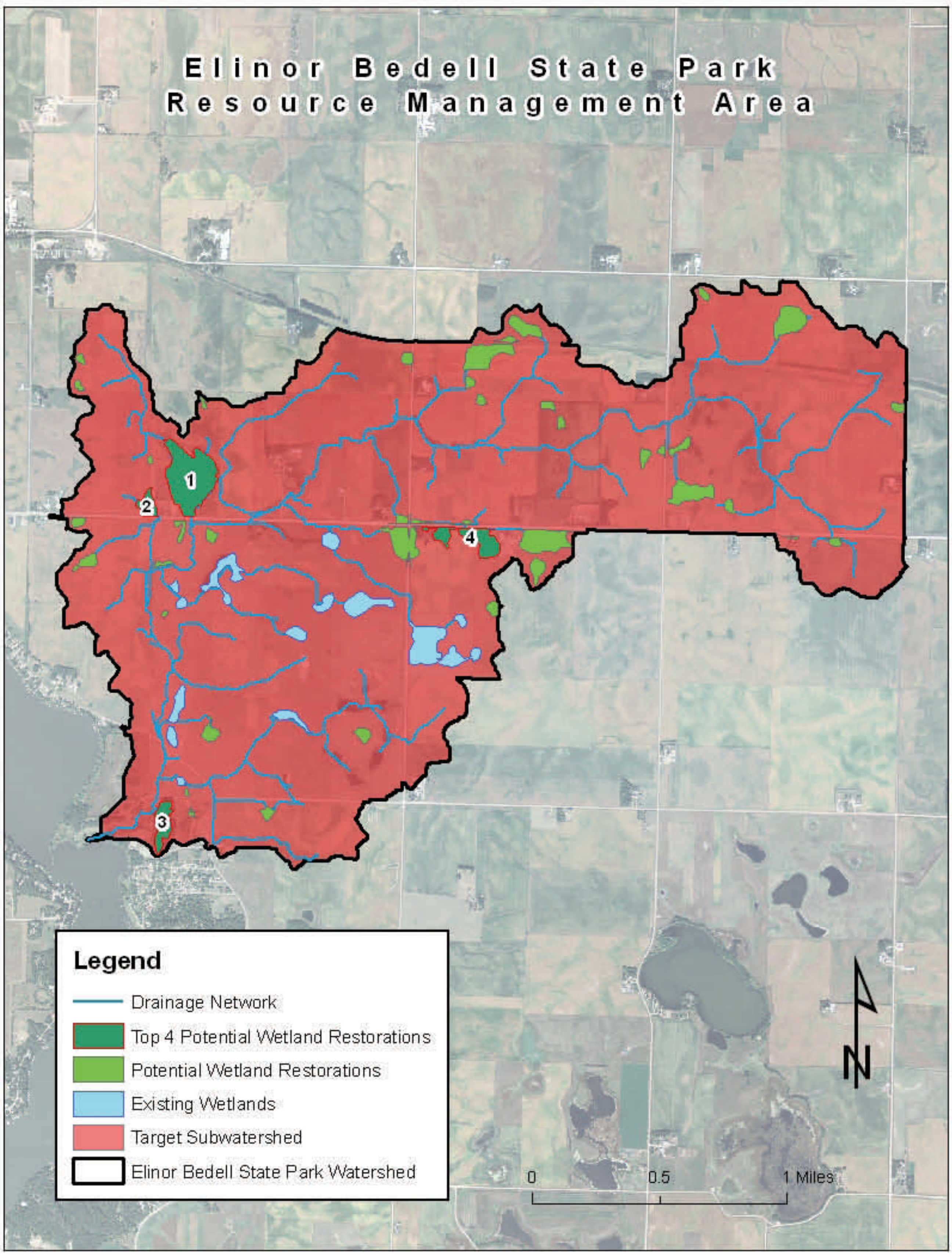


Figure 1.15 Elinor Bedell Priority Wetland Restoration Sites

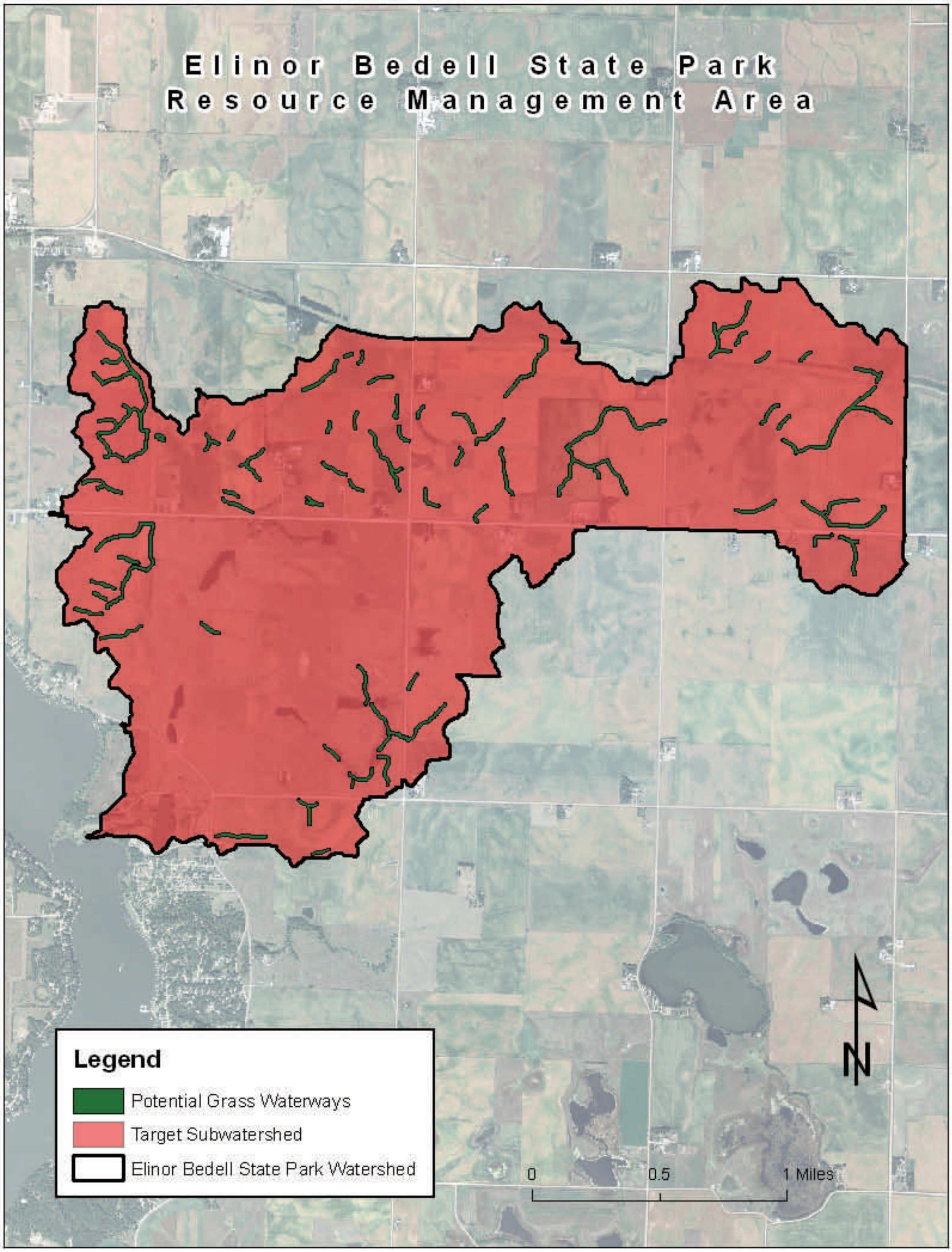


Figure 1.16 Elinor Bedell Ephemeral Gullies

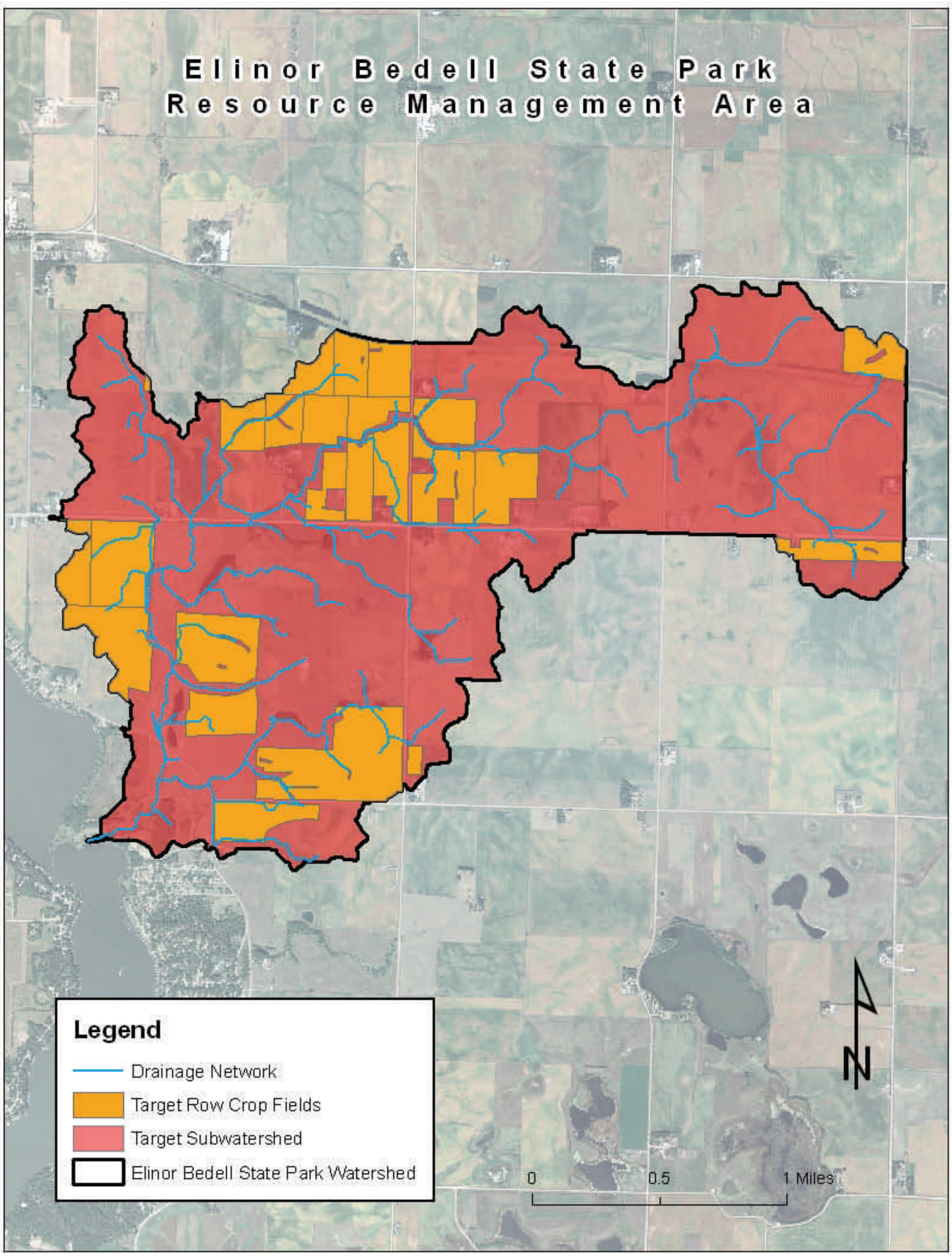


Figure 1.17 Elinor Bedell Target Row Crop Fields

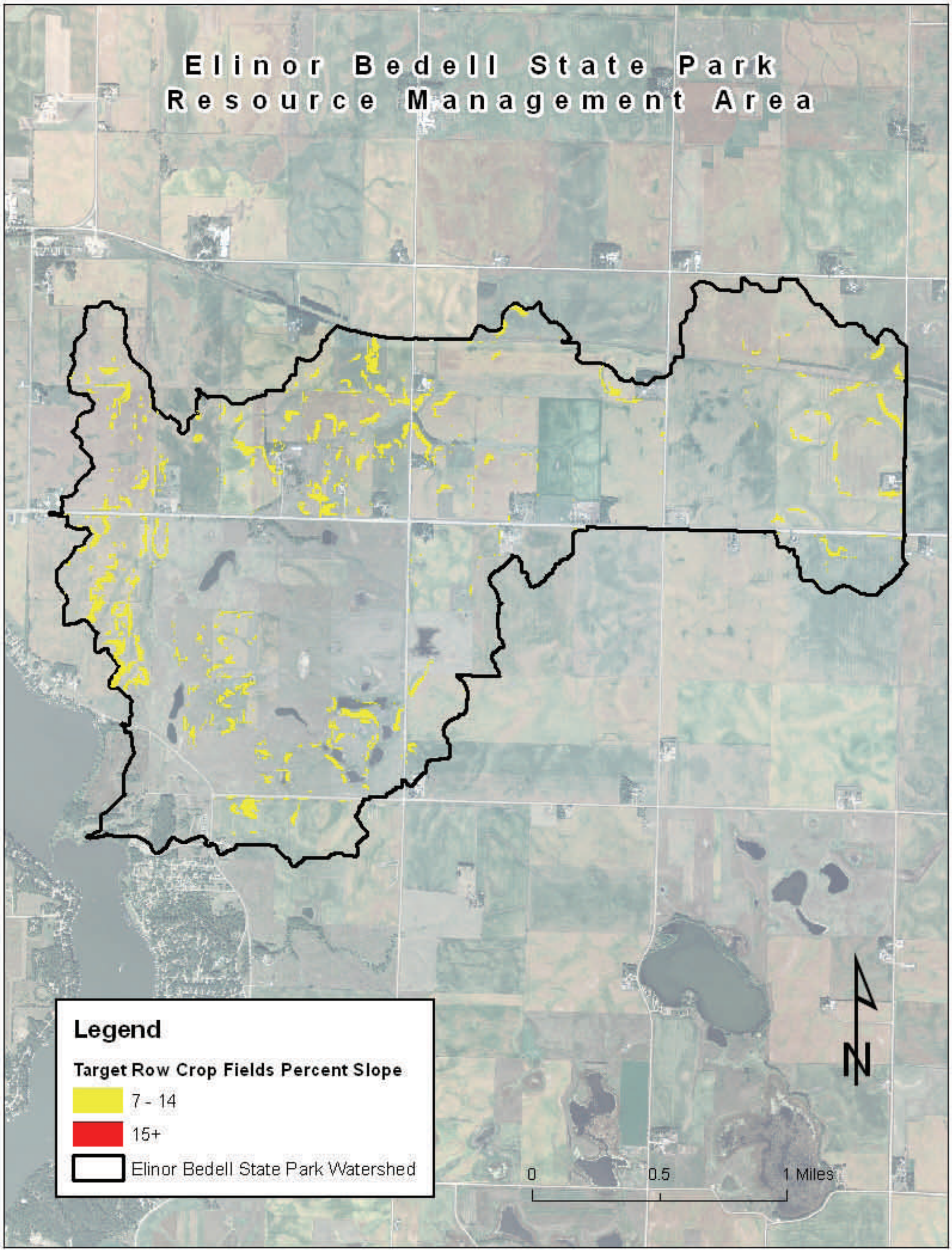


Figure 1.18 Elinor Bedell Target Row Crop Slopes

WEST OKOBOJI LAKE WATERSHED

Watershed Information:

Lake Size	Total Watershed	Watershed Direct	Watershed Indirect	Watershed Lakes	Direct RMA	Indirect RMA	Impaired
3867 ac	19,916	15,157 ac	892	3	5	1	Yes

Lakes in the watershed of West Okoboji Lake:

Direct
Center Lake

Indirect
Welch Lake
East Okoboji Lake (depending of lake levels)

RMA's that drain to West Okoboji Lake

Direct
Garlock Slough RMA
Lakeside Lab RMA
Okoboji View RMA
Lazy Lagoon
Welch Lake RMA

Indirect
Center Lake RMA

Impairment for West Okoboji Lake: West Okoboji Lake had one area, Emerson Bay, impaired in 2006 due to bacteria monitoring from the beach. The bacteria on the Emerson Bay State Park beach that is causing the impairment is e.coli. There has not been an approved TMDL written for the Emerson Bay, West Okoboji Lake impairment as of 2010 and it does not show up on the Iowa DNR Water Quality Improvement Plan Schedule that goes out to 2014.

Objective – To remove the bacteria impairment in Emerson Bay on West Okoboji is the first priority. The second priority objective is to protect West Okoboji from becoming impaired due to turbidity and nuisance algae blooms.

Garlock Slough Resource Management Area (RMA)

Objective **–** Remove bacteria issues from Emerson Bay. Restore and maintain Garlock Slough to a clear water system. 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 **–** Garlock Slough and its watershed has undergone many hydrological changes since the pioneers first settled the Iowa Great Lakes. The reduction of wetlands and the switch from prairies to farmland has left this watershed very degraded. Active grazing along streams and ephemeral wetlands has further degraded this system.

The Garlock Slough watershed represents approximately 9% of the watershed of West Okoboji Lake. When healthy, a series of shallow wetlands provide important watershed protection to West Okoboji Lake. These areas also provide critical fishery and wildlife habitats. A holistic approach is needed to restore ecological health and water quality to this complex. A combination of both watershed and lake management 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 of the slough to a clear water system can be accomplished through processes designed to mitigate watershed alterations and the introduction of common carp. To simulate natural drought conditions, managed water level draw downs are needed to stimulate growth of emergent aquatic vegetation and reduce or eliminate common carp populations.

