Dickinson Soil and Water Conservation District

Dickinson County Clean Water Alliance

The Iowa Great Lakes Watershed Management

IOWA DEPARTMENT OF AGRICULTURE AND LAND STEWARDSHIP

United to keep our lakes alive! DICKINSON COUNTY CLEAN WATER ALLIANCE

East Okoboji Sunset (David Thoreson, Blue Water Studios)

Water Quality Management Plan for the Iowa Great Lakes Watershed

"The Marshlands that once sprawled over the prairie from the Illinois to the Athabasca are shrinking northward. Man cannot live by marsh alone; therefore, he must needs live marshless. Progress cannot abide that farmland and marshland, wild and tame, exist in mutual toleration and harmony." (Leopold, 1949, p. 162)

By: John H. Wills

Welcome

This document is intended to aid watershed planning groups in creating a watershed management plan to improve water quality. Planning serves as a road map for turning today's problems into tomorrow's solutions. Water quality improvement is a big task, and trying to tackle it all at once can be daunting. This Management Plan encourages a phased approach to implementation to ensure incremental progress is made within the framework of big picture goals for the watershed.

This Management Plan provides a starting place for the planning process. It does not contain an exhaustive list of management alternatives but rather a starting place. The table of contents provides an outline for what is covered in the document. Additionally, examples (hypothetical and/or from past plans) are cited for illustrative purposes.

The more time and effort invested in watershed planning, the greater the chance of success. The planning process consists of fact-finding, analysis, and interpretation of information and trends concerning the local political, social, environmental, and economic aspects of the watershed. The planning process takes into consideration viable alternatives and their cost effectiveness to create recommendations to meet present and future needs in a comprehensive plan. Planning is a continuous process where progress and goals need to be revisited and revised at least every five years.

The following are symbols for contact resources and agencies used throughout the template.

Federal Agencies:

State Agencies:

Local Agencies:

List of Acronyms/Abbreviations

Term	Acronym/Abbreviation
Agricultural Environmental Management Plans	AEM
Best Management Practice	BMP
Colony Forming Unit	CFU
Chain Of Custody	COC
Cooperative Lakes Area Monitoring Project	CLAMP
Clean Water Alliance	CWA
County Conservation Board	CCB
Data Quality Objective	DQO
Department of Natural Resources	DNR
Dickinson County Conservation Board	DCCB
Dissolved Oxygen	DO
East Okoboji Beach	EOB
Environmental Protection Agency	EPA
Geographic Information System	GIS
Iowa Lakes Community College	ILCC
Iowa Department of Natural Resources	IDNR
Iowa Great Lakes Watershed	IGLW
Iowa Lakeside Laboratory	ILL
Iowa Watershed Improvement Review Board	WIRB
IOWATER Program	IOWATER
Nephelometric Turbidity Unit	NTU
Nitrate Nitrogen	NO_3-N
Natural Resources Conservation Services	NRCS
Quality Assurance Coordinator	QAC
Quality Assurance Manual	QAM
Quality Assurance/Quality Control	QA/QC
Quality Assurance Project Plan	QAPP
Resource Conservation and Development	RCD
Resource Management Area	RMA
Relative Percent Difference	RPD
Relative Standard Deviation	RSD
Standard Operating Procedure	SOP
Standard Methods	SM
Soil and Water Conservation District	SWCD
STORage and RETrieval	STORET
Total Maximum Daily Load	TMDL
Total Phosphorus	TP
Total Suspended Solids	TSS
United States Department of Agriculture	USDA
University of Iowa Hygienic Laboratory	UHL

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INTRODUCTION

The Iowa Great Lakes Watershed consists of approximately 90,631 acres in Northwest Iowa and Southwest Minnesota. The purpose of this management plan is to work with the total watershed within the state of Iowa. It is understood that the plan includes the information for the Minnesota portion watershed. The plan will not work without the simultaneous cooperation from Minnesota agencies of the watershed including the Minnesota Pollution Control Agency and EPA Region 5, because it is not reasonable to assume the Iowa agencies including the Iowa Department of Natural Resources and EPA Region 7 can effectively manage land outside of its jurisdiction.

The EPA Region 7 office approved use of this management plan in 2010 for the purposes of removing impairments from the lakes within the Iowa Great Lakes Watershed and for protection of the other lakes from becoming impaired. The management plan has been written to assist with any water quality work that individuals, public or private groups and governmental entities wish to do within the watershed. This management plan will continue to evolve to allow for new technologies and studies that are still to come to be taken into consideration for improvements that will greatly help the efforts to clean up the water flowing into and out of the lake system.

The areas of the watershed are broken down by lakes and watersheds here and further broken down and described as listed later:

Lake	Total Size (acre)	Total Watershed Size (acre)	Page
Lower Gar	264	10506	18
Minnewashta	118	289	18
Upper Gar	38	217	18
East Okoboji	1843	11779	29
West Okoboji	3867	15157	46
Center	280	612	89
Big Spirit	5684	37929	98
Little Spirit	604	1444	152

Each of the lakes in the region has specific watersheds that have been broken down into smaller, more manageable sub-watersheds or Resource Management Areas (RMA's). These RMA's are more easily monitored for water quality improvements and protection. The coversheet for each lake lists the RMA's that will have immediate impact for improvements and protection on that lake. The indirect RMA's flow into another lake that either flows directly in to the lake of choice or eventually has water flow that reaches the lake of choice listed. The work to be completed in an indirect RMA will show improvements to a lake but the impacts will not be seen instantaneously as they would be in a direct RMA.

Some chains of lakes listed above have been grouped under one lake. This has been done because of the minimal impact a small watershed may have on a particular secondary lake as compared to the major impacts of a principal lake that drains directly into the secondary lake. An example of this would be the Gar Lake Chain where Upper Gar has a relatively small RMA affecting the water quality, but is majorly impacted by East Lake Okoboji because it drains directly into Upper Gar Lake. Upper Gar has no phosphorus load allocation identified by the TMDL from the RMA, but the lake must be addressed because of the phosphorus source of East Lake. Upper Gar then flows into Minnewashta and Lower Gar which has a very large RMA that affects the lake so the three lakes have been grouped into one area.

The following RMA's will be discussed further in the plan:

RMA	Page	Total Size (acre)	RMA	Page	Total Size (acre)
Lower Gar (Spring Run)	19	8878	Center Lake	90	3302
East Okoboji Beach	30	1990	Sandbar Slough	99	5208
Elinor Bedell State Park	38	2737	Hales Slough	107	719
Garlock Slough	47	1608	Reed's Run	120	1574
Lakeside Lab	57	314	Templar Lagoon	128	522
Okoboji View	65	1797	Hottes/Marble Lake	137	4292
Lazy Lagoon	73	685	Little Spirit Lake	153	2060
Welch Lake	81	2924	Loon Lake	162	19238

Impaired Waters

Every two years, the Iowa Department of Natural Resources has come out with a list of Impaired Water Bodies that have been tested and shown to consistently have poor water quality due to one or more of a number of reasons. Several of the lakes in the Iowa Great Lakes area have been on the list at one point and some appear consistently. The goal of this plan is to remove and prevent all lakes from being listed by improving the water quality and managing the watershed to the point where the impairments are taken out of the water system well before the water reaches the lakes or are insignificant enough to no longer affect the lakes. Within the individual RMA plans, it will be discussed how the practices implemented will reduce the excess nutrients reaching the lakes to remove impaired status.

Below is a listing of the lakes as they appeared on the Impaired Waters Lists, the year they appeared and the reason they were impaired.

Lower Gar Lake	1998 – turbidity 2002 – turbidity	Naturally occurring condition Naturally occurring condition
Minnewashta	Not listed	
Upper Gar Lake	1998 – noxious aquatic vegetation 2002 – noxious aquatic vegetation	Naturally occurring condition Naturally occurring condition
East Lake	Not listed	
West Lake	2008 – bacteria (Emerson Bay)	Waste Storage / Storage Tank Leaks
Center Lake	2008 – pH	Internal nutrient cycling
Big Spirit	2008 – bacteria	Unknown source
Little Spirit	1998 – noxious aquatic vegetation 2002 – turbidity 2002 – algae 2004 – algae	Naturally occurring condition Naturally occurring condition Aesthetically objectionable conditions Aesthetically objectionable conditions

BEST MANAGEMENT PRACTICES (BMPS)

Throughout this plan, many different practices will be mentioned to help "clean" the water flowing into the lake system. These practices have been studied and tested extensively and have been proven to improve water quality in many settings. Several are described here with an explanation of how they help. Listed is a hierarchy of the most favored practices down to the minimum described practice that may be accepted by the landowners. All practices are acceptable and welcome in this plan and that any improvement on the land is a positive step forward towards lake improvement and protection.

Agriculture Improvements:

Wetland Restoration: The land use of the IGL Watershed has undergone dramatic changes post settlement with the bulk of the wetlands that once dominated the landscape now drained and converted to row crop production. These areas that once stored and filtered water are now left with straightened drainage ditches and tile lines leading to the lakes or a small number of over-stressed wetlands. The goal of this practice is to restore wetlands with upland buffers to filter water and assist with restoring historic hydrology where possible. This will be done with native prairie seeding on the upland, surfacing of tile lines, tile line breaks and wetland basin native seeding of a diverse hydrologic plant community. These should be large shallow basins focused only towards water quality and most likely to go nearly dry seasonally. Some of these wetlands may require structures to maximize the wetland restoration to have little to no impact on neighboring properties that don't want to participate with a wetland restoration. Wetlands within the plan have been prioritized by sediment delivery models and wetland to upland ratio. A more intense survey of the land and discussion with private landowners is needed to determine the best option whether it be wetland restoration or to look at other options.

Sediment Basin: Sediment basins are structures that are used to hold back water carrying sediment and allow the sediment to drop out of the water and allow the water to leave clean. Sediment basins will be used where wetlands are not wanted by landowners who don't want to give up land to upland plantings and wetland soils. Basins are an effective alternative which allows the landowner to maintain a farmable row pattern. These basins will be strategically located in small drainage areas where significant loading is occurring to be utilized in the more traditional sense as a catchment to trap pollutants and slow water. A more intense survey of the land and discussion with private landowners is needed to determine the better option regarding wetland restoration or sediment basin.

Grade Stabilization Structures: Grade stabilization structures are built across gullies or grassed waterways and drops flowing water to a lower elevation to protect soil in a gully from eroding into a nearby water way. There are two things that need to be addressed with grade stabilization structures in the Iowa Great Lakes Watershed the first being new structures where gullies are cannot met the standards for sediment basins.
The second is to investigate the sedimentation of the current grade stabilization structures in the watershed and possibly rehabilitate the structures so they are functional. The rehabilitation for the existing grade stabilization structures is needed as many don't have maintenance agreements from when they were built in the 1960's and are nearly full with sediment. This causes them to possibly be a larger contributor to sediment and phosphorus loads into the lakes then the watersheds draining to them would be without the practice in place.

Permanent Vegetation Easements: These easements would be used in specific areas with the highest erodible soils (mainly on steep hillsides) to remove this land from production and keep it in permanent tall grass prairie. These easements would be a permanent solution in stopping erosion from highly erodible soils by paying landowner 100% of appraised value for the land plus restoration costs for these tracts of land. The easement would be small areas that would cover slope from the 100 feet beyond the crown and 100 feet down from the toe of the hillside. This area is needed to ensure the entire slope is covered to prevent erosion or landslides.

Conservation Cover: The Conservation Reserve Program and all of its options for different conservation cover programs will be used to provide cover to key areas that perhaps are difficult to farm or should not have been farmed to begin with because of poor soil types or slopes.

Filter Strips: Filter strips promoted in critical locations and funded through the CRP program or similar programs. Filter strips are used to slow runoff water and allow it to infiltrate into the soil. Filter strips can be used on streams, lakeshores, tile inlets, storm sewers, and other areas with direct access to surface water.

Grassed Waterway: Grassed waterways are placed in areas of significant water flow to reduce soil erosion and prevent ephemeral gulley formation. One advantage to this practice allows the farmer to make up for lost crop production by entering the area affected into a Conservation Reserve Program (CRP) and receive rental payments for not farming the ground. The roots from the grass hold the soil in place preventing it from running off the field into nearby streams, rivers and lakes.

Rock Inlet / Rock Tile Intake: This practice focuses on replacing traditional Hickenbottom intake risers with an underground system to drain excess water from depressions in the field. Traditional riser systems can be tricky to farm around, get stuck in equipment and allow for unfiltered water to drain directly into the field tile without addressing nutrient and sediment concerns. Rock inlets bury the intakes under several feet of pea sized gravel allowing for sediments to naturally settle out before reaching the tile line reducing the chance for impurities to reach the drainage system. This alternative has become popular among farmers as the maintenance is minimal compared with traditional systems. Rock Inlets have the potential to reduce 18 to 30 percent of the sediment loss over conventional intakes.

Reduced Tillage Incentive (strip-, ridge-, no-till): Conservation tillage consisting of Strip-tillage, ridge-tillage and no-tillage practices is one of the best tools to keep soil from eroding and becoming sediment in the lakes. These practices allow agricultural crops to be planted with minimal disturbance to the soil and removing little to no residue. The main focus would be on land that is targeted throughout the RMA's as highly erodible. This incentive will be open to all landowners throughout the RMA's to reduce as much soil loss as possible.

Urban Improvements:

Rain Gardens: This practice is a favored one among people living in towns to handle storm water runoff. Soil from a depression or low spot is replaced with an engineered mix of soil, compost and sand to allow for better infiltration of surface water into the ground water system. Native plants are encouraged to be planted because they are tolerant of extreme wet/dry cycles rain gardens typically experience and they help to maintain a high organic content of the engineered soil and keep the soil porous and able to handle the water flow with restored hydrology.

