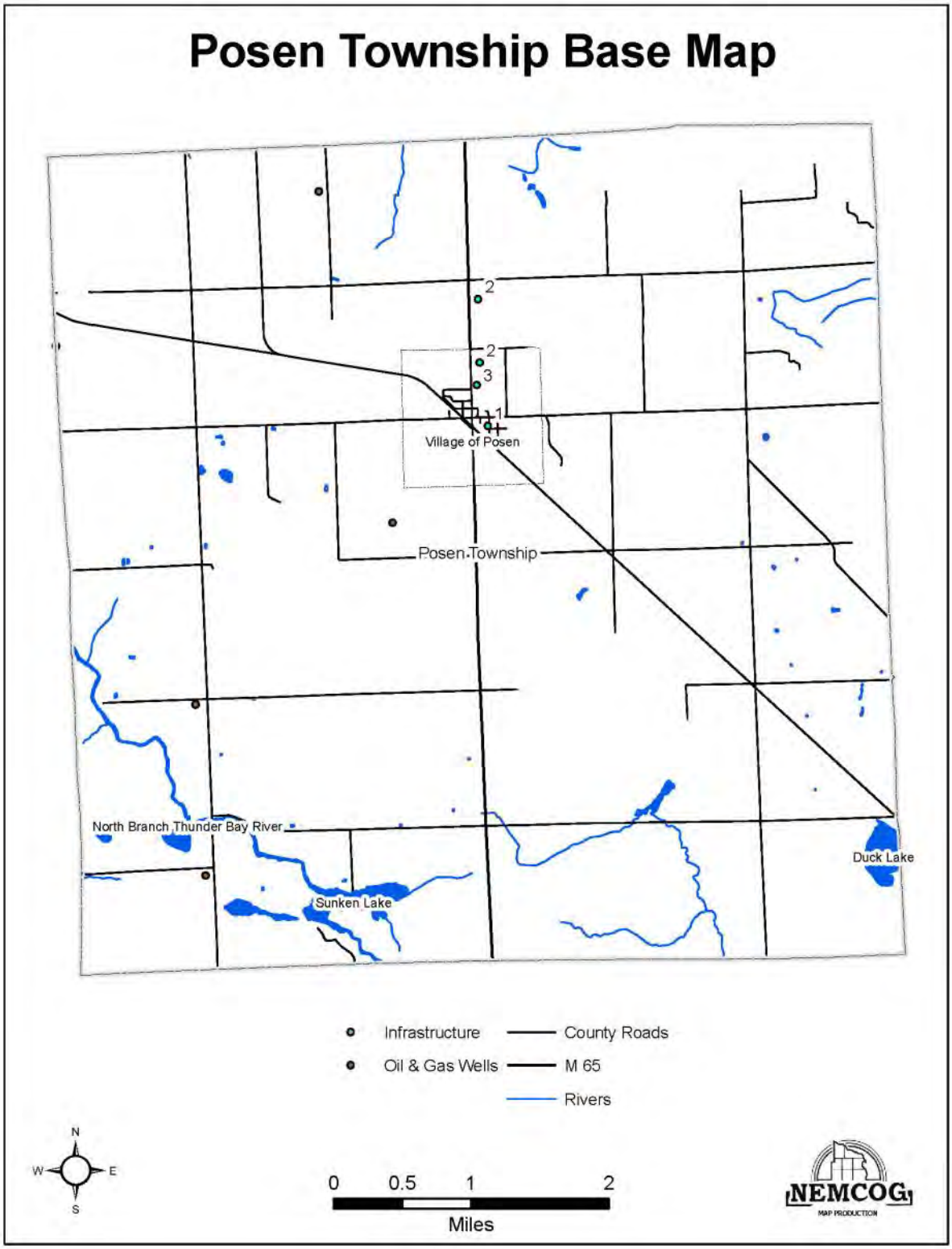
MAP PRODUCTION


Posen Township Base Map
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Village of Posen
Posen Township
North Branch Thunder Bay River
Sunken Lake
Duck Lake
Infrastructure
Oil & Gas Wells
County Roads
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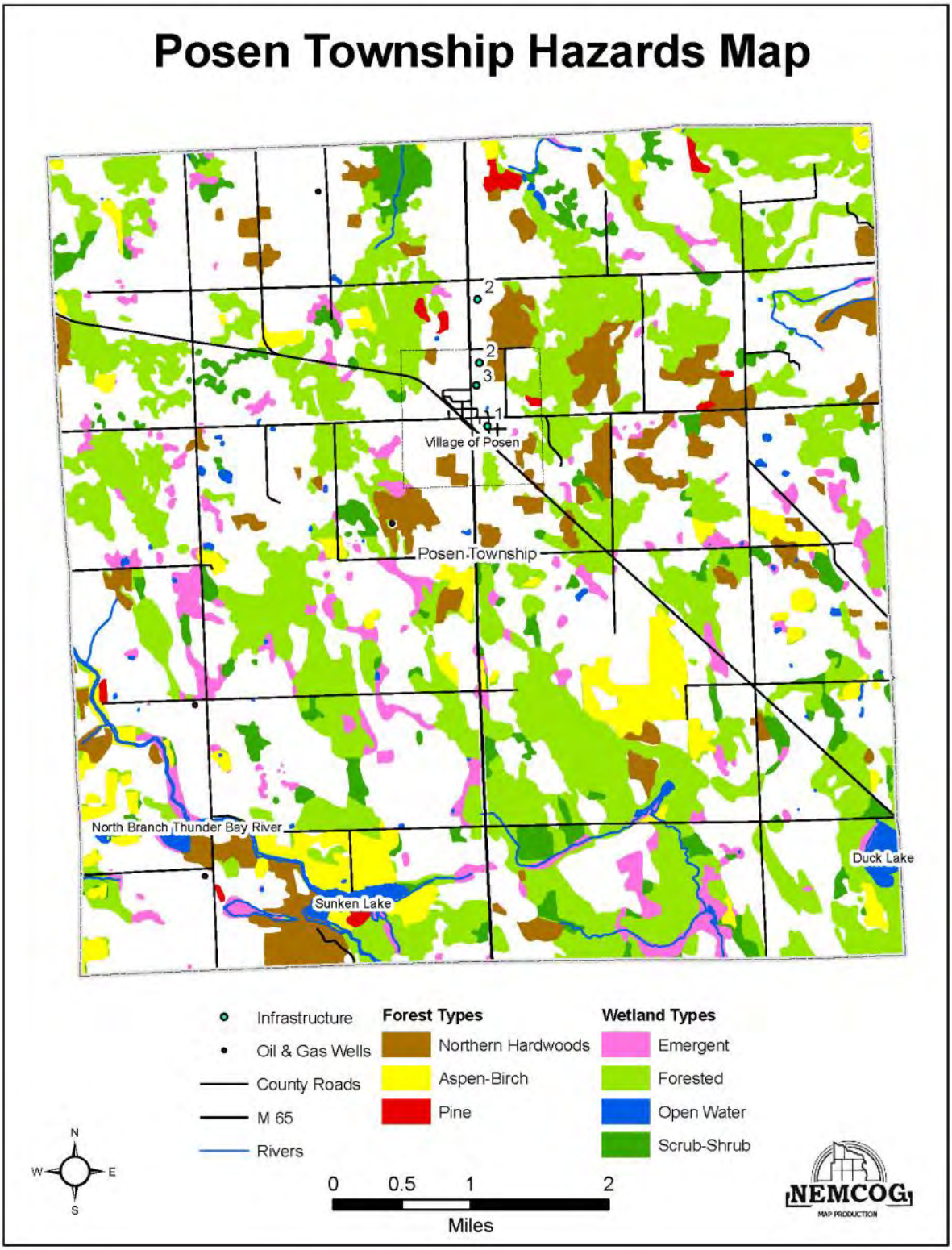
MAP PRODUCTION


Posen Township Hazards Map
Village of Posen
Posen Township
North Branch Thunder Bay River
Sunken Lake
Duck Lake
Infrastructure
Oil & Gas Wells
County Roads
M 65