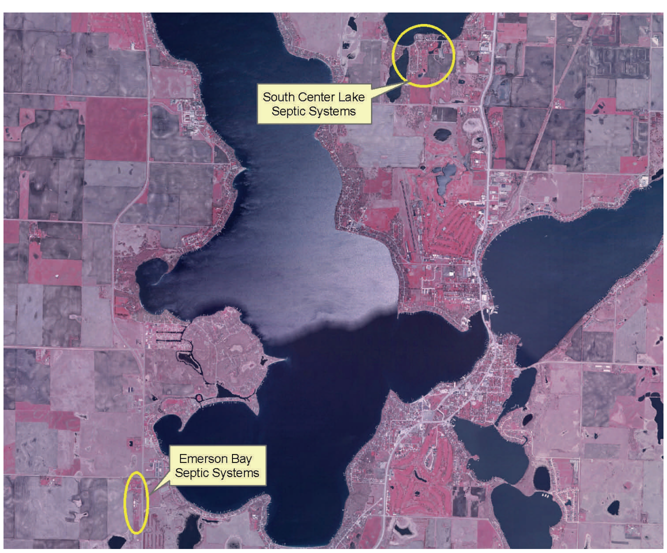
Restoration Planning Components

Watershed Practices

Prioritized Sub-watershed (Figure 1.19)

Septic System Renovation

- Meet with the seven residents and one trail court operator about septic inspections
- Work with landowners, Iowa Great Lakes Sanitary District, Iowa DNR and County Sanitarian for best option for reducing bacteria from reaching West Okoboji.
- Best option is to connect all lots up to sanitary sewer district and require a new main to be installed.
- Create a joint septic system away from main drainage into West Okoboji Lake.
- Work with individuals landowners to get septic systems up to date and functioning.



Structural Sediment Trapping
- Analysis has identified four priority wetland restorations in this sub-watershed (Figure 1.20).
- These wetland restorations have the potential to effectively intercept 348 acres (22% of the sub-watershed) of primarily agricultural runoff (Table 1.4).
- 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 deliver by 626.4 tons per year.

Gully Management
- 1.75 miles of ephemeral gully erosion has been identified within agricultural fields (Figure 1.21).
- By installing grassed waterways within each of these ephemeral gullies, 16 acres of upland habitat can be created and sediment loss from these areas significantly reduced.
- Construction of these grassed waterways can reduce the sediment deliver to the lake by 176 tons per year.

Highly Erodible Fields—Conservation Tillage
- Three agricultural fields devoted to row crop production exceed sediment loss thresholds (Figure 1.22).
- These fields, totaling 104 acres, account for 25% of the sediment loss within the targeted watershed.
- Conservation tillage on these acres can reduce 208 tons of sediment per year.

Highly Erodible Fields—Permanent Vegetation
- Sediment loss can be reduced on 50 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.
- An additional six acres have been identified and should have alternate land practices implemented because their slope is greater than 15% (Figure 1.23).
- Permanent vegetation on these slopes can reduce 316 tons of sediment per year.

Nutrient Management
- A total of 500 acres are currently being utilized for the production of corn and soybeans within the targeted watershed of Sandbar Slough.
- 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.

<u>Lake Restoration</u>

Proper wetland management begins by controlling the movement of water and fish in/out of Garlock Slough. A new fish barrier (Figure 1.24) and water control structure should be constructed to replace the existing barrier between Garlock Slough and West Okoboji Lake which no longer functions to control the movement of common carp into the slough. As Garlock Slough's shoreline is owned entirely by the State of Iowa, an electric water control structure and drain pipe should be placed at the outlet of the slough to allow for periodic draw downs that mimic historic drought conditions that are no longer occurring due to watershed changes. These water level fluctuations will allow managers to control fisheries populations and promote natural and diverse vegetation communities that benefit both fisheries and wildlife interests.

Once control structures are in place, an initial extended drawdown should occur in order to firm up near shore bottom sediments and promote extensive plant growth before water levels are allowed to return. This drawdown will also allow managers to apply chemical treatments or use winter ice conditions to completely eliminate any existing fishery. Once water levels are allowed to return, natural fish communities should reintroduce themselves to the system via the outlet to the lake. Proper barrier design will allow natural fish species passage while keeping adult common carp from entering the slough and their preferred spawning areas. Supplemental stocking of advanced northern pike fingerlings right after water levels return would help intercept any young common carp that move into the system immediately after renovation. A long term management plan should be developed between fish and wildlife professionals that outline the criteria and plan for dewatering this basin in order to maintain a balanced ecosystem.

Pollution Reduction

West 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 1,500 pound reduction of phosphorous per year to be removed. This Management Plan will help meet that 1,500 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 Garlock Slough RMA is 300 pounds of phosphorous.

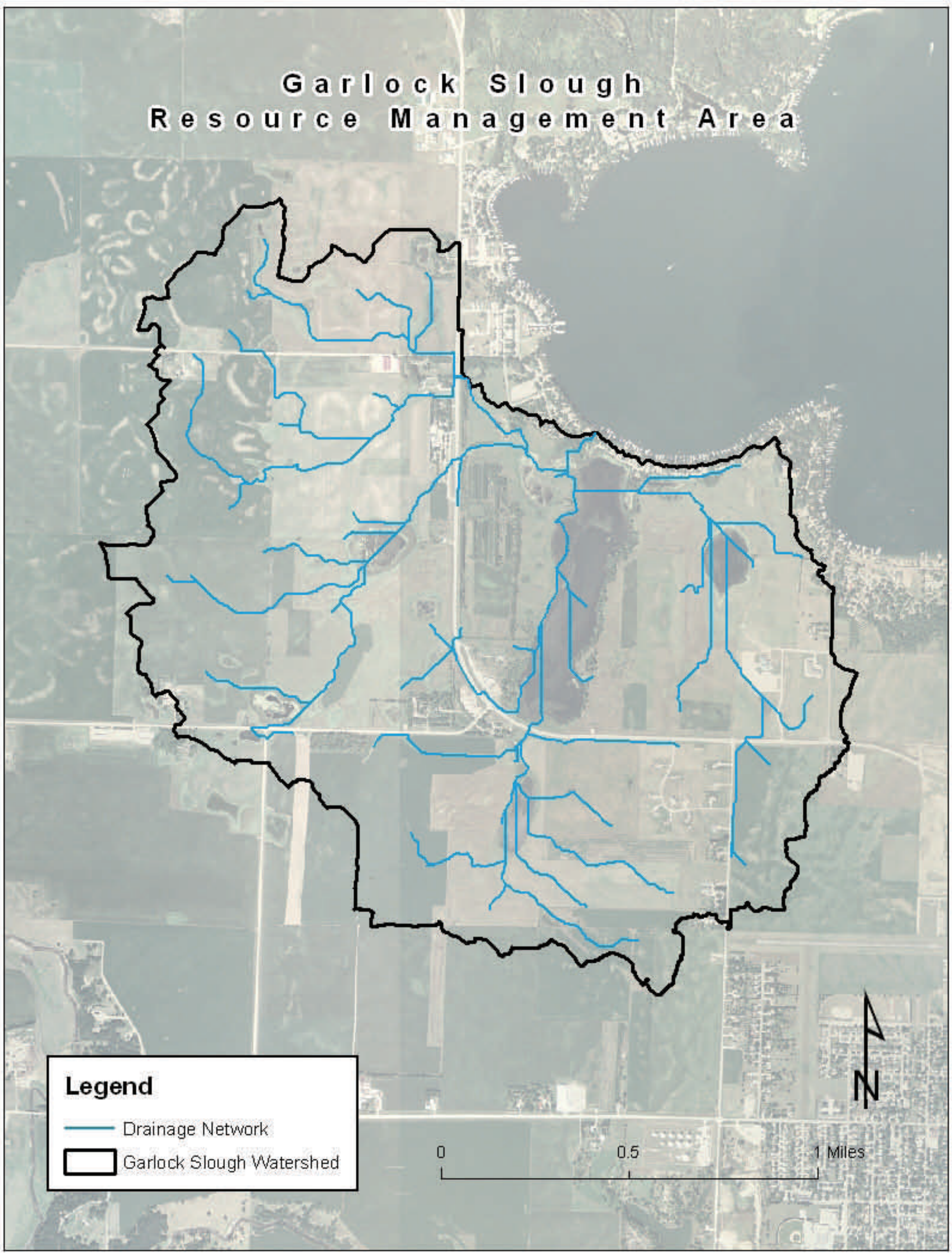


Figure 1.19 Garlock Slough Resource Management Area

Garlock Slough 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
1624	Lake				7.7	156.6	20.5	1
1673	Lake				6.9	35.7	5.2	2
1767	Lake				0.6	30.3	48.1	3
1710	Lake				4.9	105.6	21.7	4
1743	1710	Lake			20.3	50.2	2.5	5
1595	1624	Lake			0.5	20.3	44.0	6
1717	1721	Lake			0.8	29.6	37.9	7
1644	1624	Lake			2.3	11.3	4.9	8
1587	1595	1624	Lake		1.5	8.4	5.6	9
1722	1717	1721	Lake		2.6	17.4	6.6	10
1752	1743	1710	Lake		1.1	28.6	25.7	11
1781	1773	1767	Lake		2.5	7.1	2.8	12
1586	1624	Lake			1.1	12.6	11.2	13
1578	1586	1624	Lake		0.9	5.6	6.2	14
1736	Lake				2.0	27.4	13.7	15
1754	1752	1743	1710	Lake	2.2	12.2	5.6	16
1639	Lake				0.7	3.5	5.0	17
1747	1736	Lake			0.6	7.5	11.7	18
1750	Lake				0.5	34.4	71.8	19
1758	1750	Lake			2.6	30.0	11.6	20
1589	Lake				1.5	49.2	33.5	21
1753	1758	1750	Lake		1.0	22.5	21.4	22
1760	Lake				1.1	14.6	13.7	23
1695	Lake				2.3	30.2	13.2	24
1766	1760	Lake			0.8	5.2	6.8	25
1651	Lake				1.5	18.3	12.1	26
1669	Lake				0.3	16.4	53.0	27
1577	Lake				7.8	11.1	1.4	28
1655	1651	Lake			0.3	9.9	32.9	29
1700	1710	Lake			3.5	12.4	3.5	30