Pervious Pavers: Similar to conventional paver systems, this practice places individual pavers slightly more spaced out over a bed of crushed rock layers instead of sand to allow better percolation of water into the ground beneath the pavers to reduce surface runoff and to catch and trap sediments and excess nutrients preventing them from entering the ground water system. This system is typically used for patios, driveways and parking lots.

Construction Site Management: Urbanization is an ongoing issue in the IGL Watershed and additional incentives are needed to stimulate continued adoption of Low-Impact Development BMP's. Although ordinances have been adopted throughout much of the project area, instances still arise where incentives and cost-share are needed to meet overall project objectives.

Septic System Inspection and Septic System Renovation Demonstration: Rural residence septic systems throughout the watershed, in some instances, have not been adequately maintained and may not be functioning properly. This may be a significant issue due to impermeable soils found throughout the region, which may result in systems being connected directly to field drainage tile. Due to the difficult nature of assessing and detecting these faulty systems, project sponsors intend to launch a voluntary inspection incentive campaign to encourage rural residents to begin to address the issue. Three areas of interest in the Iowa Great Lakes Watershed that do not have sanitary sewer and the human wastes are disposed of via septic tanks. The connection of these three areas to the sanitary district is a key in preventing the listing of two sites in the Iowa Great Lakes onto the States impaired waters list. Emerson Bay on West Okoboji and Marble Beach on Big Spirit Lake are both located near one of these areas with septic tanks and both are proposed to be on the 2009 list of impaired waters list.

Other LID practices as described:

Lake Restoration:

Shoreline Restorations: Shoreline work is necessary to address shoreline erosion and to help reduce internal loading of phosphorus within the lakes. The restoration of native prairie buffers around the lakes has reduced shoreline erosion in some areas by up to one foot per year. The deep rooted native vegetation holds the shoreline soils in place better than short rooted turf.

Shoreline restoration projects also help reduce internal phosphorus loading by re-establishing plants to use up some of the phosphorus. Native emergent plants like bulrushes, arrowhead plant, burreed and sedges help tie down loose sediments on the lake bottoms near the shore where most stirring and re-suspension of sediment takes place. The re-establishment of these plants along with native prairie buffers should eliminate almost all shoreline erosion in areas where they are re-established.

Shallow Lake Restoration Practices: Watershed restorations and reductions in nutrient and sediment loading is not enough to restore water quality in the shallow lakes of some RMA's. Development of a long-term management strategies to improve aquatic plant diversity and density and manage common carp populations are needed to complete a holistic plan. The feasibility of using water level management (shallow lake management strategies) to positively affect water quality in some shallow lake systems should be explored.

Water-level draw downs result in consolidation of bottom sediments, germination and growth of emergent aquatic plant species, and management of common carp populations. In shallow lakes, common carp can root up aquatic vegetation and their feeding habits can stir up bottom sediments leading to high turbidity and the release of nutrients into the water. Additionally, installation of fish barriers will help to slow the re-infestation of adult common carp and maximize the period between draw downs.

Electric pumping stations and intake lines will most likely be needed to facilitate temporary draw downs in some shallow lake systems. It will be important to maintain some connectivity of these systems to the larger lake system providing spawning and nursery habitat for a number of native fish species.

WATER MONITORING PLAN

This section will be updated after the meeting with the Monitoring Section of the DNR and the Dickinson SWCD in mid-October to pick new monitoring sites and update the monitoring plan.

The water monitoring for the Iowa Great Lakes Watershed will focus on the impairments for the individual lakes including specific impairments as well as the system as a whole to determine indirect impacts. In 2010 the writing of a Quality Assurance Project Plan (QAPP) is being developed for the monitoring in the Iowa Great Lakes. In October 2010 the QAPP was still being developed and will include all potential monitoring sites for each RMA and the protocol for monitoring in these areas. Monitoring is taking place at 21 watershed locations and 23 in lake locations through two existing programs. Local groups along with the Iowa DNR monitoring section are working to evaluate current monitoring locations and all potential sites. The QAPP will be merging the two programs together and adding more sites into the current schedule. The monitoring plan will be added to each RMA as the QAPP is completed.

Monitoring research will be conducted to get data to determine load reductions in a lake from practices completed on another lake. This is necessary to show load reductions that are required for lakes like Upper Gar and Lower Gar lakes that have a large nutrient source coming from the rest of the lake in the Iowa Great Lakes watershed. When this monitoring is completed it will require a revision to the Iowa Great Lakes Watershed Management Plan so load reductions can be reassessed.

Water monitoring discussion are to begin in late 2010 to start ground water monitoring program for ground water nutrient loads feeding into the lakes to assist with completing a nutrient budget This will address a potential impairment source that has not previously been studied in the Iowa Great Lakes Watershed. This will also be incorporated in the management plan as it becomes available.

The sampling will be conducted by local volunteers and staffs from Dickinson Soil and Water Conservation District, the State Hygienic Laboratory (SHL) at the University of Iowa and/or Iowa DNR monitoring and fisheries. The hydrology of the Iowa Great Lakes is unique; therefore sampling frequency will be determined on a site by site basis. Samples will be collected on a regular basis if hydrologic conditions permit as well as after storm events. Sampling locations will be based on BMP installation and hydrologic conditions within each RMA.

The water quality indicators that have been selected for the Iowa Great Lakes Watershed Management Plan are nutrients, sediment and bacteria. The parameters to be included are total phosphorus, total Kjeldahl nitrogen, nitrate plus nitrite nitrogen, ammonia nitrogen, total suspended solids, field chloride and E. coli bacteria. The monitoring in each RMA is designed to capture conditions prior to and after BMP installation at locations where the impacts can be measured. Over the short-term, these monitoring locations will be able to show the effectiveness of the BMP's. Additional long-term, ambient monitoring throughout the watershed will also demonstrate the overall effectiveness of BMPs in the RMA's.

Standard Methods for Collection

Sampling is designed to collect baseline data that will aid in the identification of problems that exist in the watershed. This data will serve as a guideline for future implementation of suggested conservation practices. Monitoring for this purpose will continue through the fall of 2012, or longer depending upon funding. Information from other sampling and monitoring done in Dickinson County will be considered and used during this project.

The sampling design will allow for collection of data during varying flow conditions, including ambient, base flow, and storm conditions. Storm conditions that will be sampled include any storm with over 1.25 inches of rain or a significant amount of rain in a 24 hour period. The samples will be taken using first flush samplers, grab samples, and automatic samples.

Depending on the sampling site and conditions, samples will either be collected directly from the stream or lake or in a container from a bridge. Prior to sample collection, each lab sample container is labeled with a permanent waterproof marker. Lab sample container labels include site name, date and time of sample collections, and the collector's name. Equipment cleaning and decontamination and preservation methods as will be instructed by the analyzing laboratory.

Sampling will be conducted in a manner that minimizes the chances of contamination. Lab samples will be collected in sterile, unused sample containers provided by SHL. Sample collection personnel will be instructed not to touch the insides of the sample containers or caps. Lab sample containers will be filled without pre-rinsing the container. Some lab sample containers contain a preservative. When collecting samples in these containers, a small amount of air space will be left to ensure that the preservative is not lost or diluted.

When grab sampling is suitable, samples should be collected along the sample site cross-section. A sample is taken at a point that best represents the water quality of the total flow at the cross section of the stream. A sampling point should be avoided if it is poorly mixed or if it is affected by local temporary conditions such as ponding across part of the stream width, if there is an obviously disproportionate sediment load or backwater conditions. If a site is poorly mixed across the stream, an integrated sample from across the stream width should be used, or another site should be chosen that is well mixed across the stream width.

If the lab sample is collected directly from the stream, it will be collected in the middle of the channel facing upstream. If the lab sample is taken from a bridge, the sample will be collected on the upstream side of the bridge over the middle of the channel or wherever the flow is the greatest. Regardless of collection method, the grab sample is stored and transported in a clean, labeled container. Samples will be collected directly into the lab sample container, immediately capped, and then stored on ice until packaged for delivery to the lab. Field parameters are then measured for dissolved oxygen, water temperature, chloride, and turbidity. The turbidity sample will be analyzed immediately at the site after calibrating the turbidity meter. To prevent contamination, the glass vial the turbidity sample is measured in will be rinsed with distilled water three times before each use. The remaining water in the water collection container is discarded and "fresh" sample is collected. This water is then used for the chloride test. Chloride is measured using a HACH Quantab^{Ò} test strip. The dissolved oxygen/water temperature probe is lowered into the stream, ensuring that the probe is not making direct contact with the stream bed. Before making the field measurements, the sensors must be allowed to equilibrate with the water being monitored. The sensors have equilibrated adequately when the temperature measurement variance is within ±0.2 ºC and the dissolved oxygen measurement variance is within ±0.5 mg/L. The dissolved oxygen and water temperature measurements will be recorded on the field form.

Grab Samples

Grab samples can be taken at selected sites in the container and volume appropriate for each particular analysis. In-stream samples will be collected at mid-depth range to ensure a representative sample of the stream profile. The method used for any particular sample depends on several factors including flow rate, accessibility and stream depth and width.

The variations of the grab sampling method are described below.

Wading and Hand Collection
If the stream is safe to wade, the person collecting the sample wades with a lab sample bottle to the center of the stream or where the greatest flow exists. The sample collector should face upstream, taking care to ensure that any stream bottom debris disturbed by wading does not contaminate the sample. The lab sample bottle is tipped at a 45° angle, allowing the bottle to fill. If water levels or velocities cause concern for safety, DO NOT WADE!

Reach Pole Collection
When wading conditions are not safe in smaller streams, a grab sample may be collected using a reach pole. In this case, the water sample collection bottle is fitted into a wire cage attached to the end of a long, telescoping reach pole. The water sample collection bottle is tipped at a 45° angle, allowing the bottle to fill. The water sample collection device is filled and rinsed three times before water from it is used to fill the lab sample bottles.

Bridge and Rope Collection
A grab sample may be collected by using a water sample collection container that is made of a non-contaminating material, such as HDPE plastic. The water sample collection bottle should be rinsed at the site a minimum of three times before samples are collected. The rinsing consists of lowering the container into the stream from the bridge deck near the center of the bridge, letting it fill with water, lifting the container back to the bridge, and then pouring the contents of the container out. After completing the rinsing, water is poured from the water sample collection bottle directly into the lab sample bottles; bottles are immediately capped, and then stored on ice until packaged for delivery to the lab.

Grab Sampling Field Equipment
The following is a list of required and optional equipment that is used for collecting grab samples. Equipment will vary due to site differences.

- Chest or Hip Waders
- Personal Flotation Device
- Sterile labeled sample bottles
- Telescoping Reach Pole
- Water sample collection container that is made of a non-contaminating material, such as HDPE plastic with a 25 foot Nylon rope
- Cooler and Ice
- YSI Dissolved Oxygen/Water Temperature meter
- HACH 2100 Portable Turbidimeter
- HACH QuantabÒ test strips

Field form, permanent markers, pens/pencils

A reassessment of a lake will either be completed once 25% of the BMP's have been implemented in an RMA or at the end of five years. A reassessment of the lake may be needed if the lake has been found to have enough water quality violations to impair the lake. The reassessment may also be needed if water monitoring finds new water quality violations or if a new problem is found that was not originally evaluated for the current plan.

The public will be educated as part of the monitoring program so they can better understand the improvements being made to the lakes. A workshop to train new IOWATER volunteers and recertify old volunteers is being planned in the area. At these workshops volunteers will sign up for a section within an RMA to monitor and will be able to provide valuable feedback on the management plan as it is implemented.

PUBLIC OUTREACH

The Iowa Great Lakes Communication Plan is the Information and Education section of the management plan and was developed in connection with community visioning that occurred in 2004. This plan is organized around the four priority topics:

1) Save the Waves!

2) Stink or Swim!

3) It's a Shore Thing!

4) Make a Splash!

Each priority topics have goals listed with action items that can be used to reach those goals. Each priority topic along with the action items are listed below:

Save the Waves
Goal: Boaters inspect and clean their boats and trailers to keep Aquatic Invasive Species (AIS) out of the IGL.
Action Items:

- Establish and maintain an AM band radio station
- Run an Information campaign on radio, television, and newspaper
- Provide posters, maps, and other print material that has AIS information

Stink or Swim
Goal: Reduce nutrients and other pollutants that are used in the watershed which cause problems such as algae growth and fish kills.
Action Items:
Change habits regarding fertilizer:

- Use no-phosphorus lawn fertilizer on urban lawns and apply only as much fertilizer on farm fields as is needed. *(may include where to buy lake-friendly fertilizer)*
- Use no more fertilizer than you need (soil test, application rate) and only apply as much fertilizer as is needed.
- Don't use quick-release fertilizers
- Clean off sidewalks after applying fertilizer

Learning to value/employ infiltration in landscaping:

- Use rain gardens, natural landscaping, wetlands, and prairie on slopes to increase infiltration
- Don't run gutters into lakes
- Don't clip banks or remove glacial deposits on your shoreline
- Choose a gravel rather than an asphalt driveway
- Restore the lakeshores natural vegetation to allow less wave action on the shoreline and more infiltration of water moving toward the lake.

Other:

- Don't dump trash, oil, or leaves in storm sewers

It's a Shore Thing

Goal: Landowners can take specific, simple actions that can slow run-off and keep contaminants out of run-off.

Action Items:

- • Shoreline vegetation can soak up nutrients and prevent the shoreline from eroding
- • Rain Gardens and other LID practices slow water from reaching the lake and filter nutrients and pollutants from that water
- • Farming BMP's can reduce runoff and prevent farm nutrients and chemicals from reaching the lakes.

Make a Splash (with cash)

Goal: The business community understands the importance of the Clean Water Alliance communication efforts and contributes cash to conduct an information and education campaign yearly.