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Pine
Wetland Types
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Forested
Open Water
Scrub-Shrub
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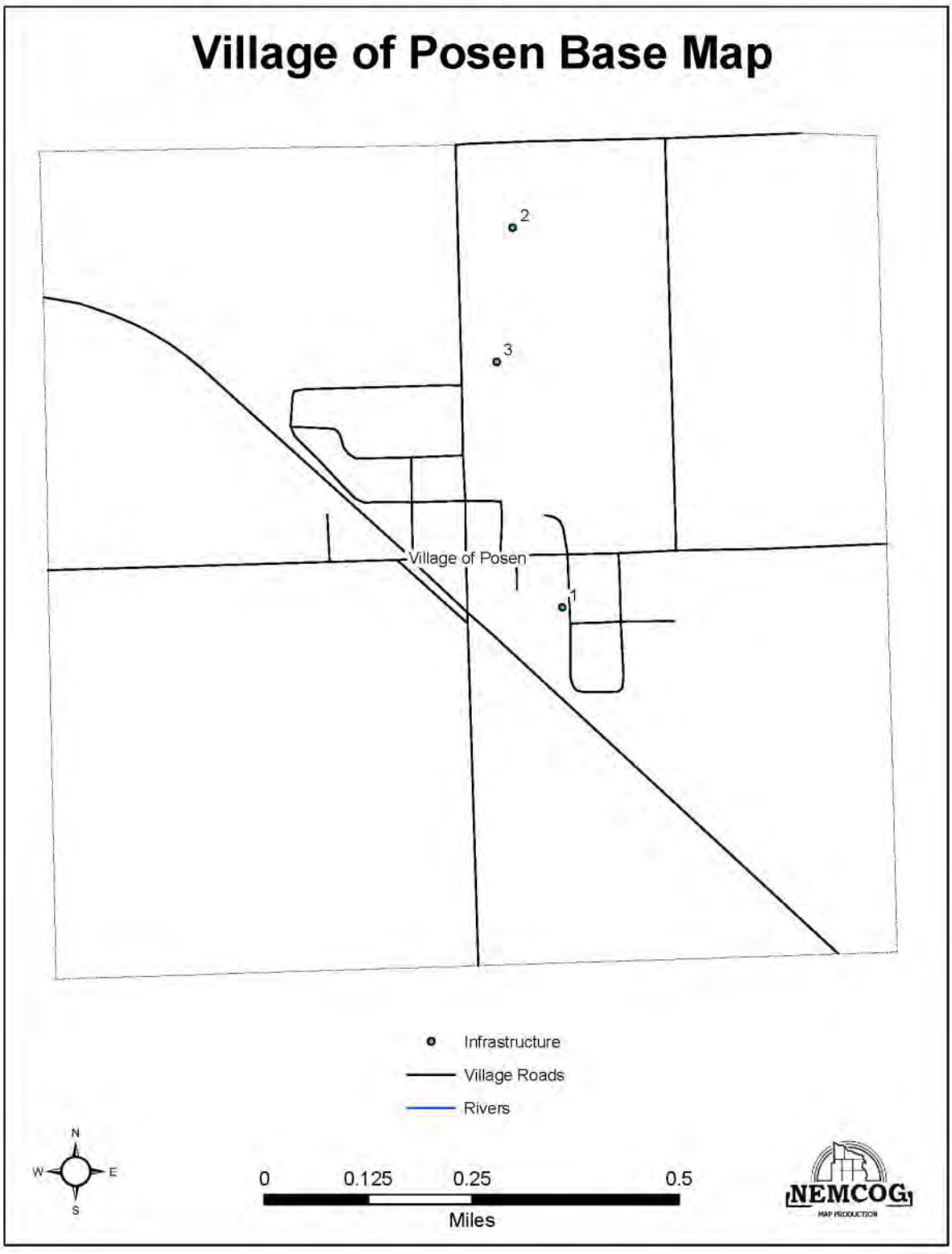
MAP PRODUCTION


Village of Posen Base Map
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Village of Posen
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Village Roads
Rivers
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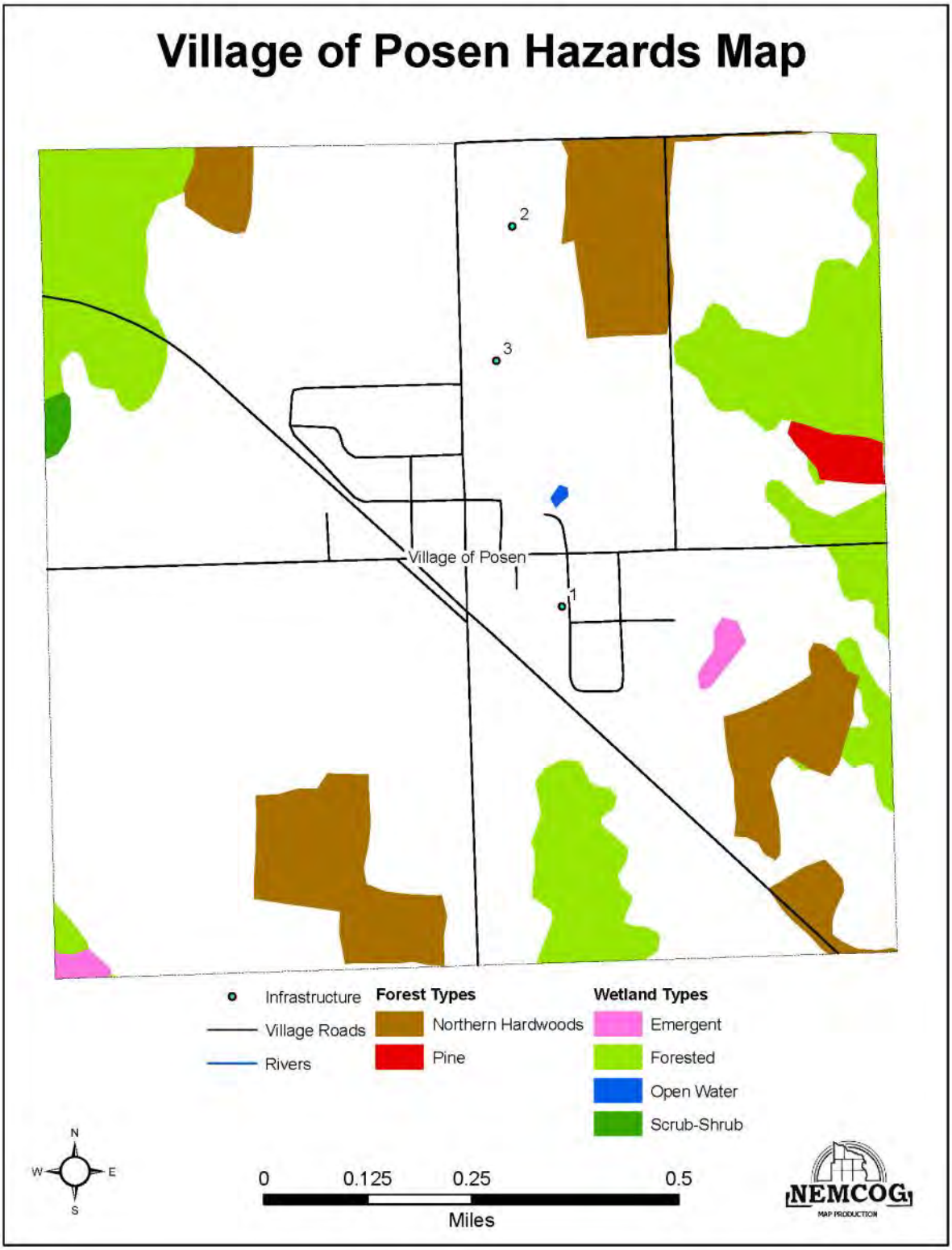