Table 1.4 Wetland restoration priorities for the Garlock Slough 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).

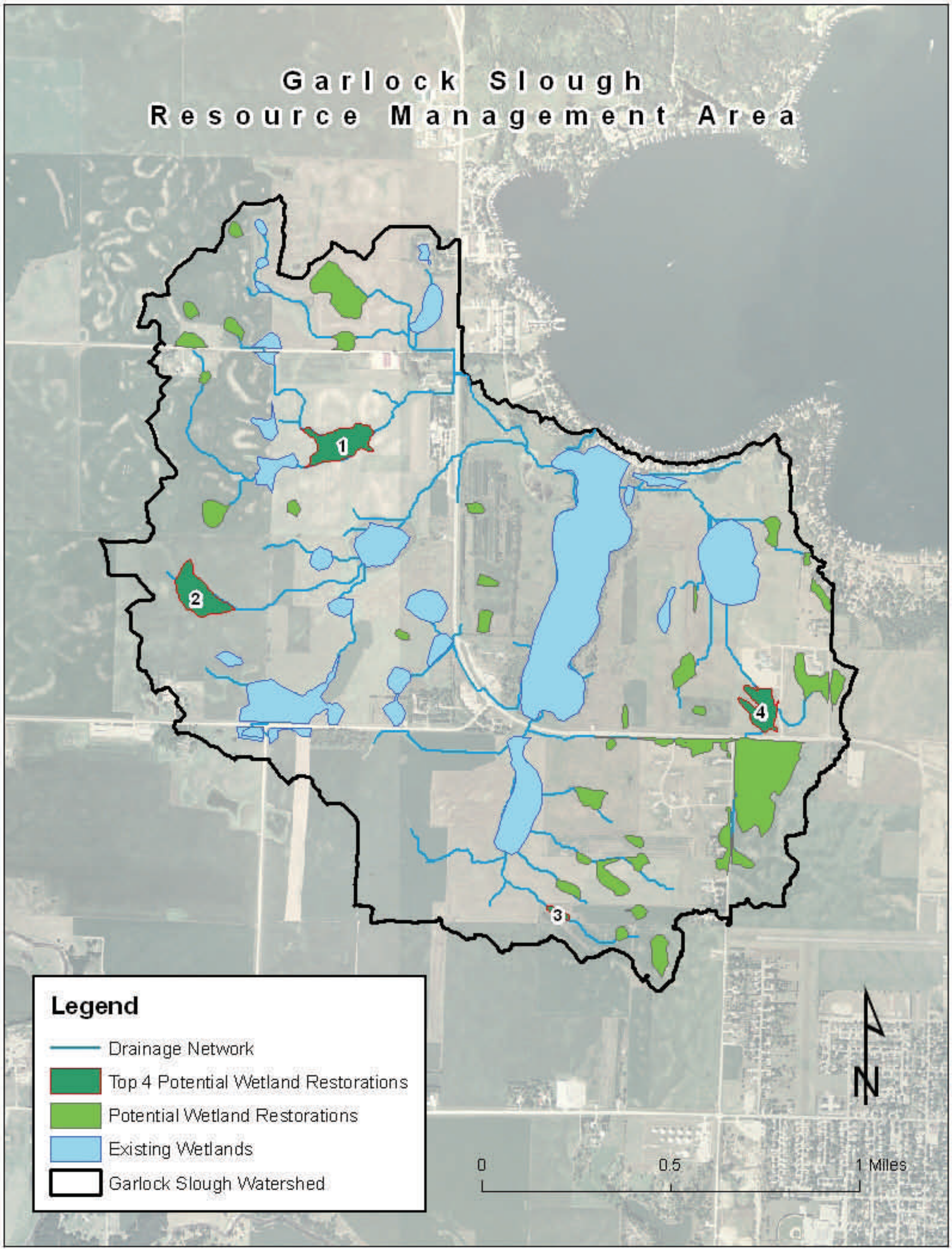


Figure 1.20 Garlock Slough Priority Wetland Restoration Sites

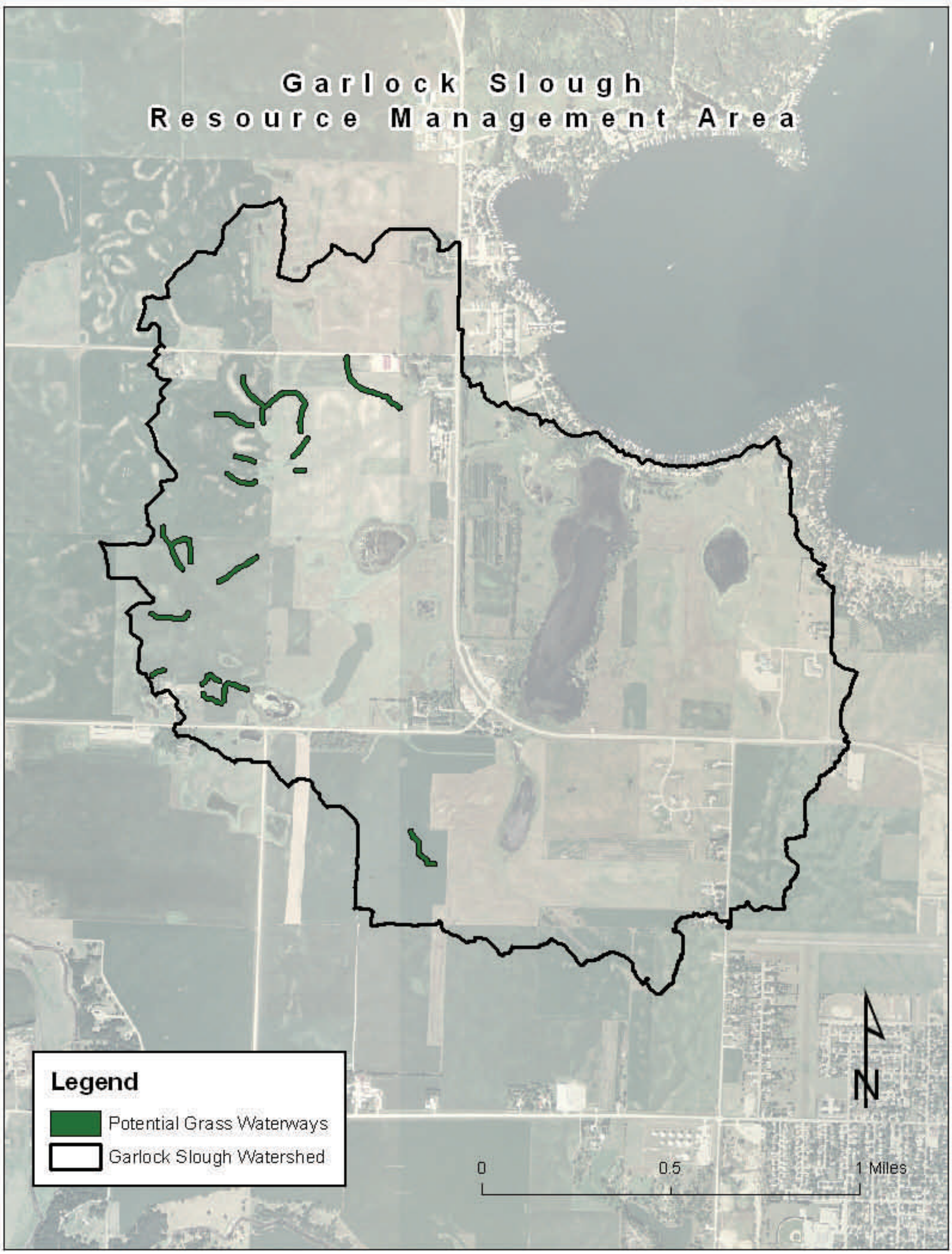


Figure 1.21 Garlock Slough Ephemeral Gullies

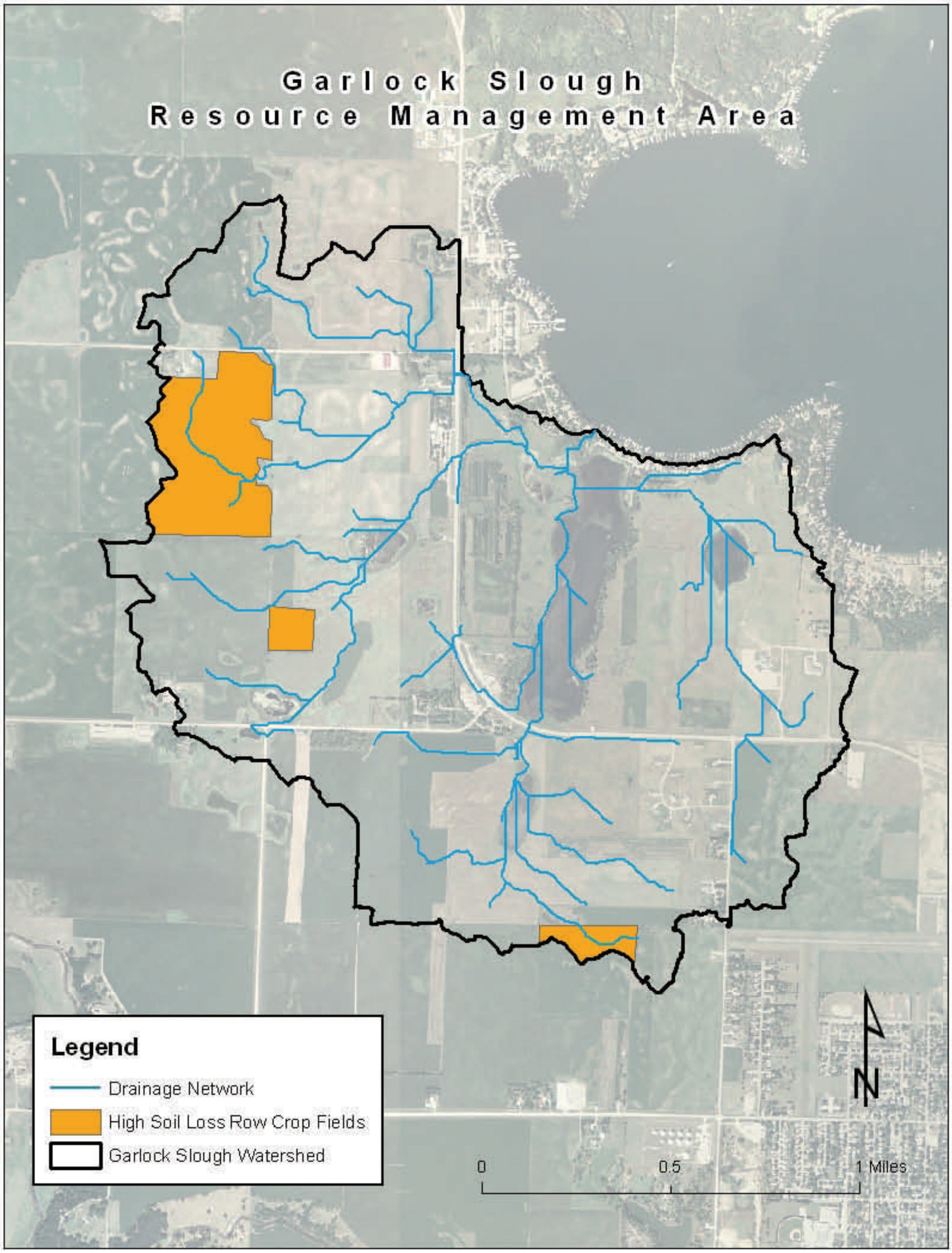


Figure 1.22 Garlock Slough Target Row Crop Fields

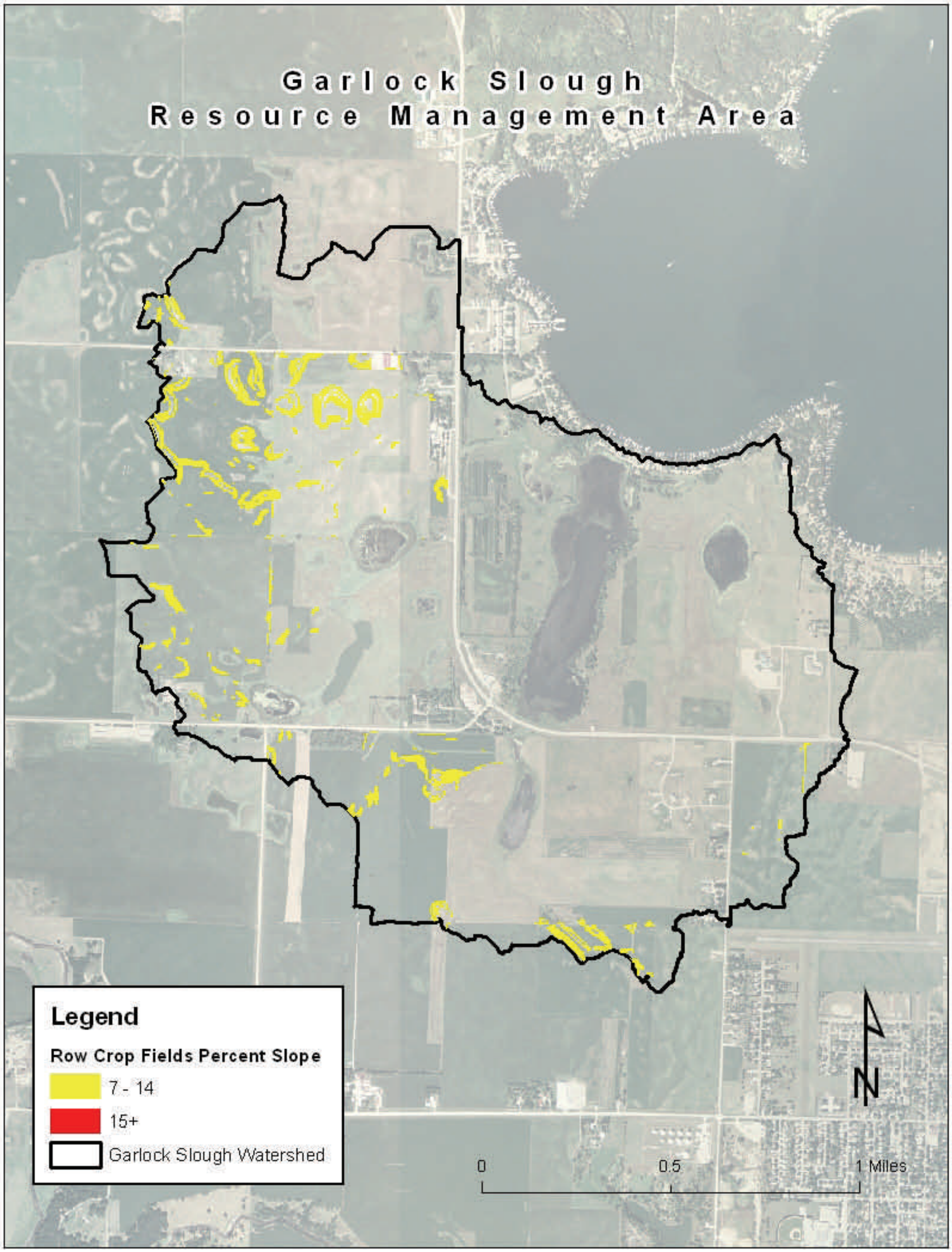


Figure 1.23 Garlock Slough Target Row Crop Slopes

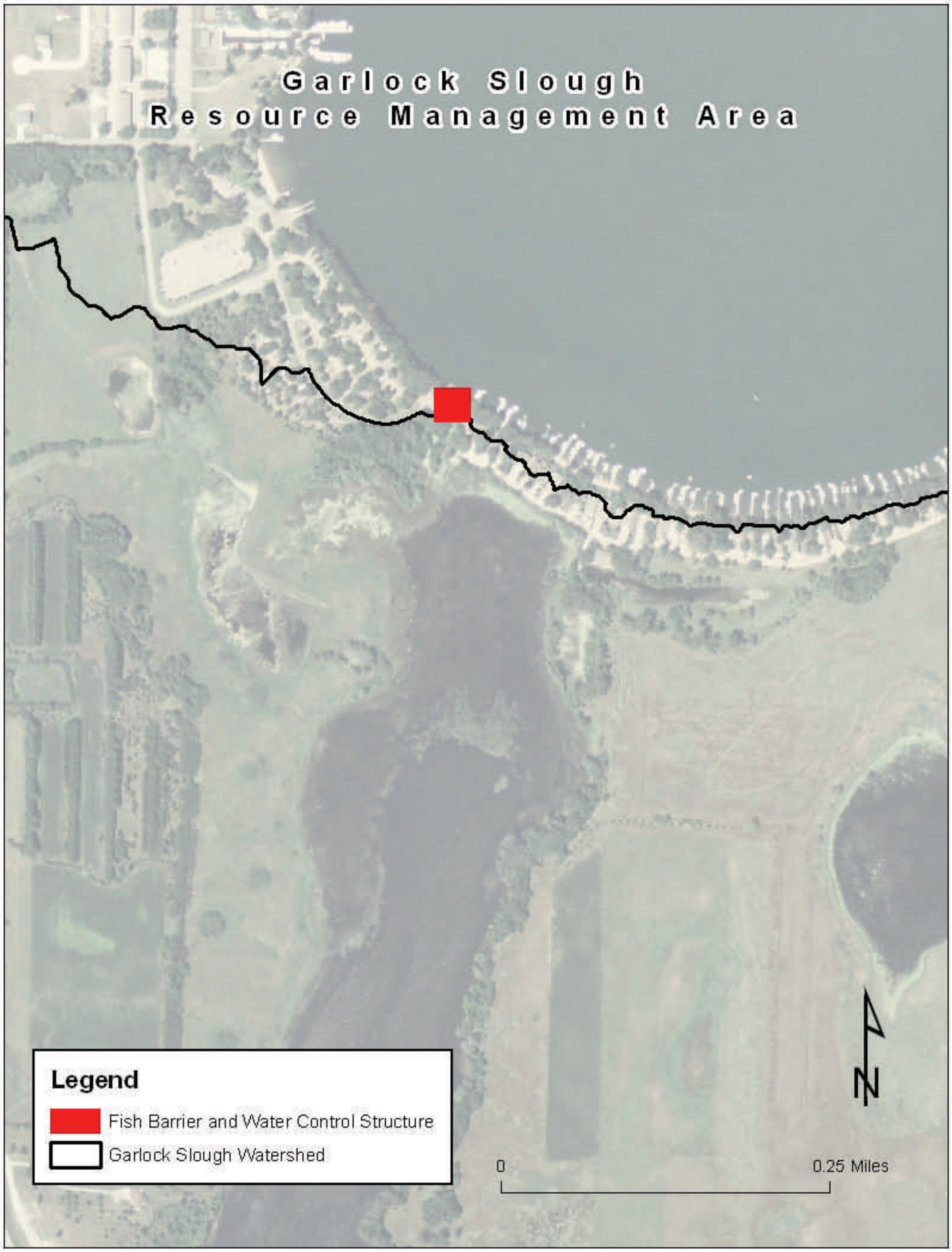


Figure 1.24 Garlock Slough Fish Barrier Location

Lakeside Labs Resource Management Area (RMA)

***Objective* –** Prevent heavy sediment loaded water reaching West Okoboji Lake via the ephemeral stream adjacent to Lakeside Labs. 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* –** This 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 watershed very degraded. It represents approximately 2% of the watershed of West Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to West 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

Watershed Practices

Prioritized Sub-watershed (Figure 1.25)

Structural Sediment Trapping

- Analysis has identified two priority wetland restorations in this sub-watershed (Figure 1.26).