In addition to the above goals and action items, a core technical advisory committee with key professionals will be maintained. This committee will provide much needed technical advice to provide direction based on the most up to date science available. A public relations person or firm who can bring the "watershed ethic" message to residents and visitors of the watershed will be hired.

Target Audiences

Stakeholders in this plan are varied and come from all lifestyles. The bottom line for each stakeholder is that they have a stake in what happens with the Iowa Great Lakes. There are five groups of Stakeholders that have been identified. Those five groups are federal, State, local government, non-governmental organizations (NGO), and private citizens.

Federal Stakeholders:

U.S. EPA, Region 7 Non-point Source Region Headquarters (Section 319 Non-point Source Pollution Program)

U.S. Fish and Wildlife Service, Desoto Bend Wildlife Area (Private Lands Biologist)

USDA, Natural Resource Conservation Service, Dickinson County, District Conservationist (Wetlands Restoration Program, Wildlife Habitat Incentive Program, Environmental Quality Incentives Program)

State Stakeholders:

Iowa Department of Natural Resources, Bureaus of Fisheries, Wildlife, and Water Resources (Private Lands Wildlife Biologist)

Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation, Field Services Bureau. (Resource Enhancement and Protection Funds, Watershed Protection Funds, Iowa Financial Incentives Program, Watershed Improvement Review Board)

Iowa Department of Economic Development

Local Government Stakeholders:

City of Orleans, Spirit Lake, Okoboji, Arnolds Park, Milford, West Okoboji, and Wahpeton

Dickinson Soil and Water Conservation District, Commissioners (Local Grants)

Jackson (MN) Soil and Water Conservation District, Commissioners (Local Grants)

Dickinson County, Supervisors

Jackson County Commissioner

Spirit Lake School District (Future Farmers of America)

Okoboji School District (Future Farmers of America)

Iowa Great Lakes Sanitary Sewer District

Public Utilities, Alliant Energy

Dickinson County Conservation Board

Non-governmental Organizations:

Dickinson County Clean Water Alliance, John H. Wills, Coordinator (Coordination and local funding)
Iowa Natural Heritage Foundation, Mark Ackelson, Chairman (Easement funds)
The Nature Conservancy, Scott Moats, Private Lands Biologist (Habitat Restoration Program)
Pheasants Forever, John Linquist, Regional Representative (Build A Wildlife Area)
Ducks Unlimited, Dr. John Synhorst (Wetland Restoration Assistance)
Dickinson County Water Quality Commission, Brad Jones, Chairman (Water Quality Grants)
Private Citizens:
Property owners (urban and agricultural)
Fishermen
Hunters
Investors
Farmers
Developers
Boaters
Swimmers
Marinas
Resort owners
Bankers
Chamber of Commerce
Golf Courses/clubs
Visitors/tourists

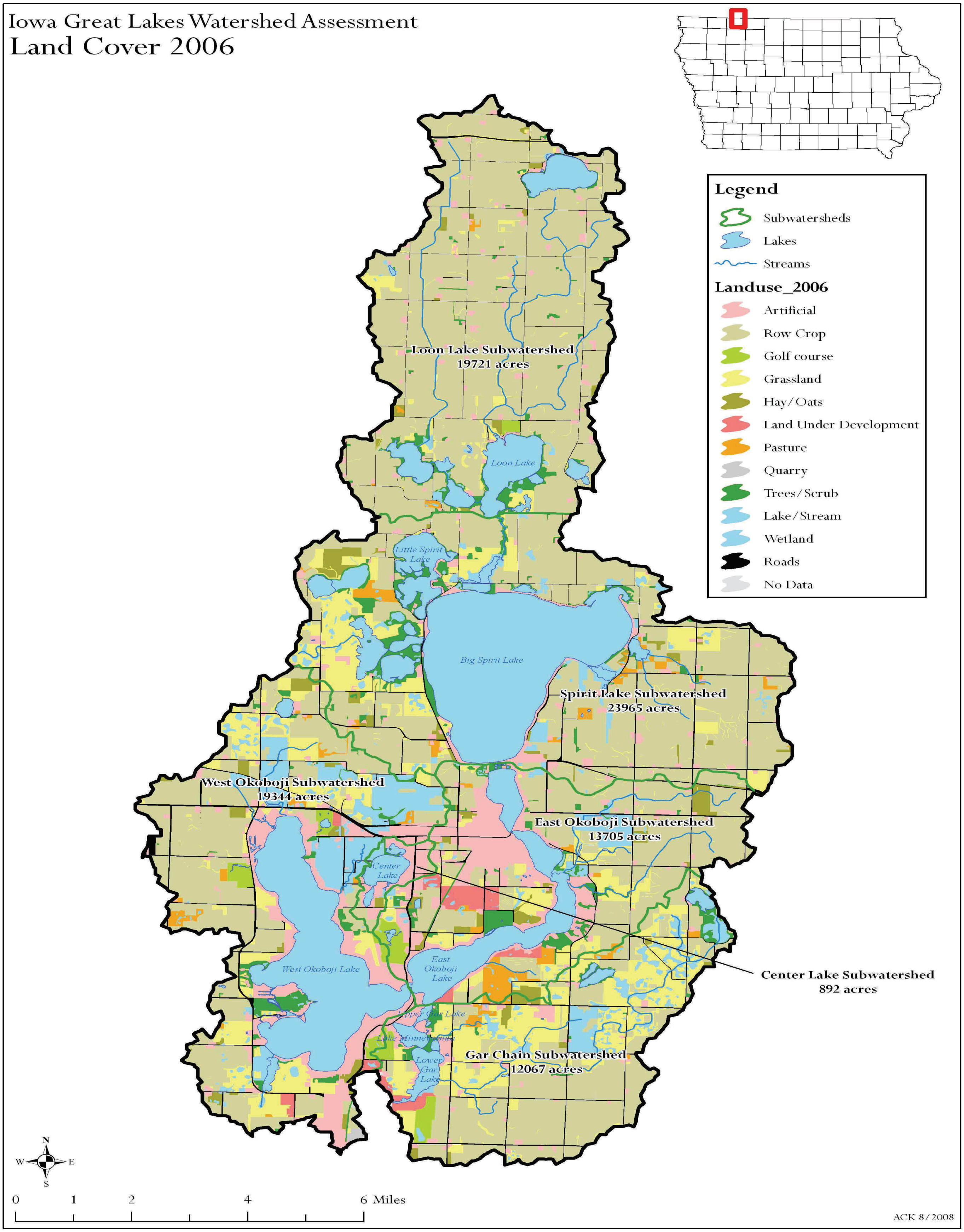

Figure 1.0 Iowa Great Lakes Identification and Land Use Overview

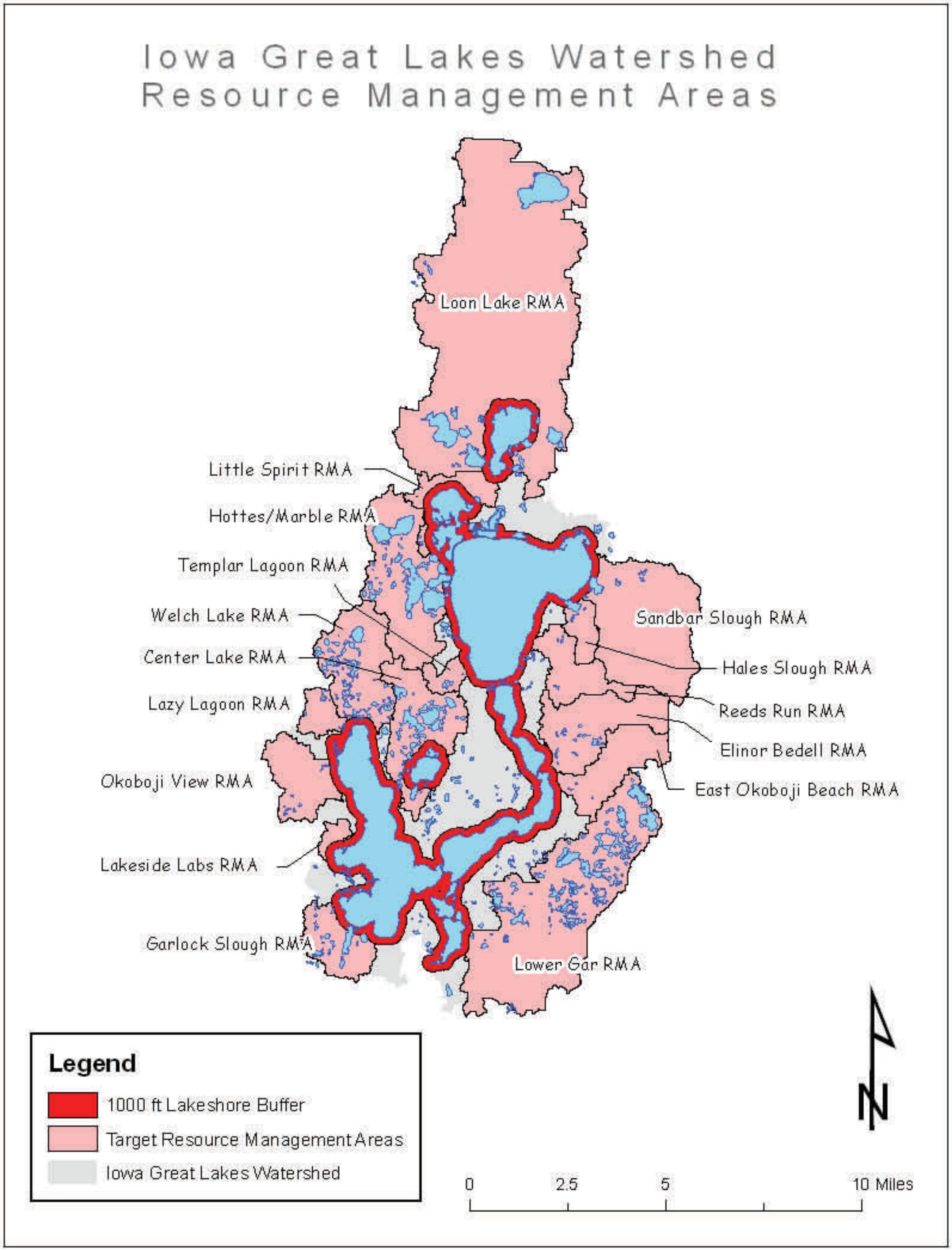

Figure 1.1 Iowa Great Lakes Resource Management Areas Identification

LOWER GAR LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
420 ac	90,631 ac	11,012 ac	79,619 ac	15	1	15	Yes

Lakes in the watershed of Lower Gar Lake:

Direct
Minnewashta Lake
Upper Gar Lake

Indirect
East Okoboji Lake
Center Lake
Little Spirit Lake
West Hottes
Grovers Lake
Rush Lake
Clear Lake
West Okoboji Lake
Big Spirit Lake
East Hottes
Marble Lake
Loon Lake
Pearl Lake

RMA's that drain to Lower Gar Lake

Direct
Lower Gar Lake RMA

Indirect
East Okoboji Beach RMA
Lakeside Lab RMA
Okoboji View RMA
Welch Lake RMA
Reeds Run RMA
Hales Slough RMA
Sandbar Slough RMA
Loon Lake RMA
Garlock Slough RMA
Elinor Bedell State Park RMA
Lazy Lagoon RMA
Center Lake RMA
Templar Lagoon RMA
Marble/Hottes RMA
Little Spirit Lake RMA

Impairment for Lower Gar Lake: Lower Gar Lake was impaired in 1998 and 2002 for turbidity that creates a condition that only partially supports its aquatic life designated use. The primary cause of the turbidity is caused by the shallowness of the lake and the resultant re-suspension of nutrients and sediment (Lower Gar TMDL 2003).

Objective – To remove the turbidity impairment from Lower Gar Lake and to improve it to a clear water state so it fully supports all its designated uses. The TMDL states phosphorus needs to be reduced by 8,000 pounds per year. The allocation is split out in three areas including 3,000 pounds per year from Lake Minnewashta, 2,600 pounds per year from the 11,000 acre watershed (Lower Gar Lake RMA) and 2,400 pounds per year with the re-suspension and recycling of previously settled phosphorous (Lower Gar TMDL 2003). New data, that will be published in 2010 through Iowa State Limnology Laboratory, has done more work to better allocate the phosphorus load and this potion of the watershed management plan will be updated after it is published.

Lower Gar (Spring Run) Resource Management Area (RMA)

Objective – Prevent sediment and excess nutrients reaching Lower Gar Lake via the outlet stream of the Spring Run Complex. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Lower Gar Lake (6,100 per year) in accordance with the approved TMDL .

Description – The Spring Run watershed has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this area very degraded. Representing approximately 83% of the watershed directly flowing into Lower Gar Lake, it is vital to improve our land management practices. Historically a long series of pothole wetlands and prairie uplands provided important watershed protection to Lower Gar Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both watershed and wetland restoration practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing a prioritized plan through augmentation of existing landowner conservation programs, easements, and public acquisitions.

Restoration Planning Components

Watershed Practices

Prioritized Sub-watershed (Figure 1.2)

Structural Sediment Trapping

- Analysis has shown that wetland restorations are not possible within this sub-watershed (Figure 1.3). It would still be possible to work with landowners to design a constructed wetland or sediment retention basin. Wetland Restoration areas have been identified outside of the priority area.
- These wetland restorations have the potential to effectively intercept many acres of agricultural runoff (Table 1.1).

Gully Management

- Five miles of ephemeral gully erosion has been identified within agricultural fields (Figure 1.4).
- By installing grassed waterways within each of these ephemeral gullies, 43 acres of upland habitat can be created and sediment loss from these areas significantly reduced.
- Construction of these grassed waterways will reduce 473 tons of sediment per year.