MAP PRODUCTION


Village of Posen Hazards Map
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Village of Posen
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Infrastructure
Village Roads
Rivers
Forest Types
Northern Hardwoods
Pine
Wetland Types
Emergent
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Open Water
Scrub-Shrub
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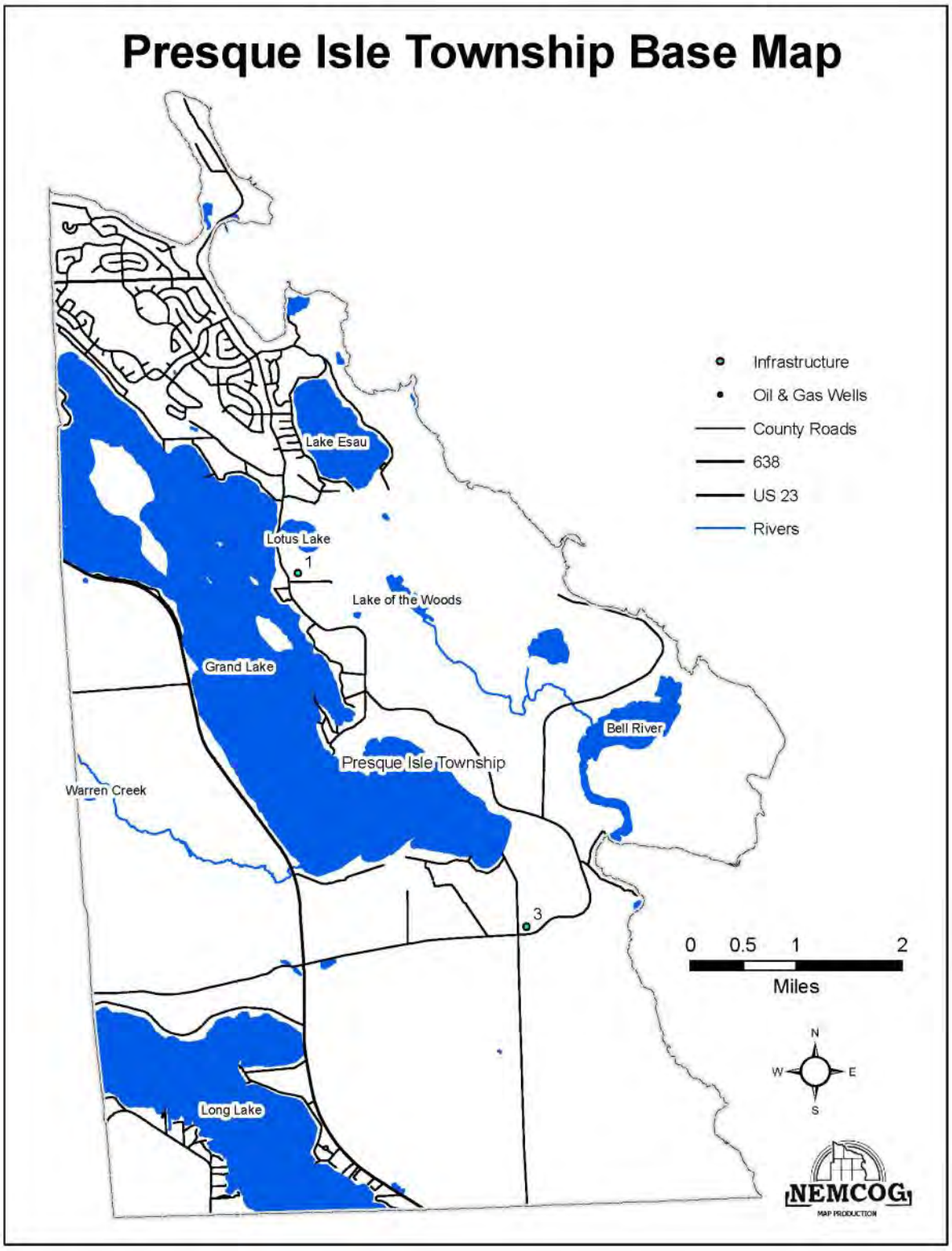
MAP PRODUCTION


Presque Isle Township Base Map
Infrastructure
Oil & Gas Wells
County Roads
638
US 23
Rivers