- These wetland restorations have the potential to effectively intercept 162 acres (52% of the priority sub-watershed) of primarily agricultural runoff (Table 1.5).
- 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 291.6 tons of sediment per year.

Gully Management

- 0.35 miles of ephemeral gully erosion has been identified within agricultural fields (Figure 1.27).
- By installing grassed waterways within each of these ephemeral gullies, three acres of upland habitat can be created and sediment loss from these areas significantly reduced.
- Construction of these grassed waterways will reduce 33 tons of sediment per year.

Highly Erodible Fields—Conservation Tillage

- Three agricultural fields devoted to row crop production exceed sediment loss thresholds (Figure 1.28).
- These fields, totaling 80 acres, account for 50% of the sediment loss within the targeted watershed.
- Conservation tillage on these acres will reduce 160 tons of sediment per year.

Highly Erodible Fields—Permanent Vegetation

- Sediment loss can be reduced on 21 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.
- Another acre has been identified and should have alternate land practices implemented because their slope is greater than 15% (Figure 1.29).
- Permanent vegetation on these slopes could reduce 116 tons of sediment per year.

Nutrient Management

- A total of 199 acres are currently being utilized for the production of corn and soybeans within the targeted watershed of Lakeside Labs.
- 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

West 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 1,500 pound reduction of phosphorous per year to be removed. This Management Plan will help meet that 1,500 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 Lakeside Lab RMA is 300 pounds of phosphorous.

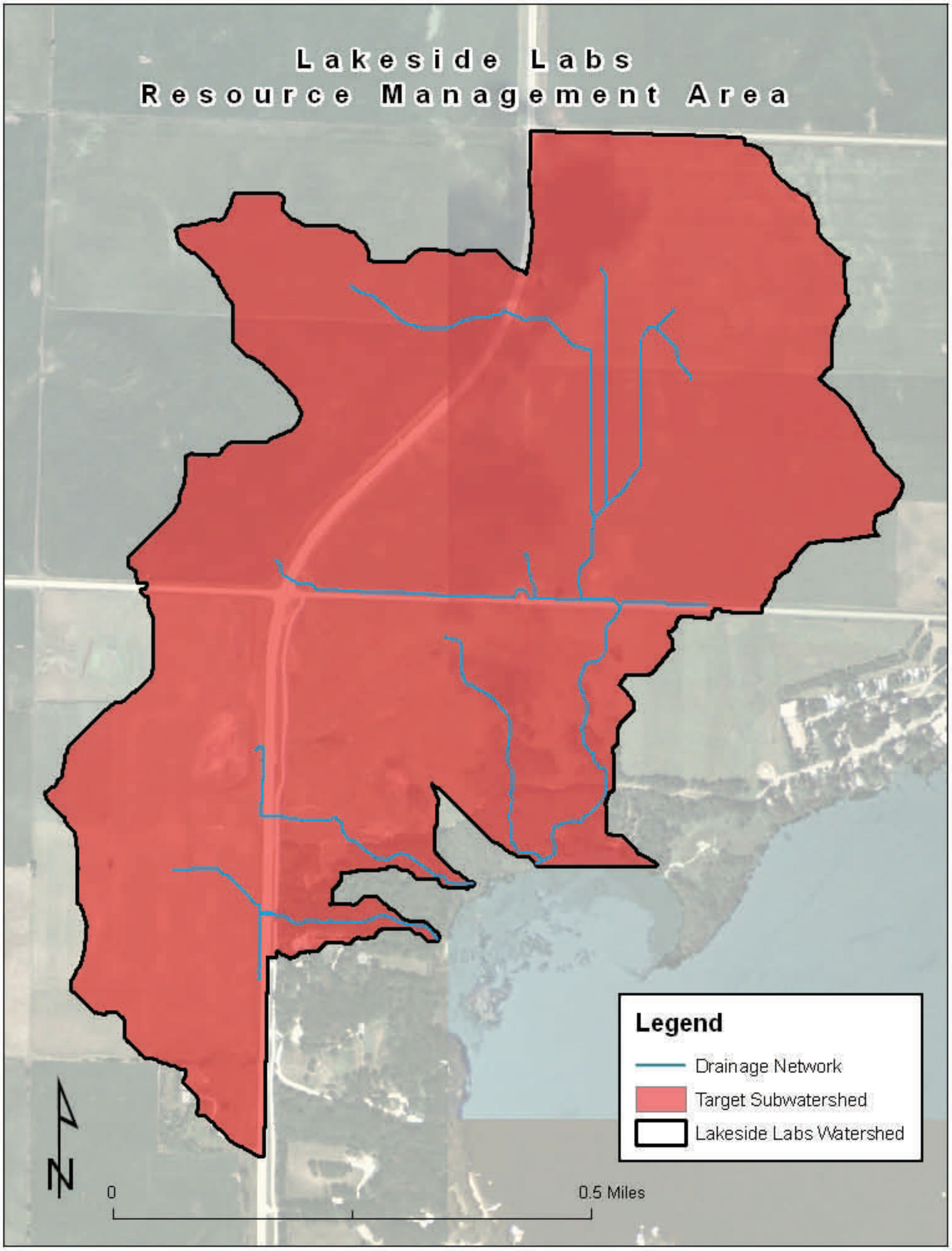


Figure 1.25 Lakeside Labs Resource Management Area

Lakeside Labs Watershed Wetland Prioritization

Wetland ID	Flows into	Flows into	Flows into	Flows into	Flows into	Wetland Size (acres)	Watershed Size (acres)	Watershed to Wetland Ratio	GIS/RUSLE Priority
1390	1400	Lake				10.2	108.7	10.7	1
1371	1390	1400	Lake			1.4	41.9	31.0	2
1446	Lake					0.4	12.5	32.9	3
1368	1390	1400	Lake			5.5	18.1	3.3	4
1396	1400	Lake				2.0	16.5	8.1	5
1399	1400	Lake				0.6	9.4	16.8	6
1367	1371	1390	1400	Lake		1.3	8.4	6.7	7
1376	1368	1390	1400	Lake		0.7	3.1	4.3	8
1369	1367	1371	1390	1400	Lake	1.4	3.4	2.5	9
1395	1400	Lake				0.5	2.9	5.6	10

Table 1.5 Wetland restoration priorities for the Lakeside Labs 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).