Highly Erodible Fields—Conservation Tillage

- Ten agricultural fields devoted to row crop production exceed sediment loss thresholds (Figure 1.5).
- These fields, totaling 444 acres, account for 50% of the sediment loss within the targeted watershed.
- Conservation tillage on these acres will reduce 888 tons of sediment per year.

Highly Erodible Fields—Permanent Vegetation

- Sediment loss can be reduced on 33 acres of row cropped fields by implementing alternative practices (i.e. permanent vegetation, sediment basins, and reduced tillage) where field slope is greater than seven percent.
- Three acres have been identified and should have alternate land practices implemented because their slope is greater than 15% (Figure 1.6).
- Permanent vegetation on these slopes will reduce 198 tons of sediment per year.

Nutrient Management

- A total of 693 acres are currently being utilized for the production of corn and soybeans within the targeted watershed of Lower Gar Lake.
- A nutrient and pesticide management plan should be set up with each individual landowner to ensure that over application and runoff of nutrients and pesticides is minimized.
- A plan should also be put into place to protect field tile intakes from excessive nutrients and sediment.
- Rock tile intakes with an additional 50 foot vegetative buffer should be discussed and implemented at all tile intake locations within the sub-watershed.

Outside Prioritized Sub-watershed (Figure 1.2)

Structural Sediment Trapping
- Analysis has identified five priority wetland restorations in this portion of the sub-watershed (Figure 1.3).
- These wetland restorations have the potential to effectively intercept 1650 acres (15% of the entire Lower Gar Lake watershed) of primarily agricultural runoff (Table 1.1).
- In lieu of restoration of these priority wetland areas, analysis has identified several locations for sediment retention basins or constructed wetlands.
- Restoration of these wetlands will reduce 2,970 tons of sediment per year.

Gully Management
- 13 miles of ephemeral gully erosion has been identified within agricultural fields (Figure 1.7).
- By installing grassed waterways within each of these ephemeral gullies, 120 acres of upland habitat could be created and sediment loss from these areas significantly reduced.
- Construction of these wetlands will reduce 1,320 tons of sediment per year.

Highly Erodible Fields—Conservation Tillage
- Three agricultural fields devoted to row crop production exceed sediment loss thresholds (Figure 1.8).
- These fields, totaling 50 acres, account for 25% of the sediment loss within this portion of the watershed.
- Conservation tillage on these acres will reduce 100 tons of sediment per year.

Highly Erodible Fields—Permanent Vegetation
- Sediment loss can be reduced on 268 acres of row cropped fields by implementing alternative practices (i.e. permanent vegetation, sediment basins, reduced tillage) where field slope is greater than seven percent.
- An additional 17 acres have been identified and should have alternate land practices implemented because their slope is greater than 15% (Figure 1.8).
- Permanent vegetation on these slopes will reduce 1,527 tons of sediment per year.

Nutrient Management
- A total of 3,268 acres are currently being utilized for the production of corn and soybeans within the second priority portion of the watershed for Lower Gar Lake.
- A nutrient and pesticide management plan should be set up with each individual landowner to ensure that over application and runoff is minimized.
- A plan should also be put into place to protect field tile intakes from excessive nutrients and sediment.
- Rock tile intakes with an additional 50 foot vegetative buffer should be discussed and implemented at all tile intake locations within the sub-watershed.

Pollution Reduction

Lower Gar has a TMDL assigned to it and in order to ensure the Lake and its watershed are removed from the 303(d) list of Impaired Waters in Iowa, this plan requires a 8,000 pound reduction of phosphorous per year to be removed. This Management Plan will help meet that 8,000 pound goal with a reduction in Phosphorous coming from the restored priority wetlands, stopping the ephemeral gullies using grassed waterways and sediment basins, conservation tillage, vegetative cover, and nutrient and pest management and a reduction in suspended phosphorous from the upstream lakes (including West Okoboji, Little Spirit Lake, Big Spirit Lake, Upper Gar Lake, and Minnewashta Lake). In addition, rock tile intakes and vegetation around the intakes will ensure an adequate reduction of phosphorous and associated sediment. The total reduction in phosphorous from the Lower Gar RMA is 4,000 pounds of phosphorous. The remaining reduction of 4,000 pounds will come from urban pollution reduction and reduction in the amount coming from upstream lakes.

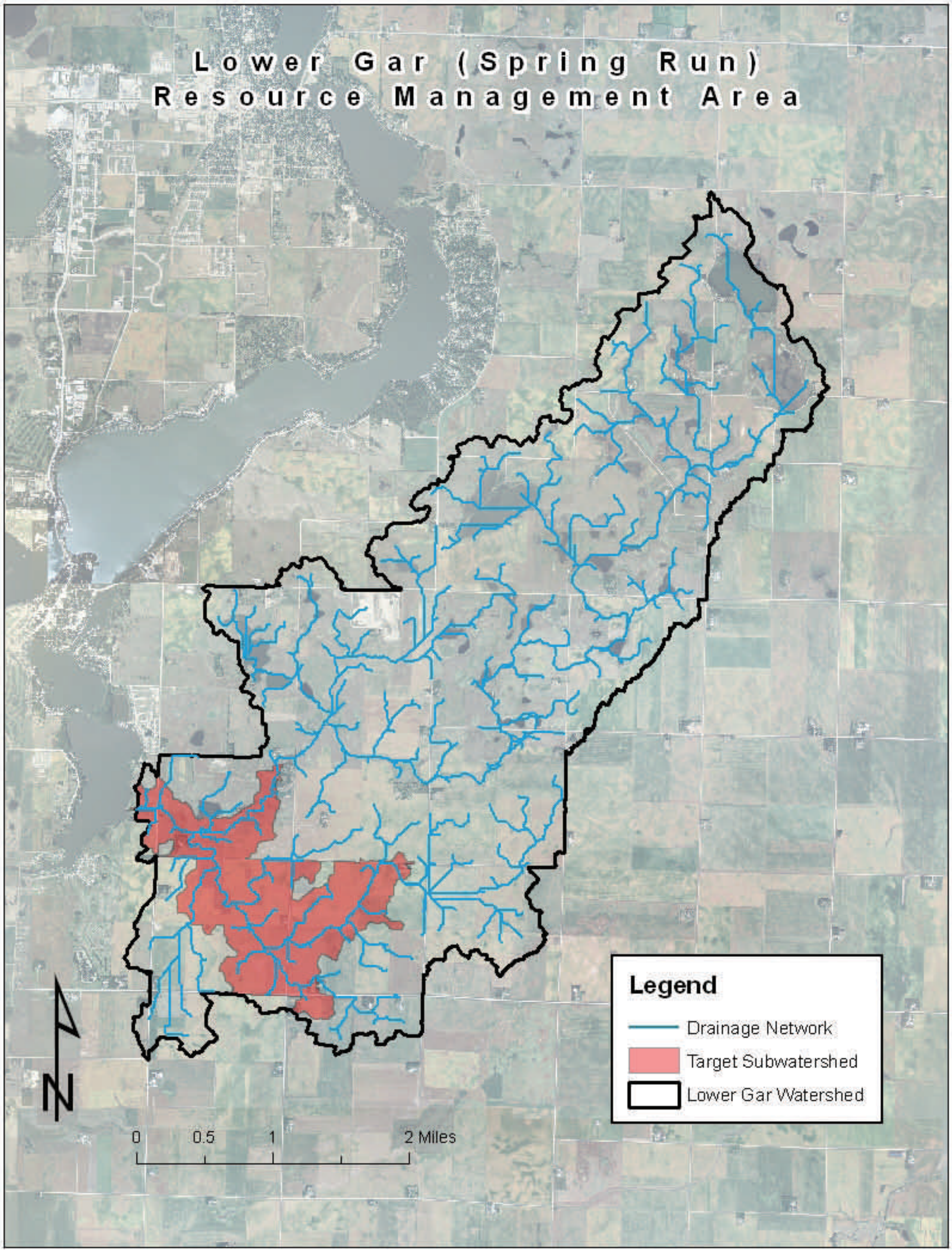

Figure 1.2 Lower Gar Resource Management Area

Lower Gar (Spring Run) Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Area (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
1788	1748	Lake					108.9	626.0	5.8	1
1848	Lake						90.2	259.7	2.9	2
1726	Lake						6.4	131.4	20.4	3
1552	1563	1565	1630	1637	Lake		31.3	235.8	7.5	4
1851	1840	Lake					9.1	151.1	16.7	5
1805	Lake						8.4	115.6	13.8	6
1734	1788	1748	Lake				5.5	252.1	46.1	7
1728	Lake						2.7	133.7	49.9	8
1692	1630	1637	Lake				6.1	69.3	11.4	9
1601	1630	1637	Lake				1.2	77.2	65.5	10
1727	1726	Lake					1.7	103.1	62.1	11
1716	1734	1788	1748	Lake			3.1	197.3	63.0	12
1730	Lake						0.8	59.6	72.7	13
1593	1601	1630	1637	Lake			2.9	48.9	17.0	14
1808	1848	Lake					3.9	39.9	10.4	15
1604	1630	1637	Lake				3.1	20.4	6.7	16
1731	1788	1748	Lake				3.6	116.5	32.3	17
1523	1552	1563	1565	1630	1637	Lake	0.7	28.0	41.9	18
1617	1630	1637	Lake				7.2	8.9	1.2	19
1449	1630	1637	Lake				1.2	16.6	13.7	20
1303	1630	1637	Lake				1.0	30.7	30.7	21
1757	1730	Lake					2.9	21.7	7.4	22
1853	1848	Lake					1.5	25.8	17.1	23
1854	1848	Lake					0.6	18.1	30.1	24
1790	1788	1748	Lake				4.2	25.4	6.1	25
1388	1389	1630	1637	Lake			1.2	25.8	21.5	26
1859	1851	1840	Lake				5.2	36.3	7.0	27
1852	1851	1840	Lake				4.0	26.2	6.5	28
1699	1728	Lake					7.7	40.7	5.3	29
1711	1699	1728	Lake				4.9	65.0	13.4	30

Table 1.1 Wetland restoration priorities for the Lower Gar watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