Lake Esau
Lotus Lake
1
Lake of the Woods
Grand Lake
Bell River
Presque Isle Township
Warren Creek
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Long Lake
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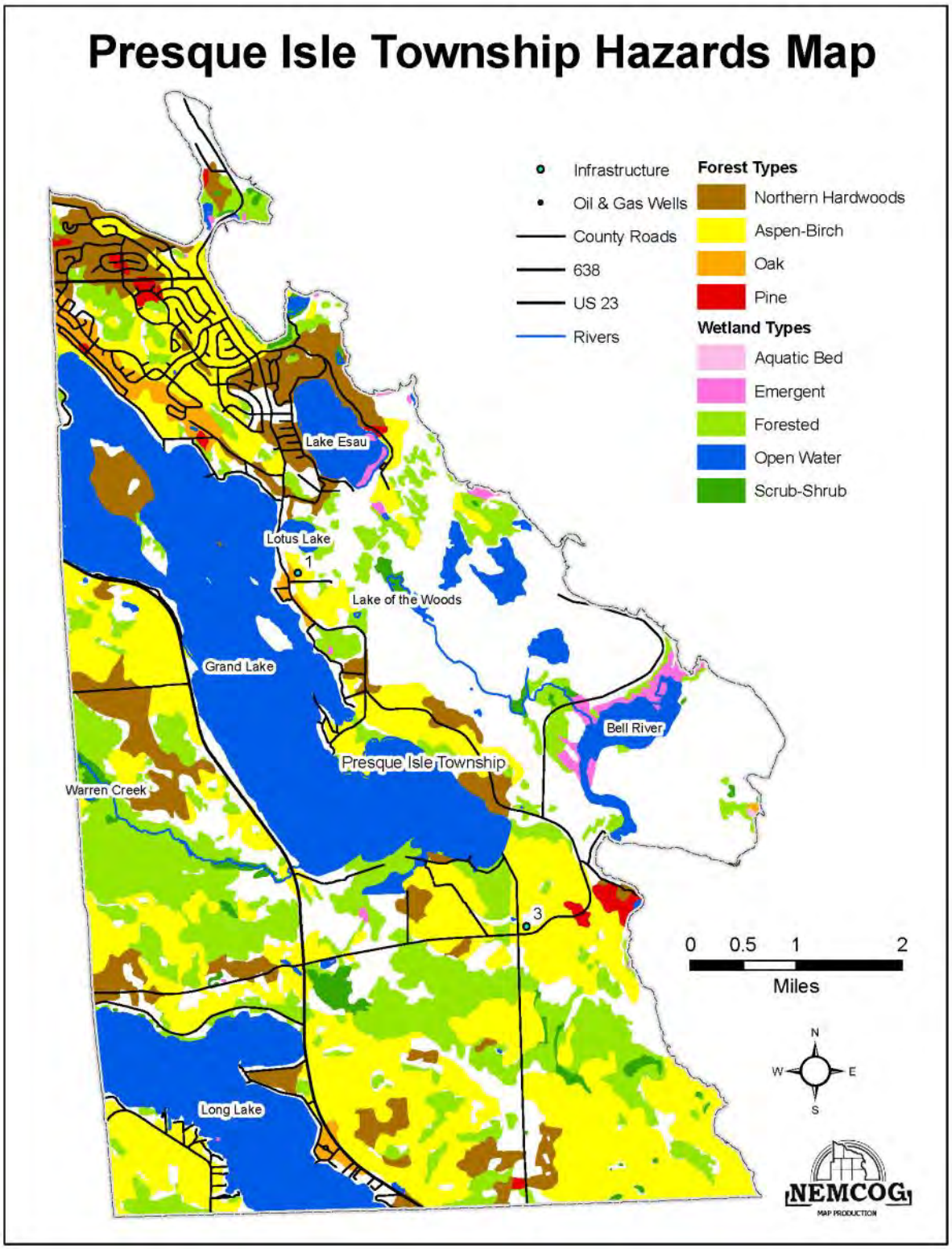
MAP PRODUCTION


Presque Isle Township Hazards Map
Infrastructure
Oil & Gas Wells
County Roads
638
US 23
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Oak
Pine
Wetland Types
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
Lake Esau
Lotus Lake