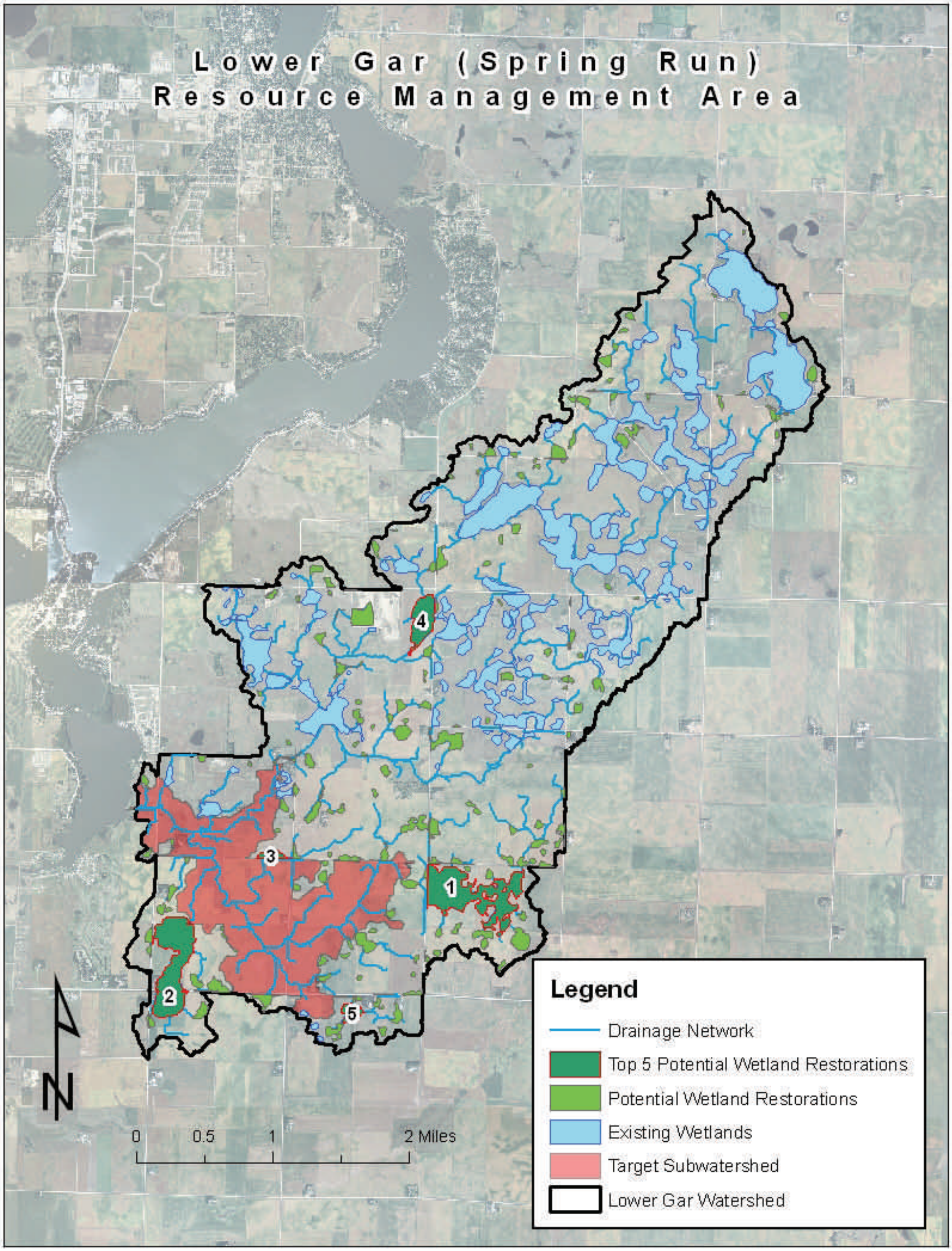

Figure 1.3 Lower Gar Priority Wetland Restoration Sites

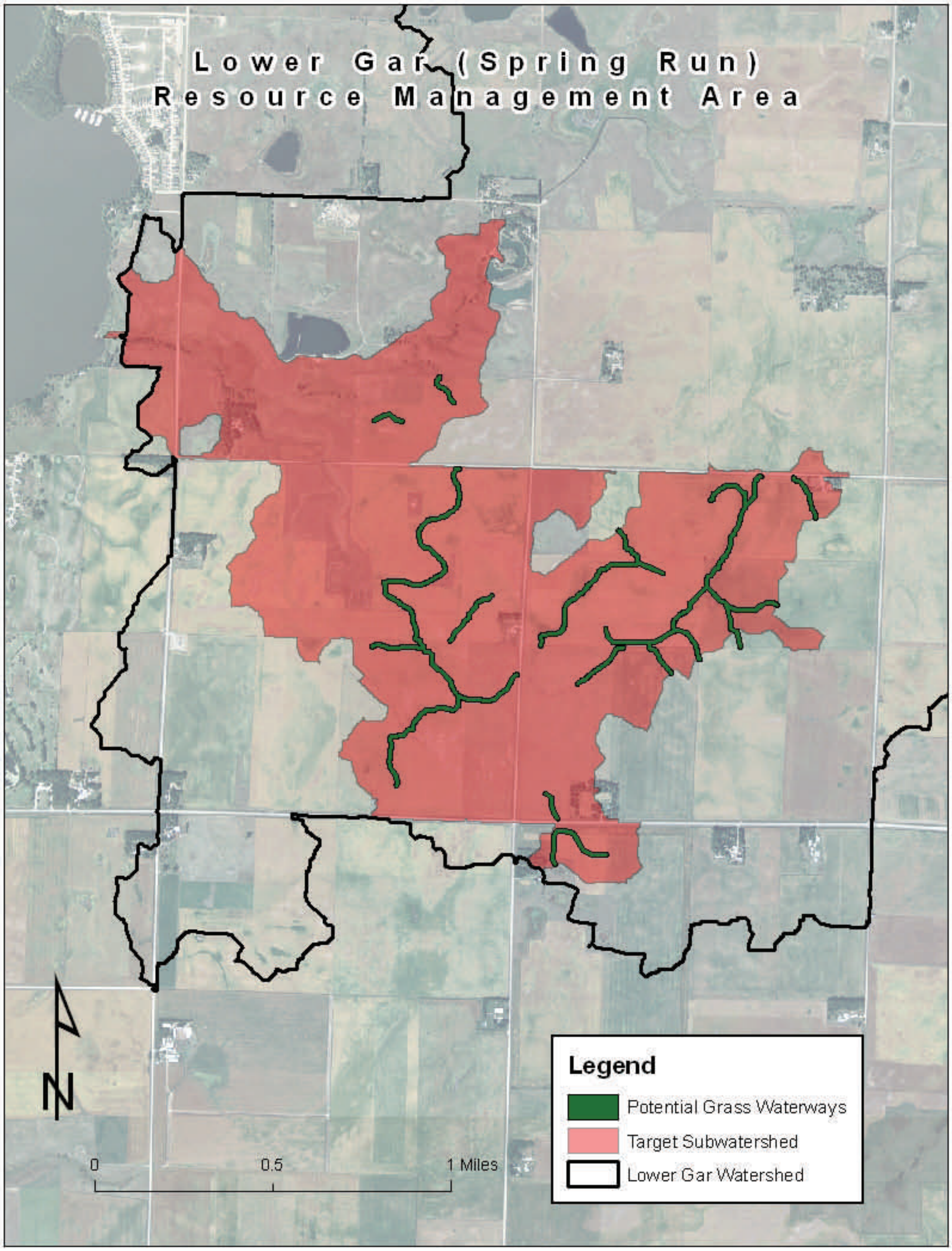

Figure 1.4 Lower Gar Priority Target Area Ephemeral Gullies

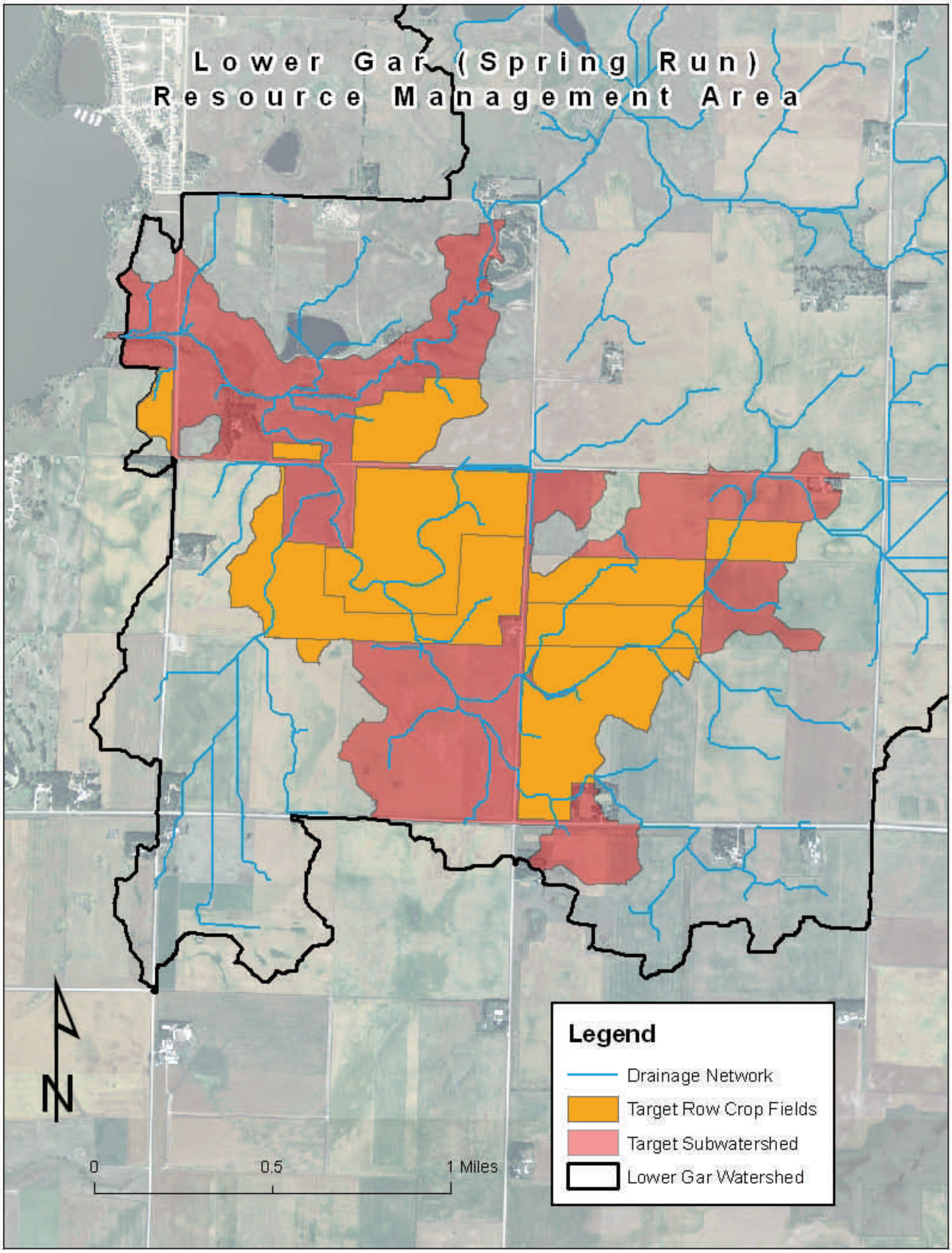

Figure 1.5 Lower Gar Priority Area Target Row Crop Fields

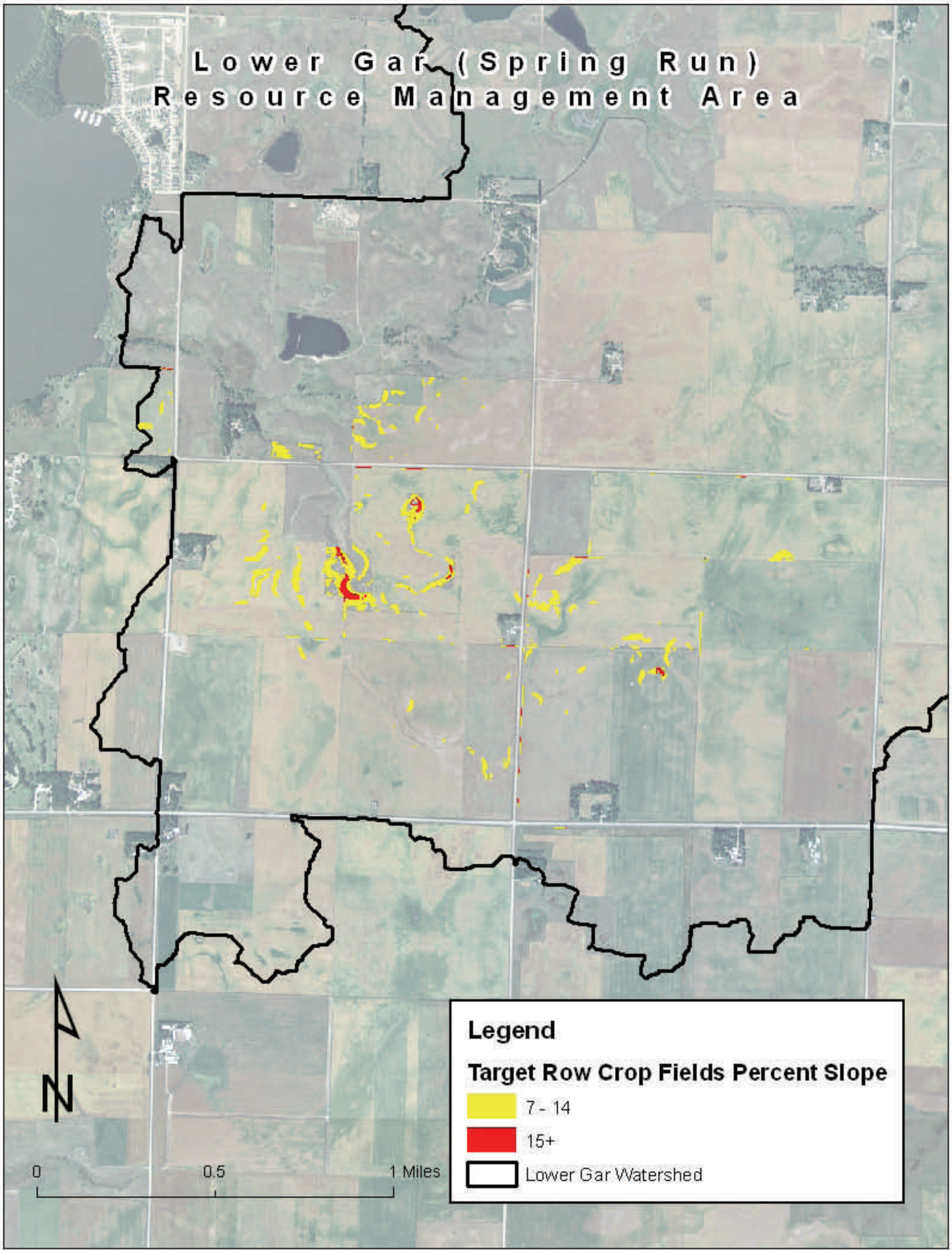

Figure 1.6 Lower Gar Target Row Crop Slopes

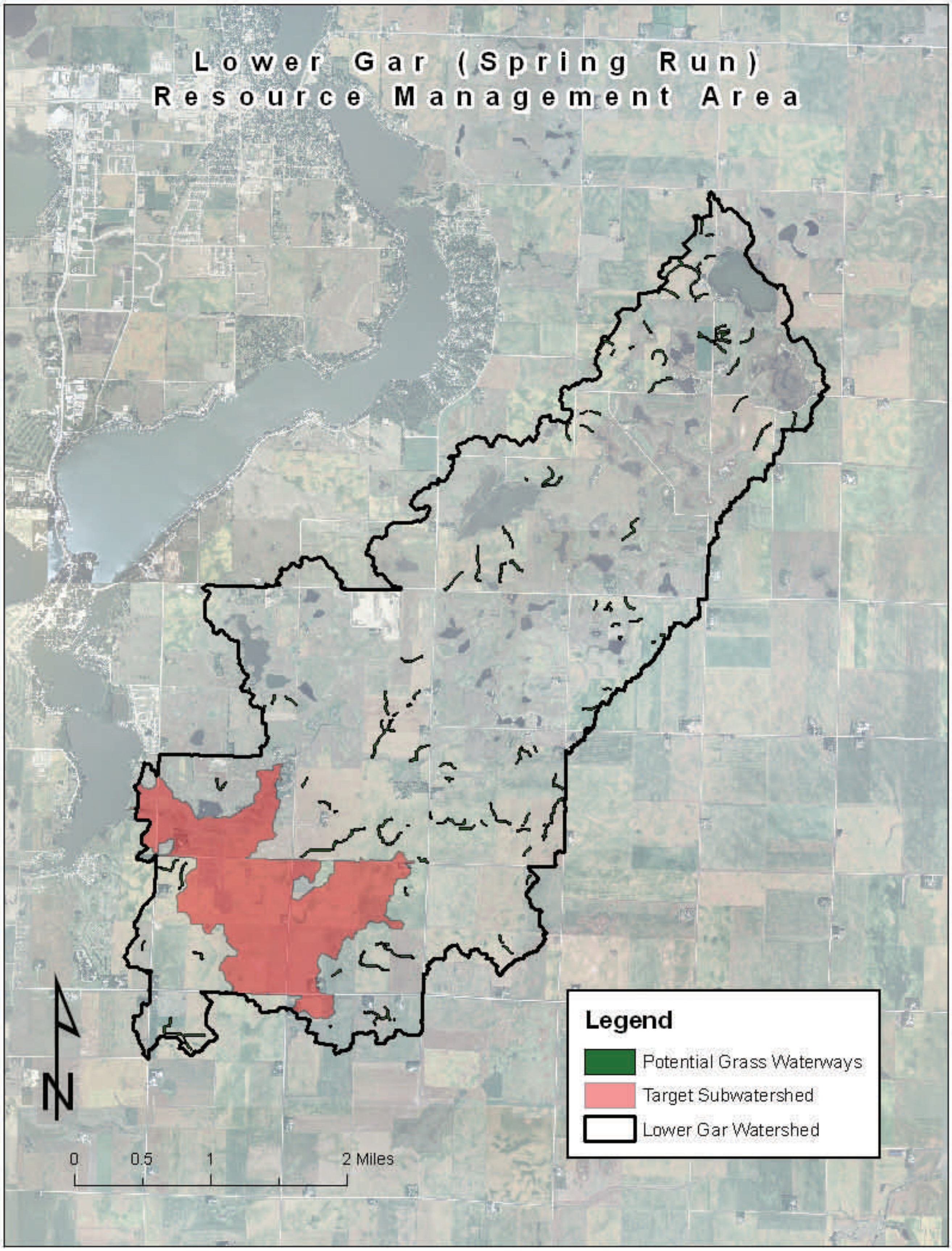

Figure 1.7 Lower Gar Non-priority Ephemeral Gullies

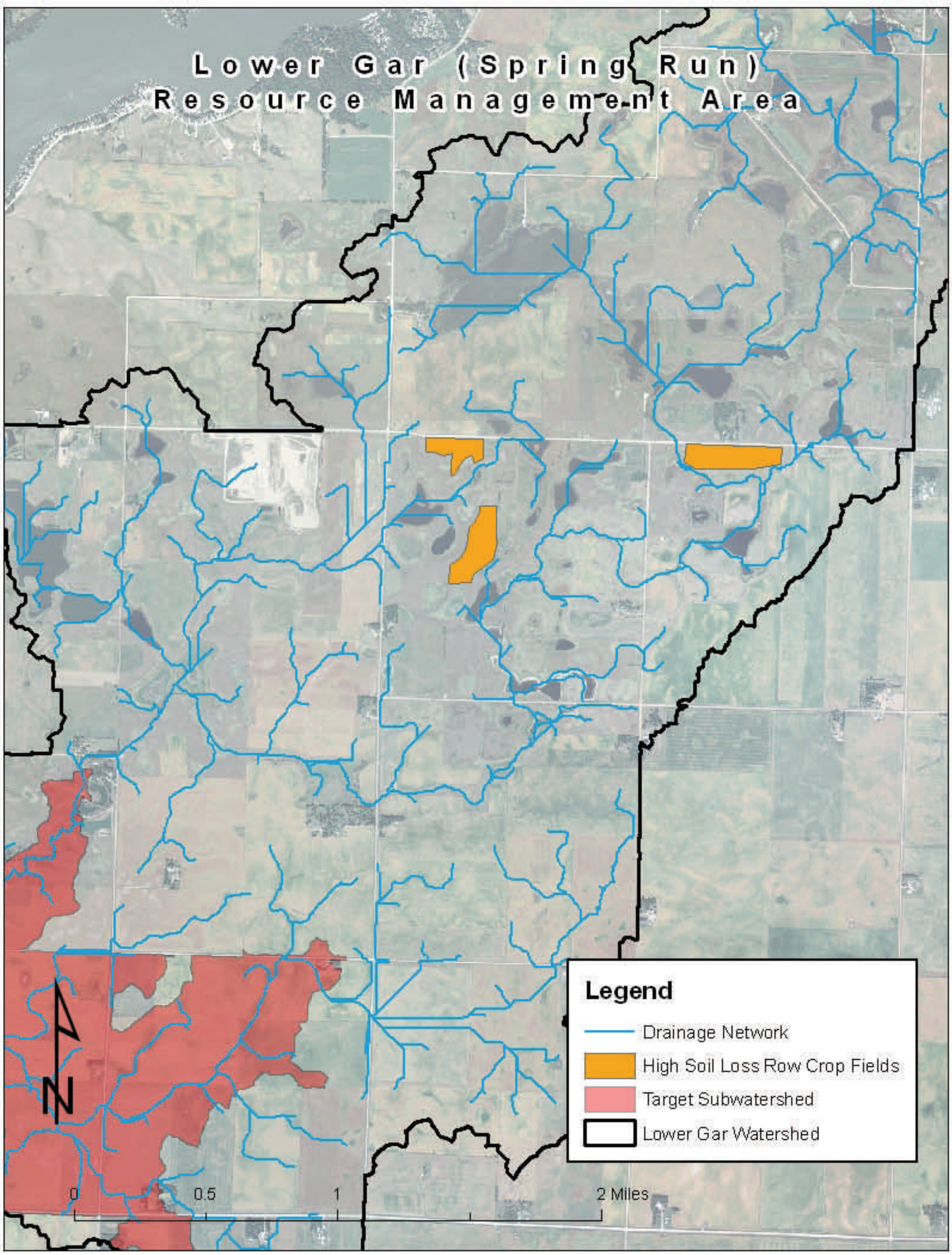

Figure 1.8 Lower Gar Non-priority High Soil Loss Row Crop Fields

EAST OKOBOJI LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
1843 ac	79,199 ac	11,779 ac	65,577 ac	13	2	13	No

Lakes in the watershed of East Okoboji Lake:

Direct
West Okoboji Lake
Big Spirit Lake

Indirect
Center Lake
East Hottes
Marble Lake
Loon Lake
Pearl Lake
Little Spirit Lake
West Hottes
Grovers Lake
Rush Lake
Clear Lake

RMA's that drain to East Okoboji Lake:

Direct
East Okoboji Beach RMA
Elinor Bedell State Park RMA

Indirect
Garlock Slough RMA
Okoboji View RMA
Welch Lake RMA
Reeds Run RMA
Hales Slough RMA
Sandbar Slough RMA
Loon Lake RMA
Lakeside Lab RMA
Lazy Lagoon RMA
Center Lake RMA
Templar Lagoon RMA
Marble/Hottes RMA
Little Spirit Lake RMA

Impairment for East Okoboji Lake: East Okoboji Lake is not impaired as of 2010. Work done within the East Okoboji Lake watershed is to protect East Okoboji from being impaired for turbidity and nuisance algae blooms. The work within the East Okoboji Lake watershed will also have a impact on sediment and phosphorus reductions in Upper Gar and Lower Gar Lakes that are both impaired.

Objective – To keep East Okoboji from becoming impaired and to assist with reducing phosphorus loads and sediment loads to impaired lakes that East Okoboji directly and indirectly drain to within the Iowa Great Lakes Watershed.

East Okoboji Beach Resource Management Area (RMA)

Objective – Prevent heavy sediment loaded water reaching East Okoboji Lake via the stream adjacent to East Okoboji Beach. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake (3,300 pounds per year) and Lower Gar Lake (6,100 per year) in accordance with their specific approved TMDL's .

Description – The watersheds draining towards East Okoboji Lake have undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. This watershed represents approximately 15% of the watershed of East Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to East Okoboji Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both watershed and wetland restoration practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing a prioritized plan through augmentation of existing landowner conservation programs, easements, and public acquisitions.

Restoration Planning Components

<u>Watershed Practices</u>

Prioritized Sub-watershed (Figure 1.9)

Structural Sediment Trapping

- Analysis has identified four priority wetland restorations in this sub-watershed (Figure 1.10).
- These wetland restorations have the potential to effectively intercept 1231 acres (62% of the priority sub-watershed) of primarily agricultural runoff (Table 1.2).
- In lieu of restoration of these priority wetland areas, analysis has identified several locations for sediment retention basins or constructed wetlands.