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Lake of the Woods
Grand Lake
Bell River
Presque Isle Township
Warren Creek
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Long Lake
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Miles
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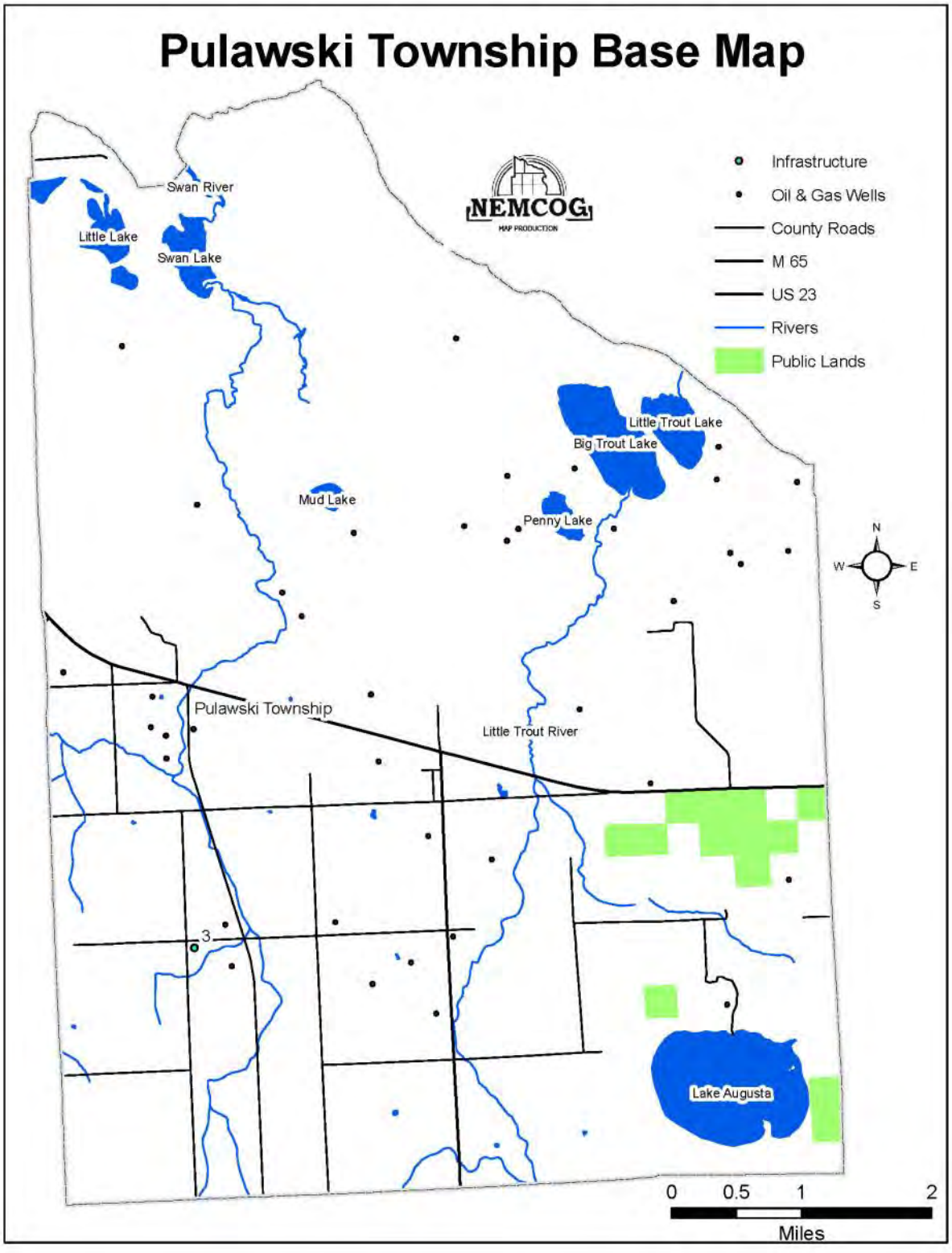
NEMCOG
MAP PRODUCTION


Pulawski Township Base Map
NEMCOG
MAP PRODUCTION
Infrastructure
Oil & Gas Wells
County Roads
M 65
US 23
Rivers
Public Lands
Swan River
Little Lake
Swan Lake
Little Trout Lake
Big Trout Lake
Mud Lake