- Restoration of these wetlands will reduce 2,215.8 tons of sediment per year.

Gully Management

- 12 miles of ephemeral gully erosion has been identified within agricultural fields (Figure 1.11).
- By installing grassed waterways within each of these ephemeral gullies, 109 acres of upland habitat can be created and sediment loss from these areas significantly reduced.
- Construction of these grassed waterways will reduce 1,119 tons of sediment per year.

Highly Erodible Fields—Conservation Tillage

- 12 agricultural fields devoted to row crop production exceed sediment loss thresholds (Figure 1.12).
- These fields, totaling 750 acres, account for 50% of the sediment loss within the targeted watershed.
- Conservation tillage on these acres will reduce 1,500 tons of sediment per year.

Highly Erodible Fields—Permanent Vegetation

- Sediment loss can be reduced on 55 acres of row cropped fields by implementing alternative practices (i.e. permanent vegetation, sediment basins, and reduced tillage) where field slope is greater than seven percent.
- One half acres have been identified and should have alternate land practices implemented because their slope is greater than 15% (Figure 1.13).
- Permanent vegetation on these slopes will reduce 241.5 tons of sediment per year.

Nutrient Management

- A total of 1525 acres are currently being utilized for the production of corn and soybeans within the targeted watershed of East Okoboji Beach.
- A nutrient and pesticide management plan should be set up with each individual landowner to ensure that over application and runoff of nutrients and pesticides is minimized.
- A plan should also be put into place to protect field tile intakes from excessive nutrients and sediment.
- Rock tile intakes with an additional 50 foot vegetative buffer should be discussed and implemented at all tile intake locations within the sub-watershed.

Pollution Reduction

East Okoboji Lake does not have a TMDL assigned to it, but in order to ensure the Lake and its watershed are sustainable for future years this plan requires a 2,600 pound reduction of phosphorous per year to be removed. This Management Plan will help meet that 2,600 pound goal with a reduction in Phosphorous coming from the restored priority wetlands, stopping the ephemeral gullies using grassed waterways and sediment basins, conservation tillage, vegetative cover, and nutrient and pest management. In addition, rock tile intakes and vegetation around the intakes will ensure an adequate reduction of phosphorous and associated sediment. The total reduction in phosphorous from the East Okoboji Beach RMA is 1,300 pounds of phosphorous.

Grade Stabilization Rehabilitation

The one grade stabilization structure in this watershed needs to be investigated for possible rehabilitation. The structure was built in 1964 and may be causing creating a larger pollution source then the watershed it is protecting. The sedimentation can be seen from the photos below. The surface area this grade stabilization structure originally about 2.5 acres has lost 48% and know is about 1.3 acres in size. An investigation includes sediment depth survey and water monitoring above and below the structure for phosphorus and sediment levels entering and exiting the structure.