Penny Lake
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Pulawski Township
Little Trout River
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Lake Augusta
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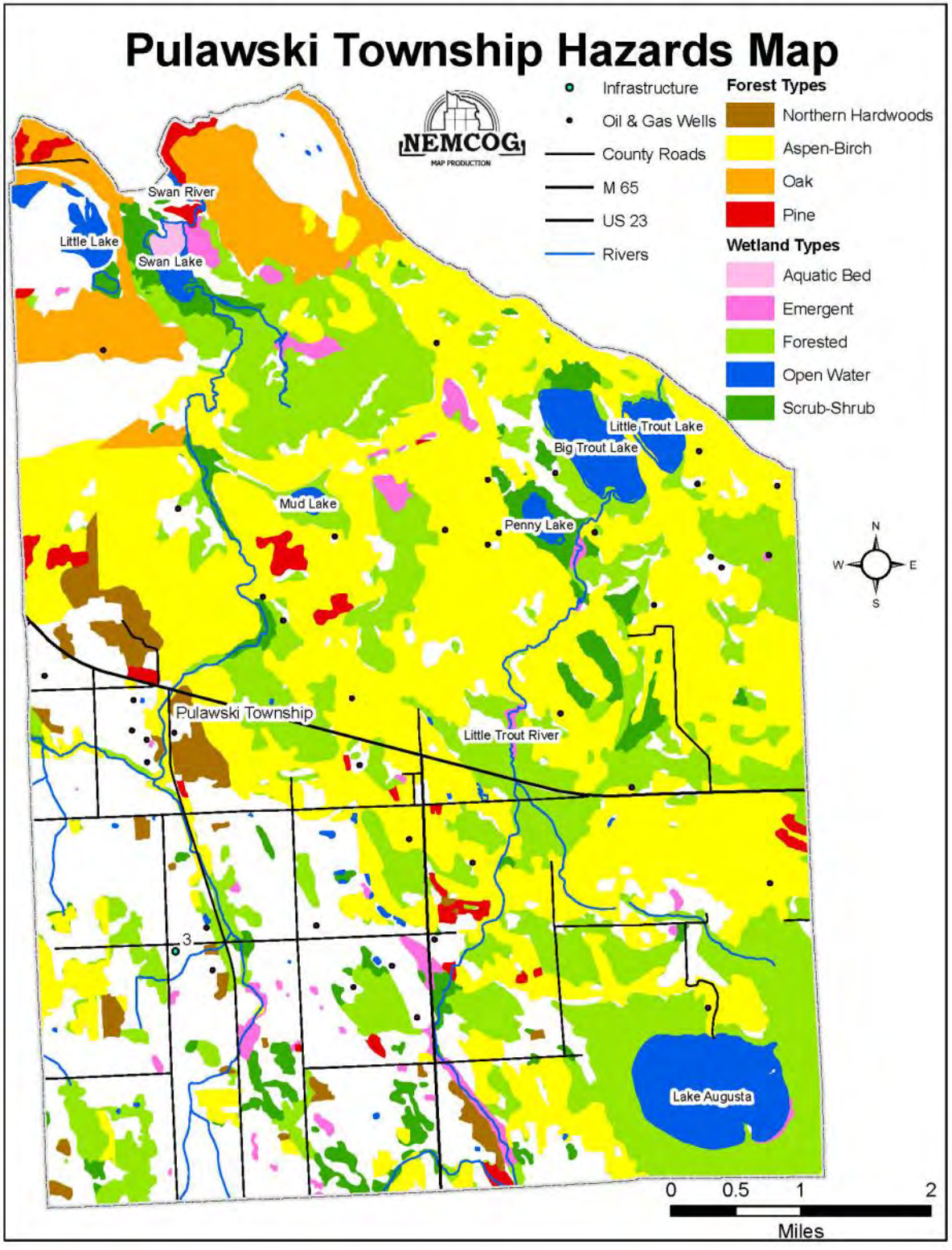
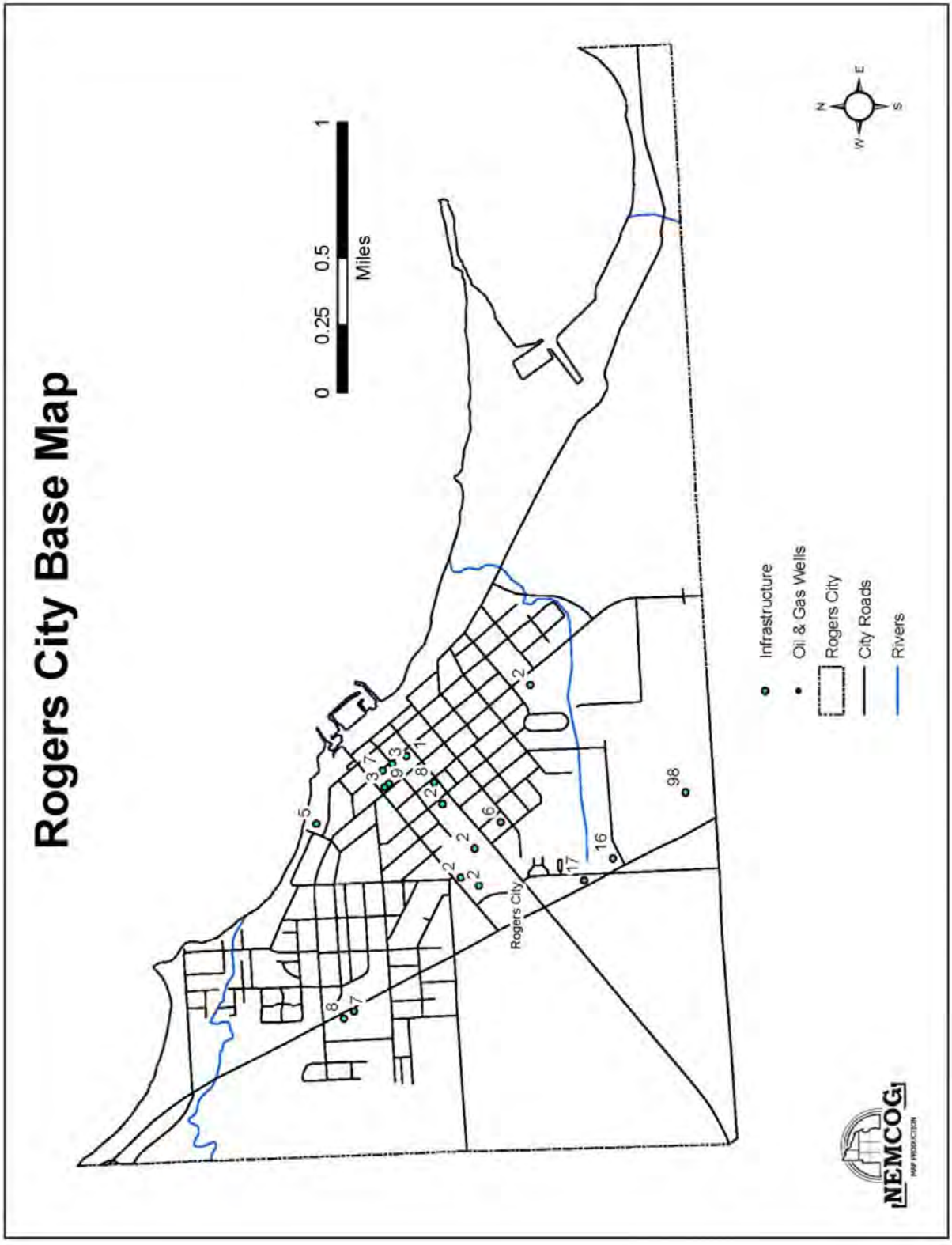
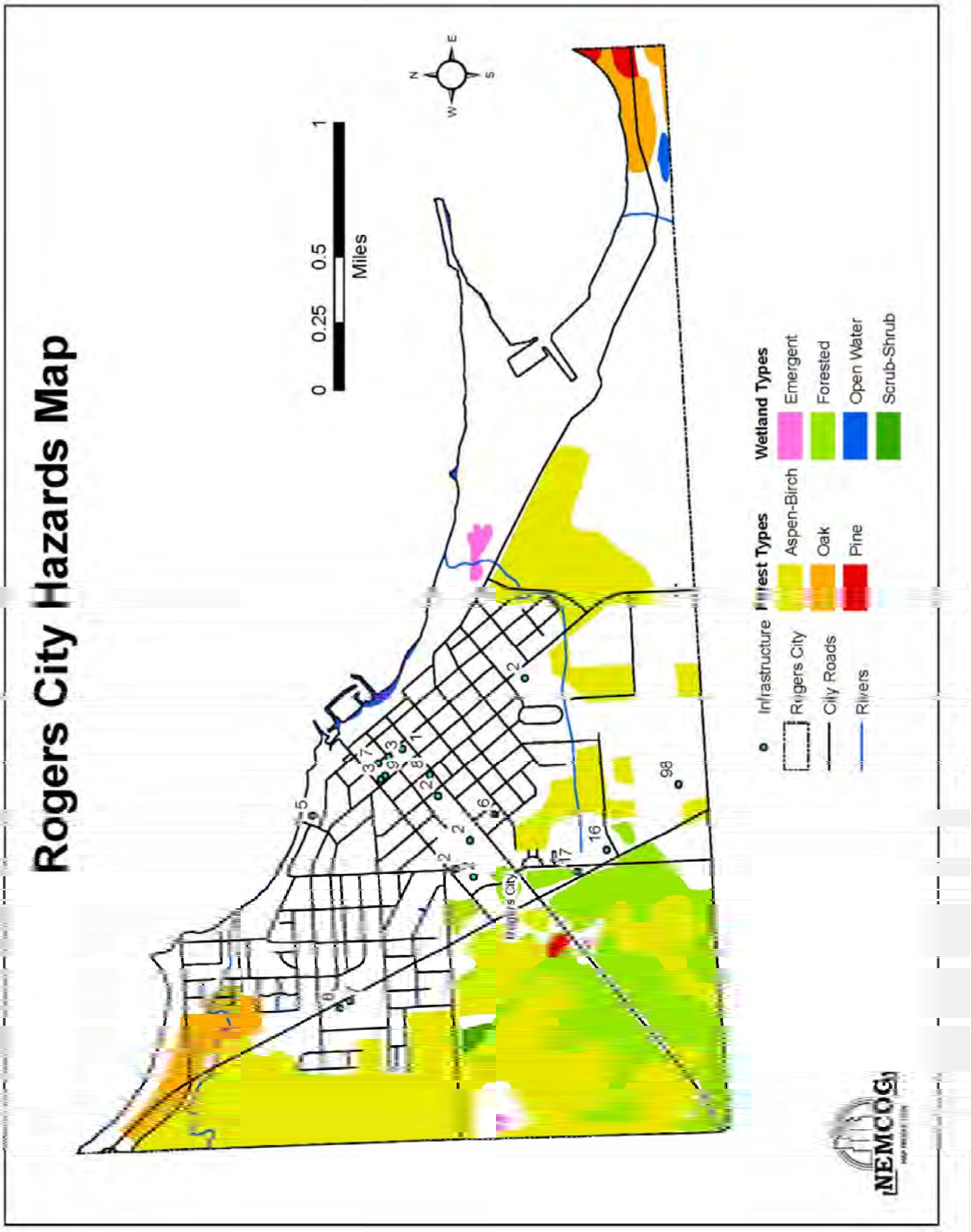
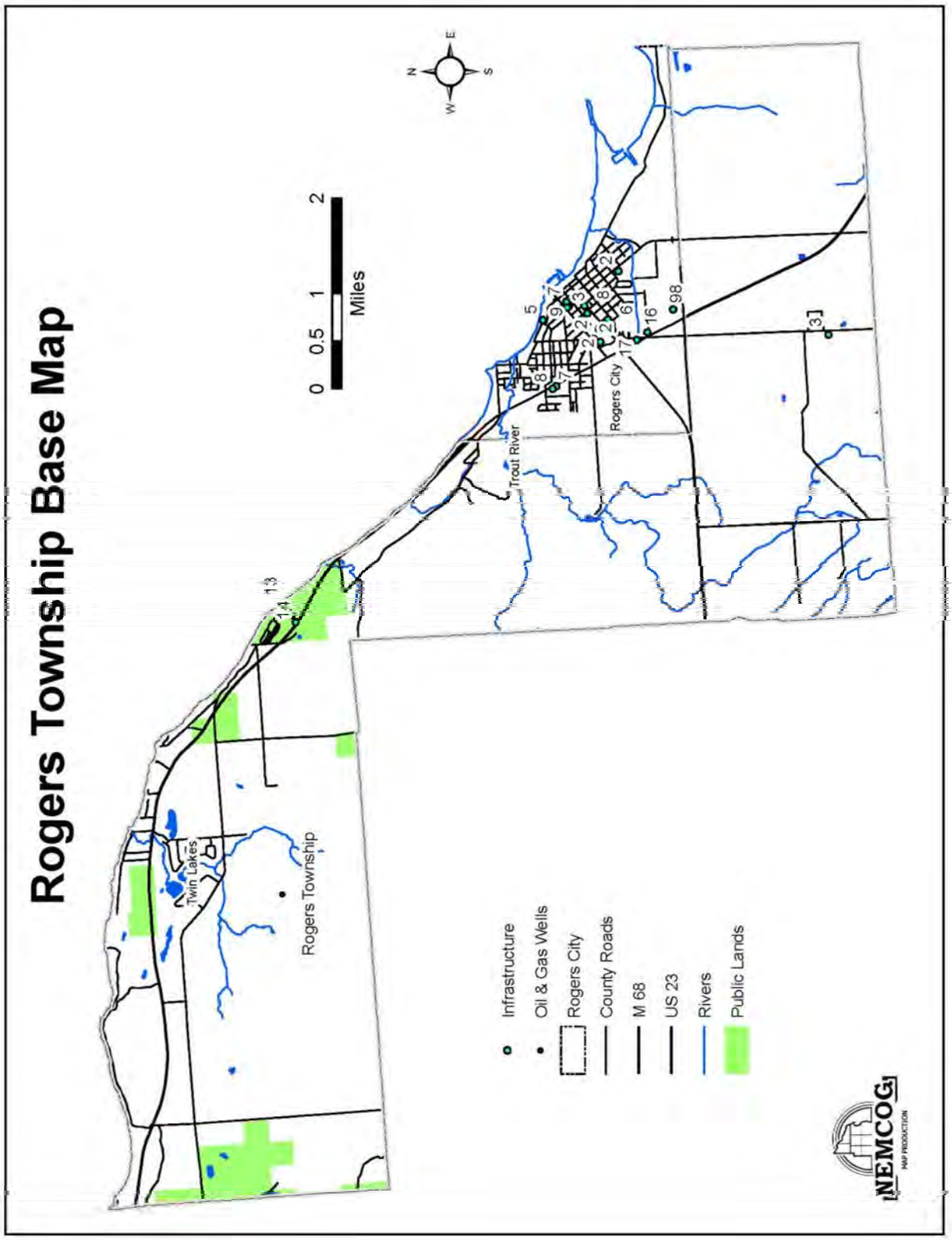
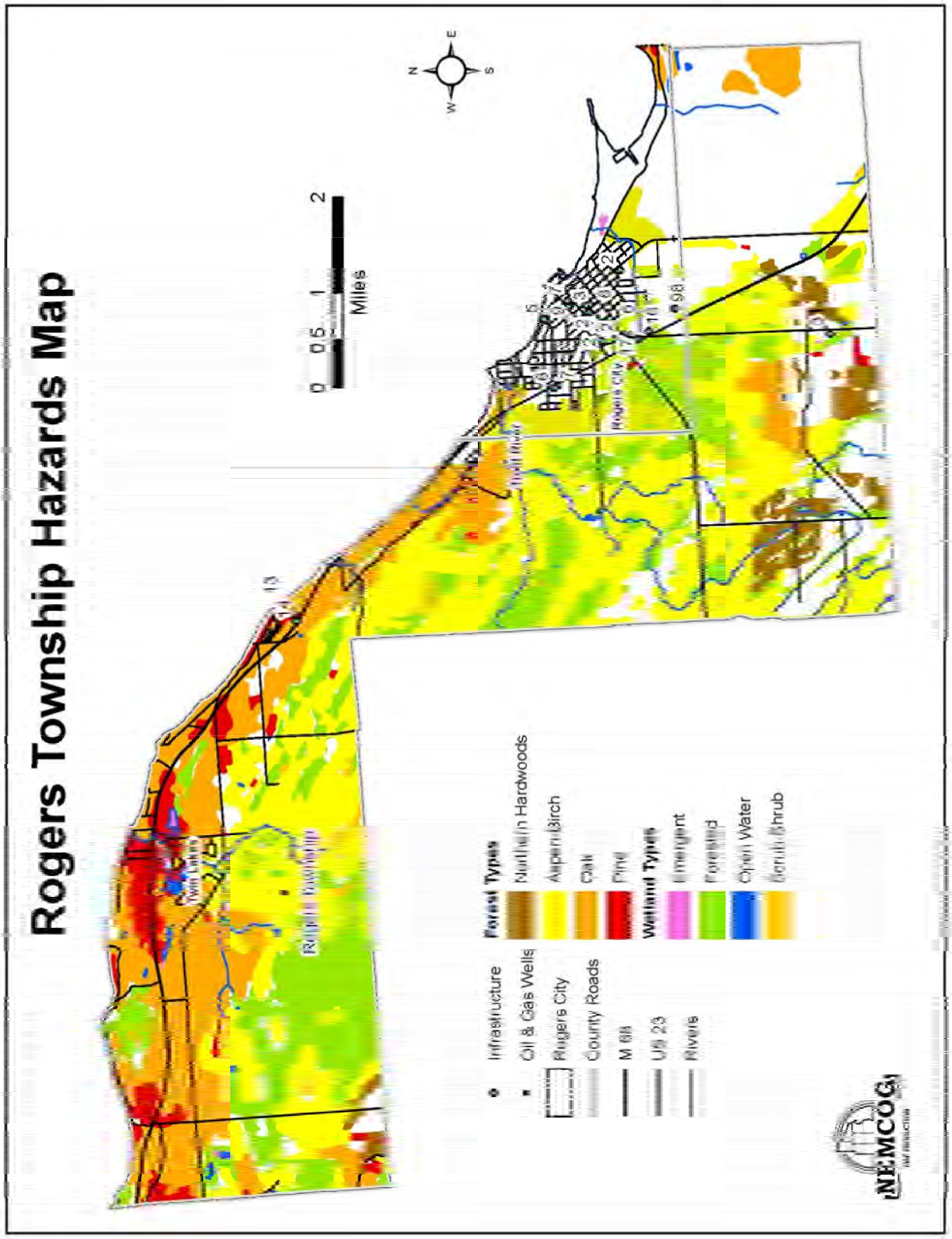
2
Miles


Pulawski Township Hazards Map
NEMCOG
MAP PRODUCTION
Infrastructure
Oil & Gas Wells
County Roads
M 65
US 23