Photo: 1970

Photo: 2007

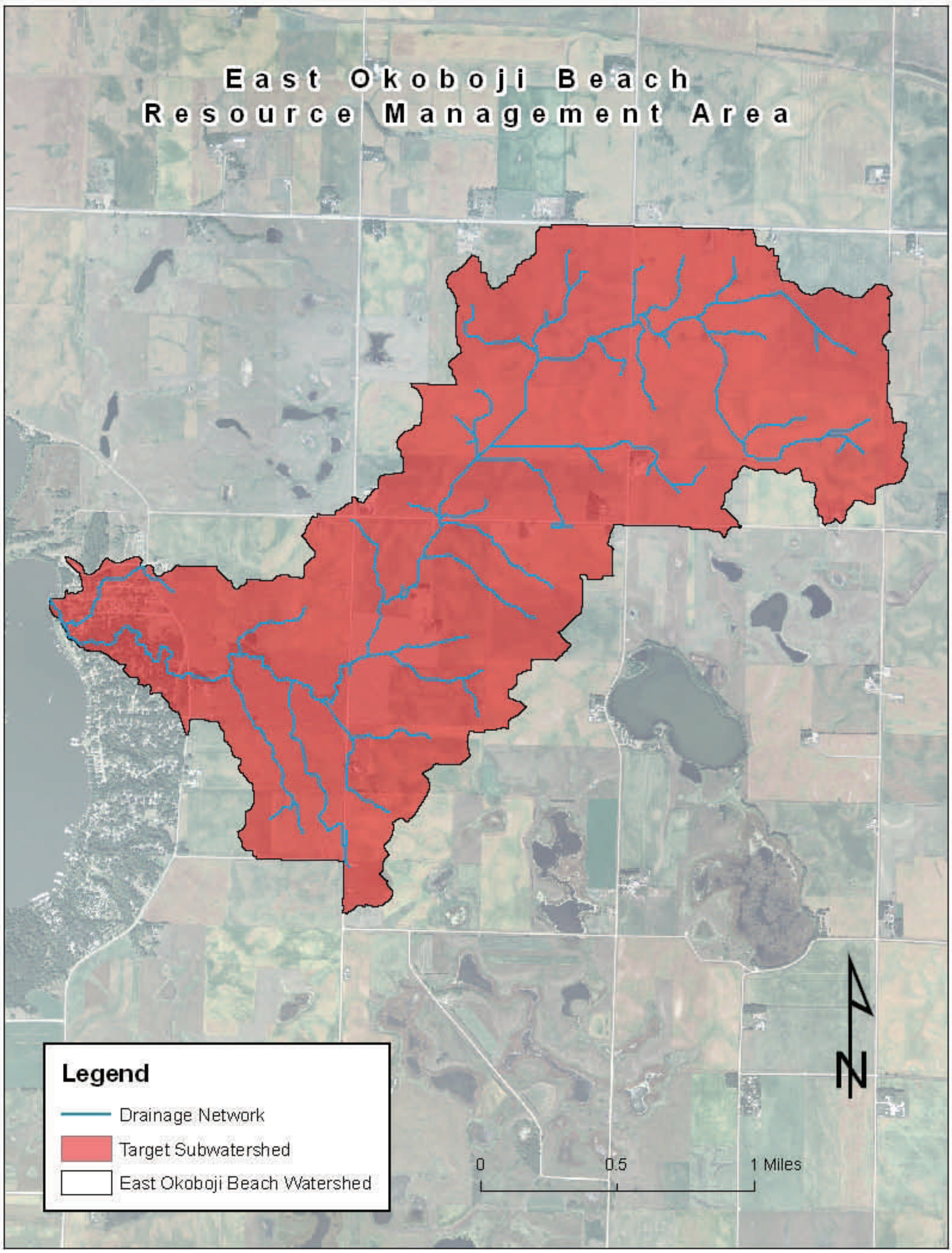

Figure 1.9 East Okoboji Beach Resource Management Area

East Okoboji Beach Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
1096	1119	1131	Lake				50.2	952.1	19.0	1
1078	1096	1119	1131	Lake			1.8	82.9	45.8	2
1107	1080	1096	1119	1131	Lake		8.4	61.9	7.4	3
1068	1078	1096	1119	1131	Lake		1.5	72.4	47.3	4
1308	Lake						1.1	39.5	35.5	5
990	1096	1119	1131	Lake			4.7	46.2	9.8	6
1102	1068	1078	1096	1119	1131	Lake	16.5	34.3	2.1	7
1084	1096	1119	1131	Lake			15.4	43.8	2.8	8
1310	1308	Lake					3.2	32.5	10.2	9
1020	1096	1119	1131	Lake			15.5	65.1	4.2	10
1281	Lake						1.0	33.2	32.2	11
1264	Lake						0.3	22.3	63.8	12
1341	1310	1308	Lake				3.4	14.0	4.1	13
1233	Lake						3.6	10.8	3.0	14
1094	1107	1080	1096	1119	1131	Lake	6.6	17.8	2.7	15
1132	1096	1119	1131	Lake			2.3	18.2	7.8	16
1121	1107	1080	1096	1119	1131	Lake	1.7	9.6	5.6	17
1053	1096	1119	1131	Lake			1.1	17.2	15.1	18
961	1096	1119	1131	Lake			2.6	7.1	2.7	19
1170	1131	Lake					4.9	20.8	4.3	20
951	990	1096	1119	1131	Lake		0.9	8.1	9.4	21
1311	1281	Lake					2.0	8.5	4.3	22
1060	1068	1078	1096	1119	1131	Lake	1.5	12.3	8.5	23
1297	1281	Lake					2.2	10.9	5.0	24
1161	Lake						0.3	7.0	27.1	25
1148	1153	1160	Lake				0.3	3.8	13.6	26
1101	1119	1131	Lake				1.8	6.4	3.5	27
1194	Lake						1.0	6.9	7.1	28
964	1096	1119	1131	Lake			1.9	9.8	5.0	29
1312	1311	1281	Lake				1.0	2.8	2.8	30

Table 1.2 Wetland restoration priorities for the East Okoboji Beach watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).