Rivers
Forest Types
Northern Hardwoods
Aspen-Birch
Oak
Pine
Wetland Types
Aquatic Bed
Emergent
Forested
Open Water
Scrub-Shrub
Swan River
Little Lake
Swan Lake
Little Trout Lake
Big Trout Lake
Mud Lake
Penny Lake
Pulawski Township
Little Trout River
3
Lake Augusta
N
W
E
S
0
0.5
1
2
Miles


Rogers City Base Map
0
0.25
0.5
1
Miles
N
E
S
W
Infrastructure
Oil & Gas Wells
Rogers City
City Roads
Rivers
Rogers City
NEMCOG


Rogers City Hazards Map
0 0.25 0.5 1
Miles
N
E
S
W
Infrastructure
Rogers City
City Roads
Rivers
Forest Types
Aspen-Birch
Oak
Pine
Wetland Types
Emergent
Forested
Open Water
Scrub-Shrub
NEMCOG


Rogers Township Base Map
0 0.5 1 2
Miles
N
E
S
W
Twin Lakes
Rogers Township
Trout River
Rogers City
98
[31]
Infrastructure
Oil & Gas Wells
Rogers City
County Roads
M 68
US 23
Rivers
Public Lands
NEMCOG
MAP PRODUCTION


Rogers Township Hazards Map
0 0.5 1 2
Miles
N
E
S
W
Infrastructure
Oil & Gas Wells
Rogers City
County Roads
M 68
US 23
Rivers
Forest Types
Northern Hardwoods
Aspen/Birch
Oak
Pine
Wetland Types
Emergent
Forested
Open Water
Scrub/Shrub
NEMCOG