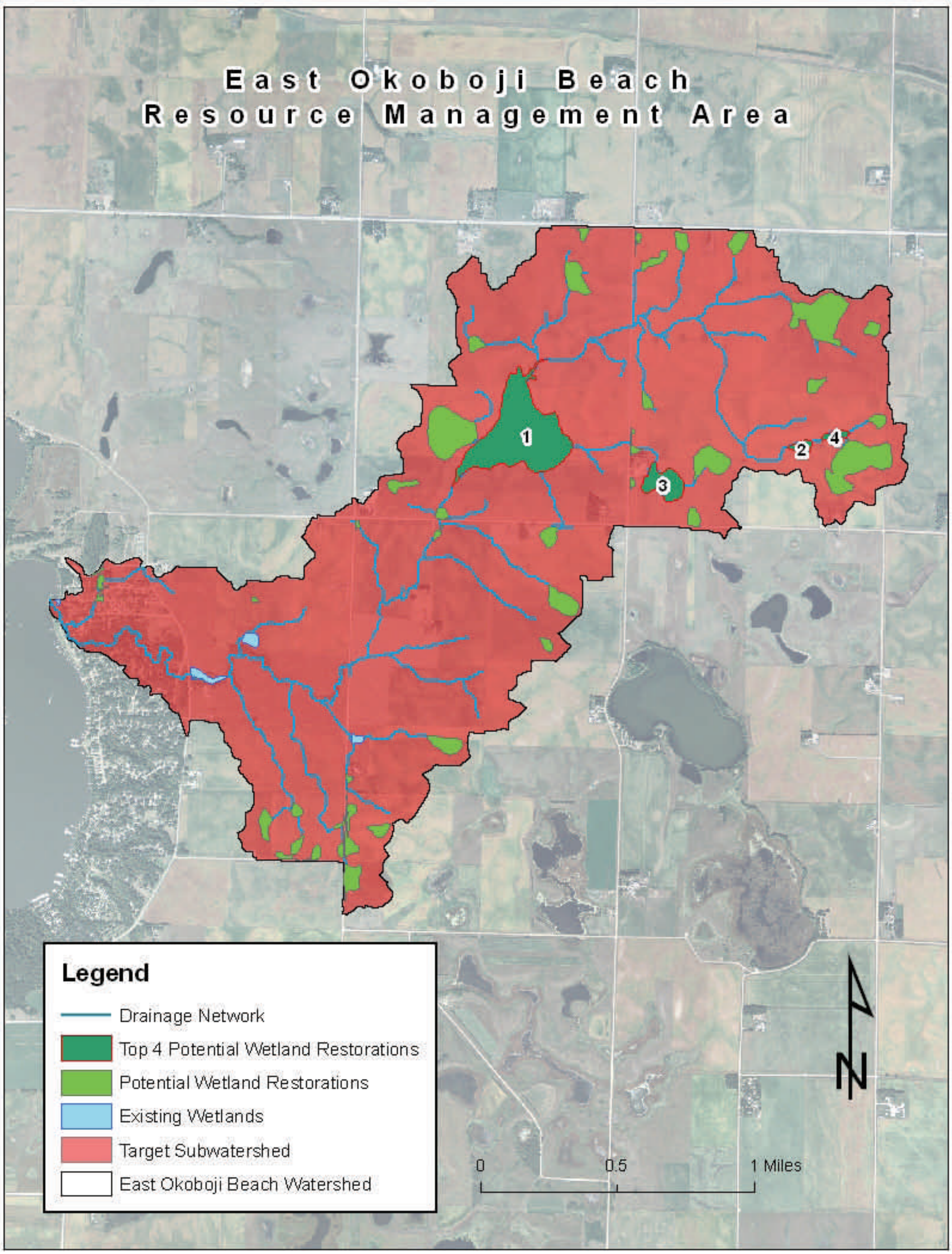

Figure 1.10 East Okoboji Beach Priority Wetland Restorations

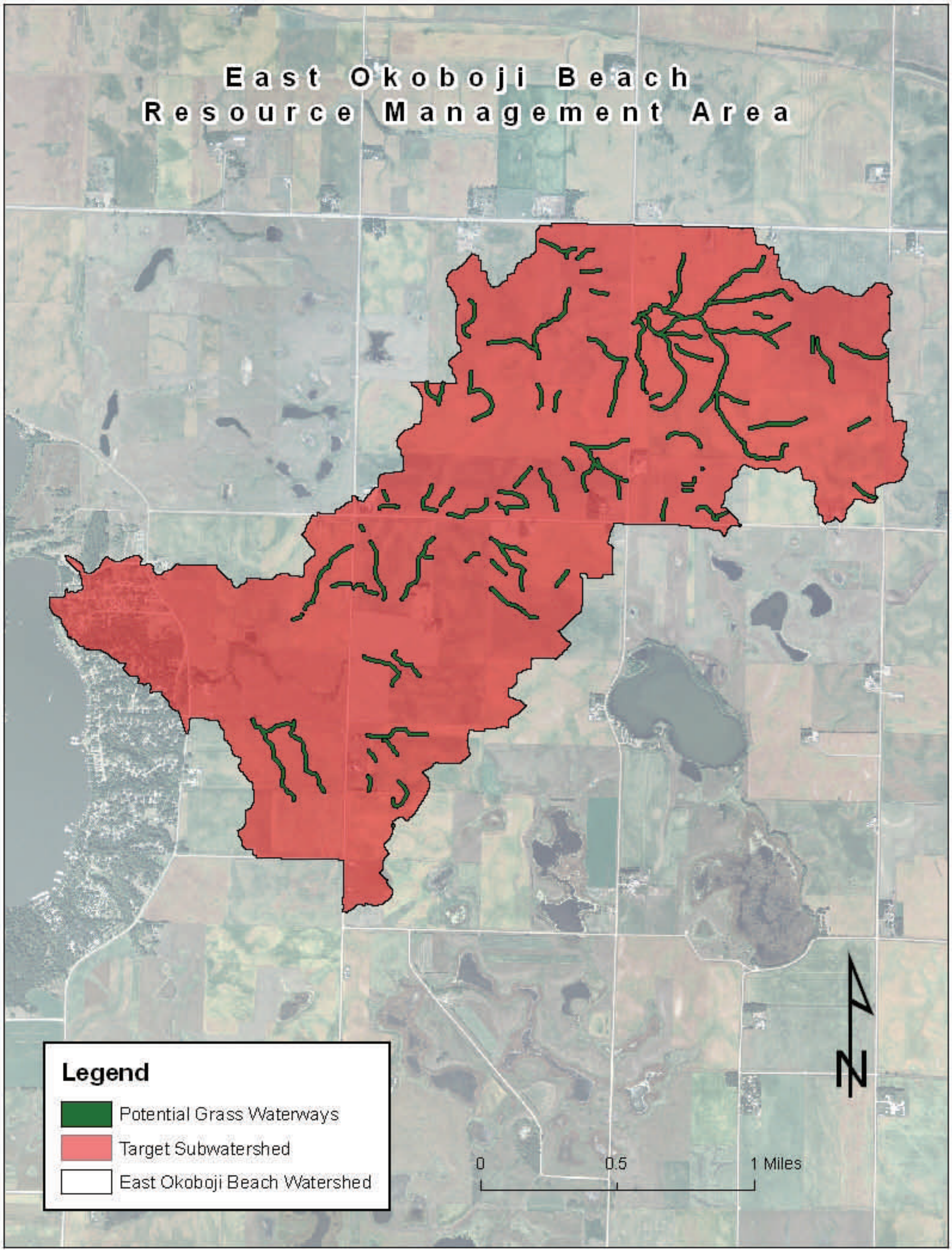

Figure 1.11 East Okoboji Beach Ephemeral Gullies

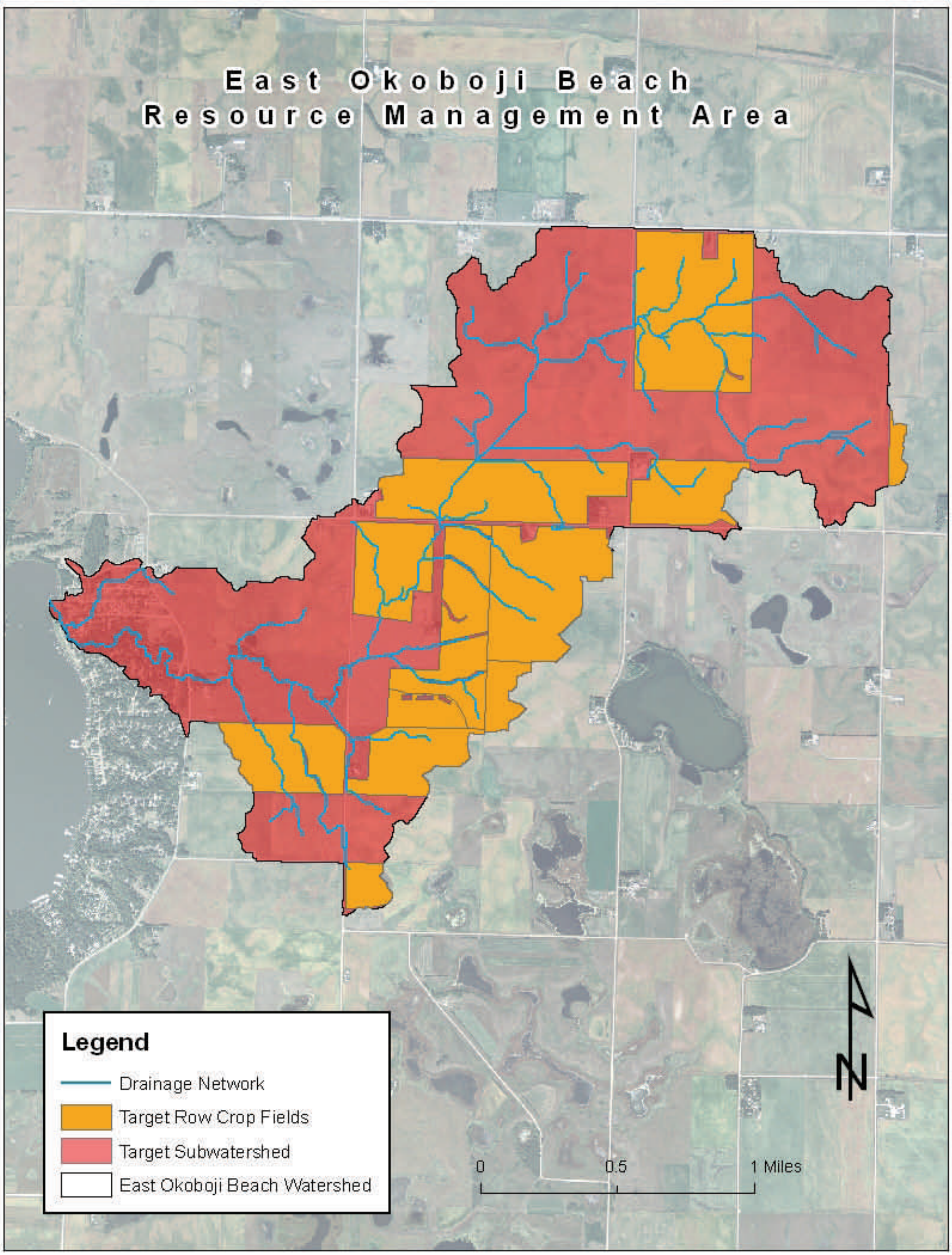

Figure 1.12 East Okoboji Beach Target Row Crop Fields

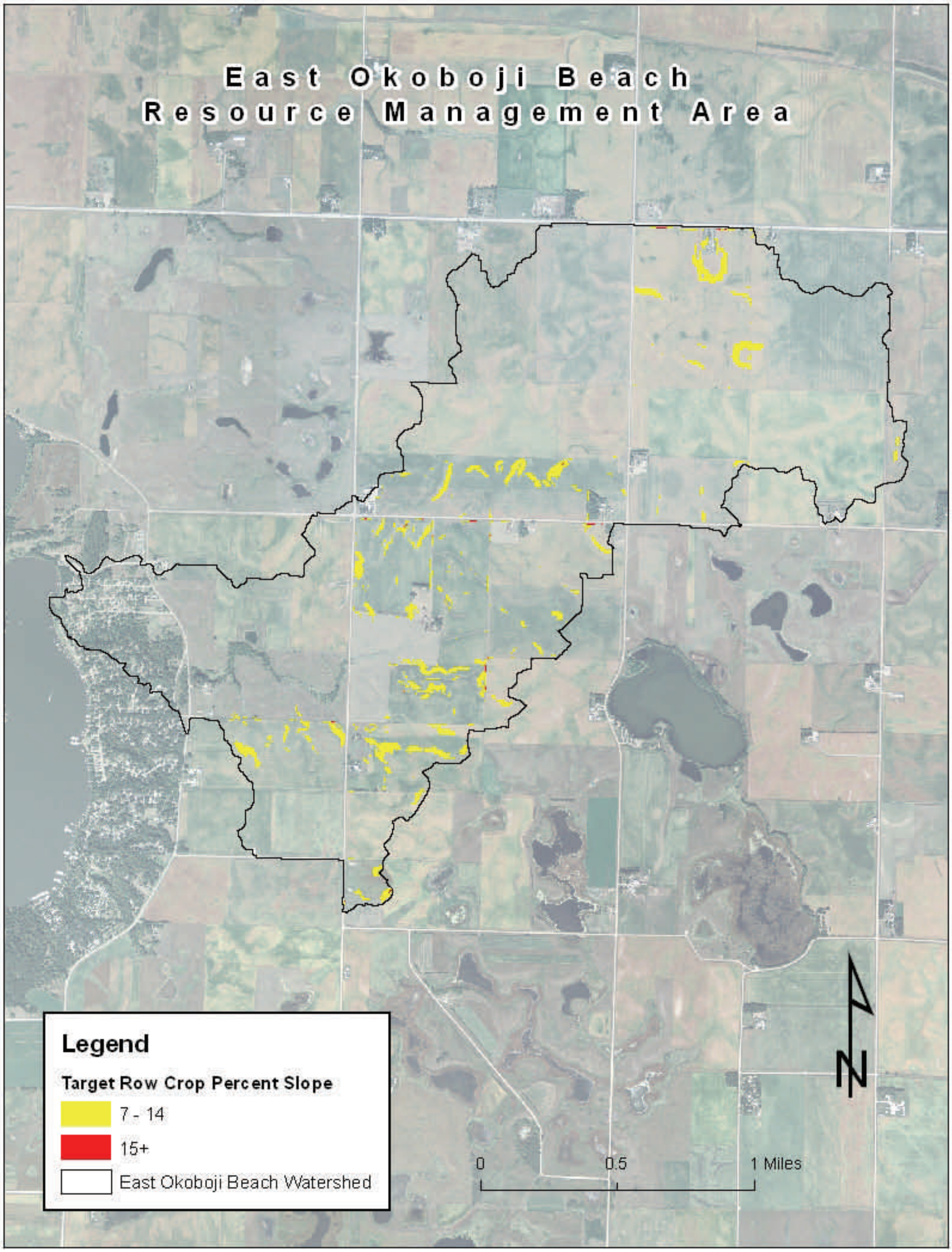

Figure 1.13 East Okoboji Beach Target Row Crop Slopes

Elinor Bedell State Park Resource Management Area (RMA)

Objective – Prevent heavily sediment loaded water reaching East Okoboji Lake via the stream running through Elinor Bedell State Park. The sediment reductions in this RMA will assist with the target reduction of phosphorus in Upper Gar Lake (3,300 pounds per year) and Lower Gar Lake (6,100 per year) in accordance with their specific approved TMDL's .

Description – The watershed draining towards Elinor Bedell State Park has undergone many hydrological changes in the past 100 years. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. This watershed represents approximately 20% of the watershed of East Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to East Okoboji Lake and provided critical wildlife habitat. A holistic approach is needed to restore ecological health and water quality to this area. A combination of both watershed and wetland restoration practices is needed to reach the project objective. Sediment, nutrients, and water volume loadings from the watershed should be reduced utilizing a prioritized plan through augmentation of existing landowner conservation programs, easements, and public acquisitions.

Restoration Planning Components

<u>Watershed Practices</u>

Prioritized Sub-watershed (Figure 1.14)

Structural Sediment Trapping

- Analysis has identified three priority wetland restorations in this sub-watershed (Figure 1.15).
- These wetland restorations have the potential to effectively intercept 450 acres (16% of the priority sub-watershed) of primarily agricultural runoff (Table 1.3).
- In lieu of restoration of these priority wetland areas, analysis has identified several locations for sediment retention basins or constructed wetlands.
- Restoration of these wetlands can reduce sediment by 810 tons per year.

Gully Management

- 11 miles of ephemeral gully erosion has been identified within agricultural fields (Figure 1.16).
- By installing grassed waterways within each of these ephemeral gullies, 100 acres of upland habitat can be created and sediment loss from these areas significantly reduced.
- Construction of these grassed waterways can reduce the sediment by 1,100 tons per year.

Highly Erodible Fields—Conservation Tillage

- 25 agricultural fields devoted to row crop production exceed sediment loss thresholds (Figure 1.17).
- These fields, totaling 675 acres, account for 50% of the sediment loss within the targeted watershed.
- Conservation tillage on these acres can reduce sediment by 1,350 tons per year.

Highly Erodible Fields—Permanent Vegetation

- Sediment loss can be reduced on 110 acres of row cropped fields by implementing alternative practices (i.e. permanent vegetation, sediment basins, and reduced tillage) where field slope is greater than seven percent.
- Four acres have been identified and should have alternate land practices implemented because their slope is greater than 15% (Figure 1.18).
- By planting permanent vegetation on these acres sediment can be reduced by 994 tons.

Nutrient Management

- A total of 1,707 acres are currently being utilized for the production of corn and soybeans within the targeted watershed of Elinor Bedell State Park.
- A nutrient and pesticide management plan should be set up with each individual landowner to ensure that over application and runoff of nutrients and pesticides is minimized.
- A plan should also be put into place to protect field tile intakes from excessive nutrients and sediment.
- Rock tile intakes with an additional 50 foot vegetative buffer should be discussed and implemented at all tile intake locations within the sub-watershed.

Pollution Reduction

East Okoboji Lake does not have a TMDL assigned to it, but in order to ensure the Lake and its watershed are sustainable for future years this plan requires a 2,600 pound reduction of phosphorous per year to be removed. This Management Plan will help meet that 2,600 pound goal with a reduction in Phosphorous coming from the restored priority wetlands, stopping the ephemeral gullies using grassed waterways and sediment basins, conservation tillage, vegetative cover, and nutrient and pest management. In addition, rock tile intakes and vegetation around the intakes will ensure an adequate reduction of phosphorous and associated sediment. The total reduction in phosphorous from the Elinor Bedell RMA is 1,300 pounds of phosphorous.

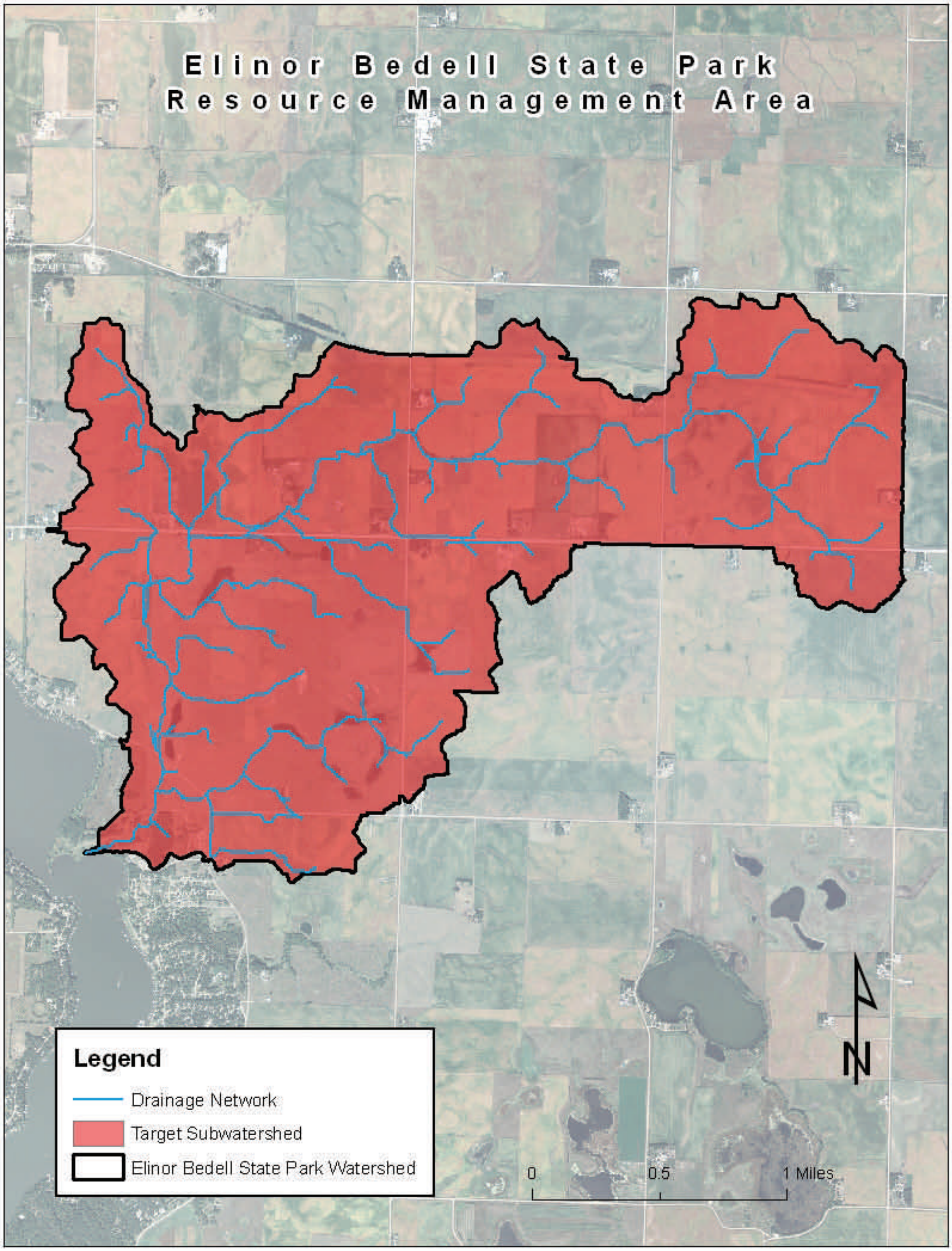

Figure 1.14 Elinor Bedell Resource Management Area

Elinor Bedell State Park Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
933	Lake				25.1	293.3	11.7	1
935	Lake				3.5	33.1	9.4	2
1146	Lake				6.3	22.5	3.6	3
963	939	938	Lake		10.1	57.4	5.7	4
898	Lake				1.5	36.2	23.5	5
1077	Lake				2.2	19.3	8.7	6
836	Lake				7.3	34.7	4.8	7
930	Lake				1.1	17.1	16.0	8
834	Lake				4.0	13.0	3.3	9
973	Lake				2.0	12.1	6.1	10
862	Lake				0.9	21.3	24.0	11
849	862	Lake			8.1	10.6	1.3	12
969	Lake				0.7	7.2	11.0	13
970	Lake				7.7	9.0	1.2	14
1129	Lake				1.2	18.4	15.3	15
923	898	Lake			6.8	10.7	1.6	16
1128	1146	Lake			0.3	4.8	15.4	17
1079	Lake				1.7	4.4	2.5	18
950	Lake				1.2	6.3	5.3	19
900	Lake				0.6	2.3	4.0	20
943	Lake				1.0	2.5	2.5	21
837	834	Lake			0.9	3.5	4.1	22
909	Lake				1.4	8.0	5.5	23
863	933	Lake			0.7	5.9	8.9	24
881	Lake				1.1	2.8	2.6	25
889	Lake				0.8	7.4	9.2	26
945	953	Lake			0.3	3.2	11.4	27
1115	Lake				0.3	0.7	2.7	28
957	963	939	938	Lake	9.7	16.6	1.7	29
848	Lake				1.2	2.6	2.2	30

Table 1.3 Wetland restoration priorities for the Elinor Bedell watershed. GIS priority rankings are based on a combination of erosion rates and size of watershed draining to each wetland (wetlands having watershed to wetland area ratios greater than 75:1 are excluded).