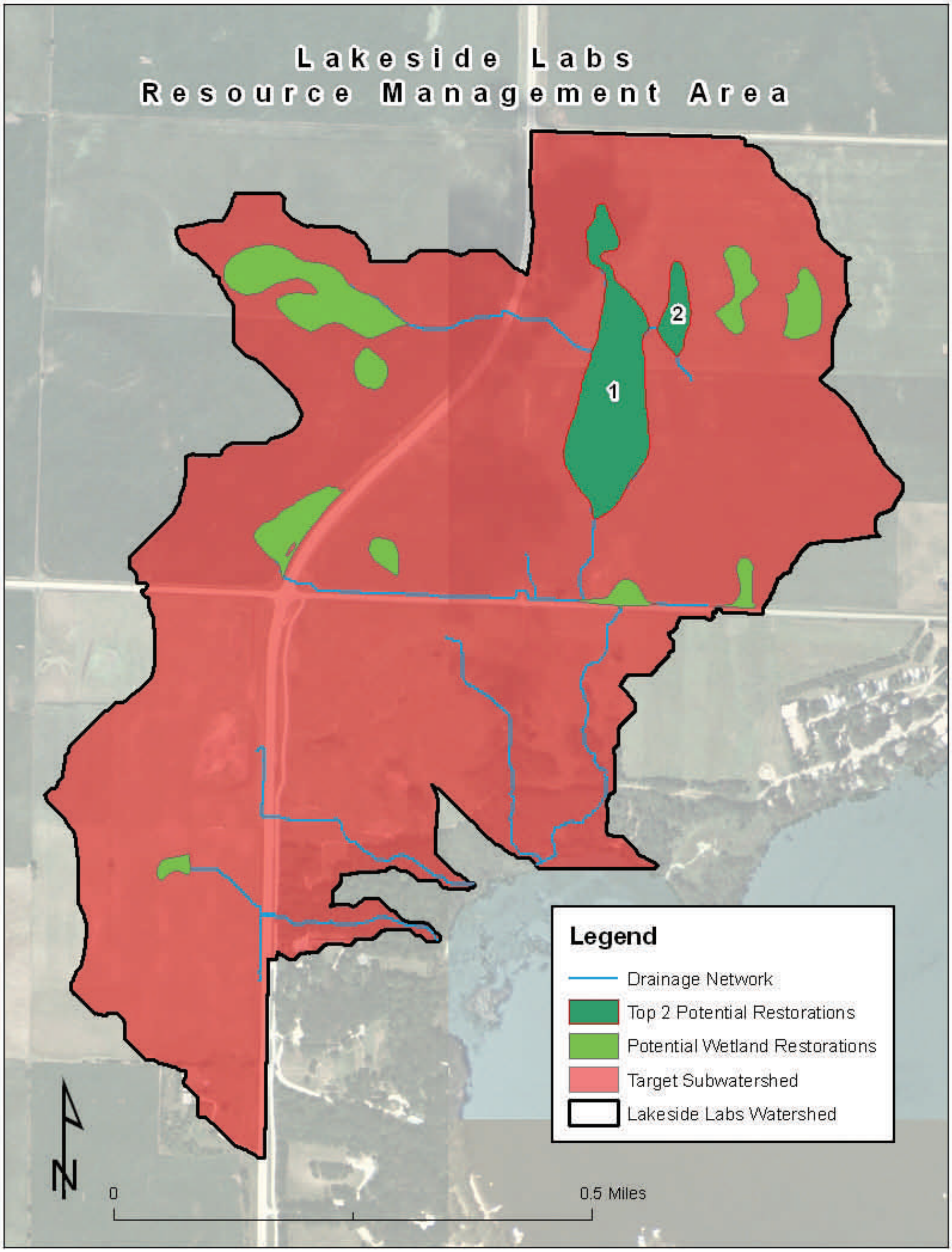


Figure 1.26 Lakeside Labs Priority Wetland Restoration Sites

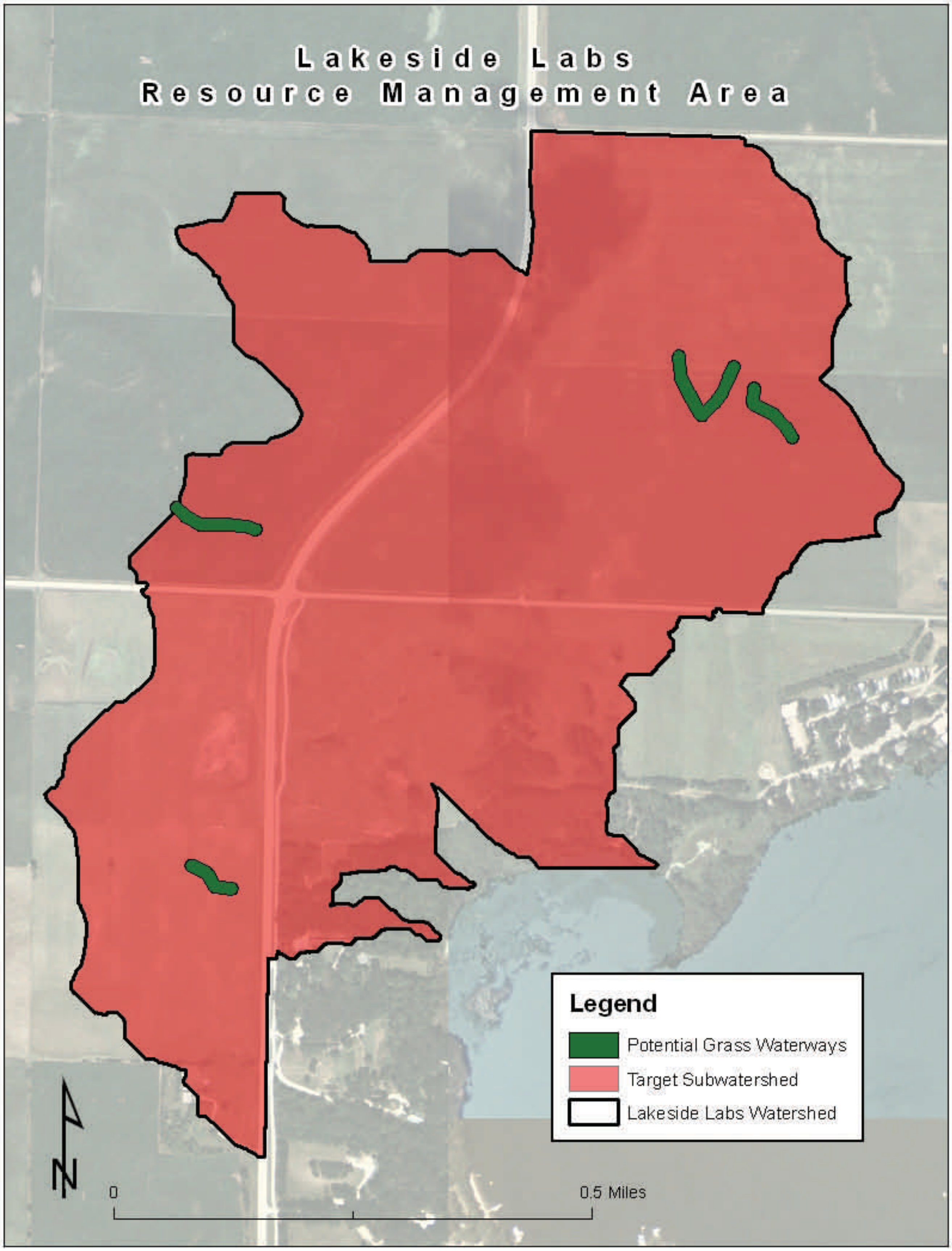


Figure 1.27 Lakeside Labs Ephemeral Gullies

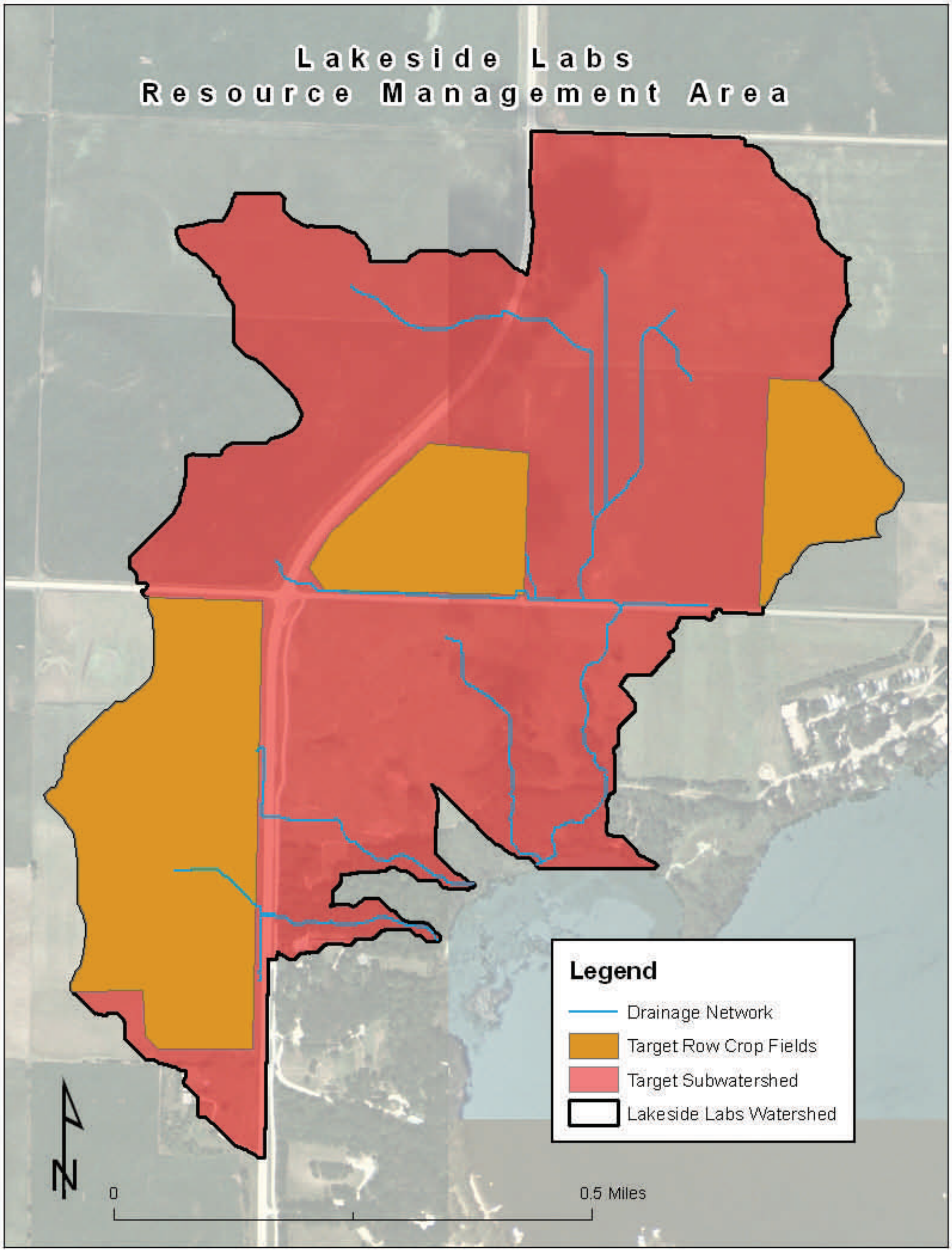


Figure 1.28 Lakeside Labs Target Row Crop Fields

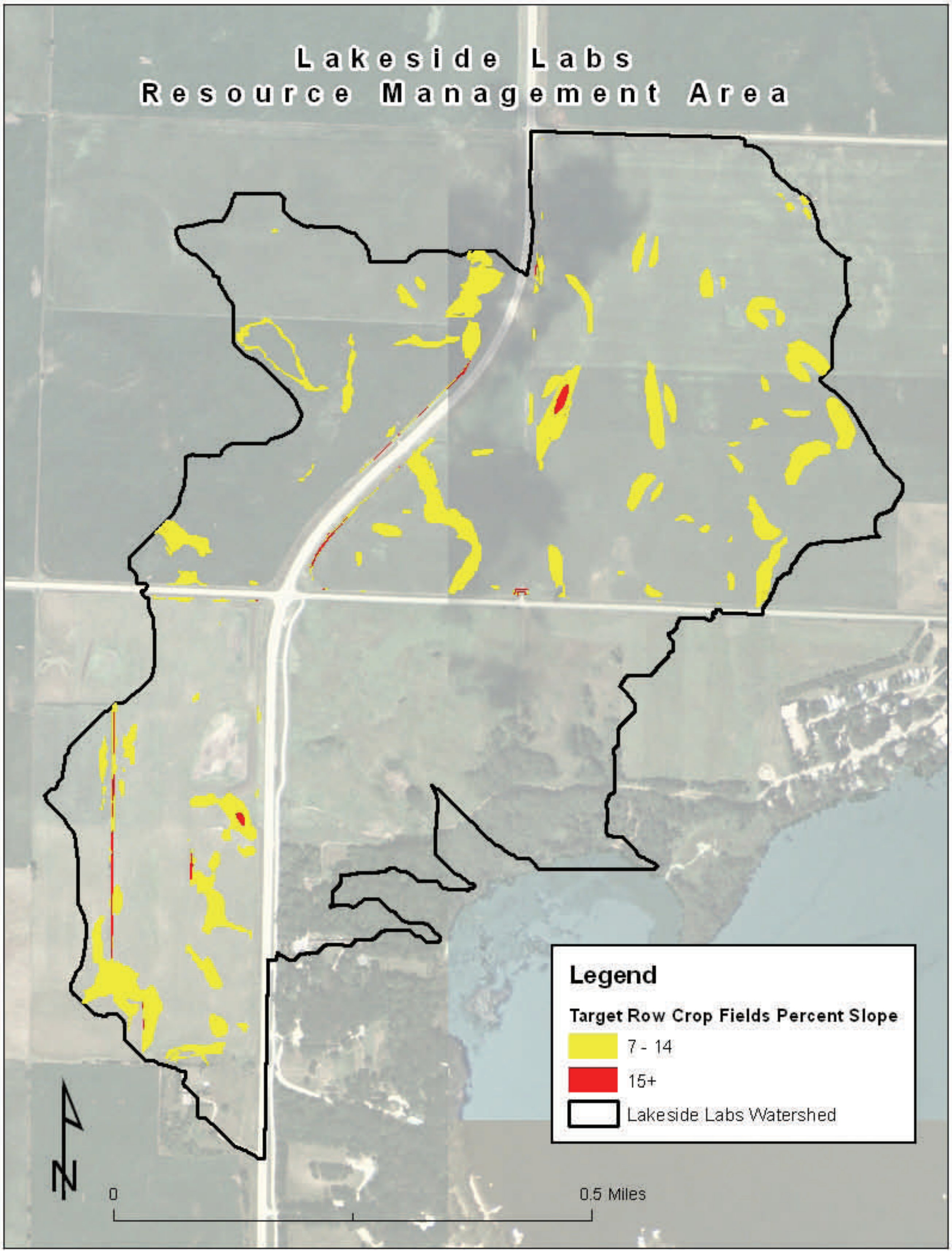


Figure 1.29 Lakeside Labs Target Row Crop Slopes

Okoboji View Resource Management Area (RMA)

Objective – Prevent heavy sediment loaded water reaching West Okoboji Lake via the ephemeral stream adjacent to Okoboji View Golf Course. 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 – This 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 watershed very degraded. It represents approximately 10% of the watershed of West Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to West 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 1.30)

Structural Sediment Trapping

- Analysis has identified three priority wetland restorations in this sub-watershed (Figure 1.31).
- These wetland restorations have the potential to effectively intercept 408 acres (23% of the priority sub-watershed) of primarily agricultural runoff (Table 1.6).
- 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 734.4 tons per year.

Gully Management

- 6.7 miles of ephemeral gully erosion has been identified within agricultural fields (Figure 1.32).
- By installing grassed waterways within each of these ephemeral gullies, 60 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 660 tons per year.

Highly Erodible Fields—Conservation Tillage

- 18 agricultural fields devoted to row crop production exceed sediment loss thresholds (Figure 1.33).
- These fields, totaling 460 acres, account for 50% of the sediment loss within the targeted watershed.
- Conservation tillage can reduce sediment by 920 tons per year on these acres.

Highly Erodible Fields—Permanent Vegetation

- Sediment loss can be reduced on 164 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.
- Another seven acres have been identified and should have alternate land practices implemented because their slope is greater than 15% (Figure 1.34).
- Permanent vegetation on these slopes can reduce sediment by 897 tons per year.

Nutrient Management

- A total of 1,357 acres are currently being utilized for the production of corn and soybeans within the targeted watershed of Okoboji View.
- 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

West 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 1,500 pound reduction of phosphorous per year to be removed. This Management Plan will help meet that 1,500 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 Okoboji View RMA is 300 pounds of phosphorous.

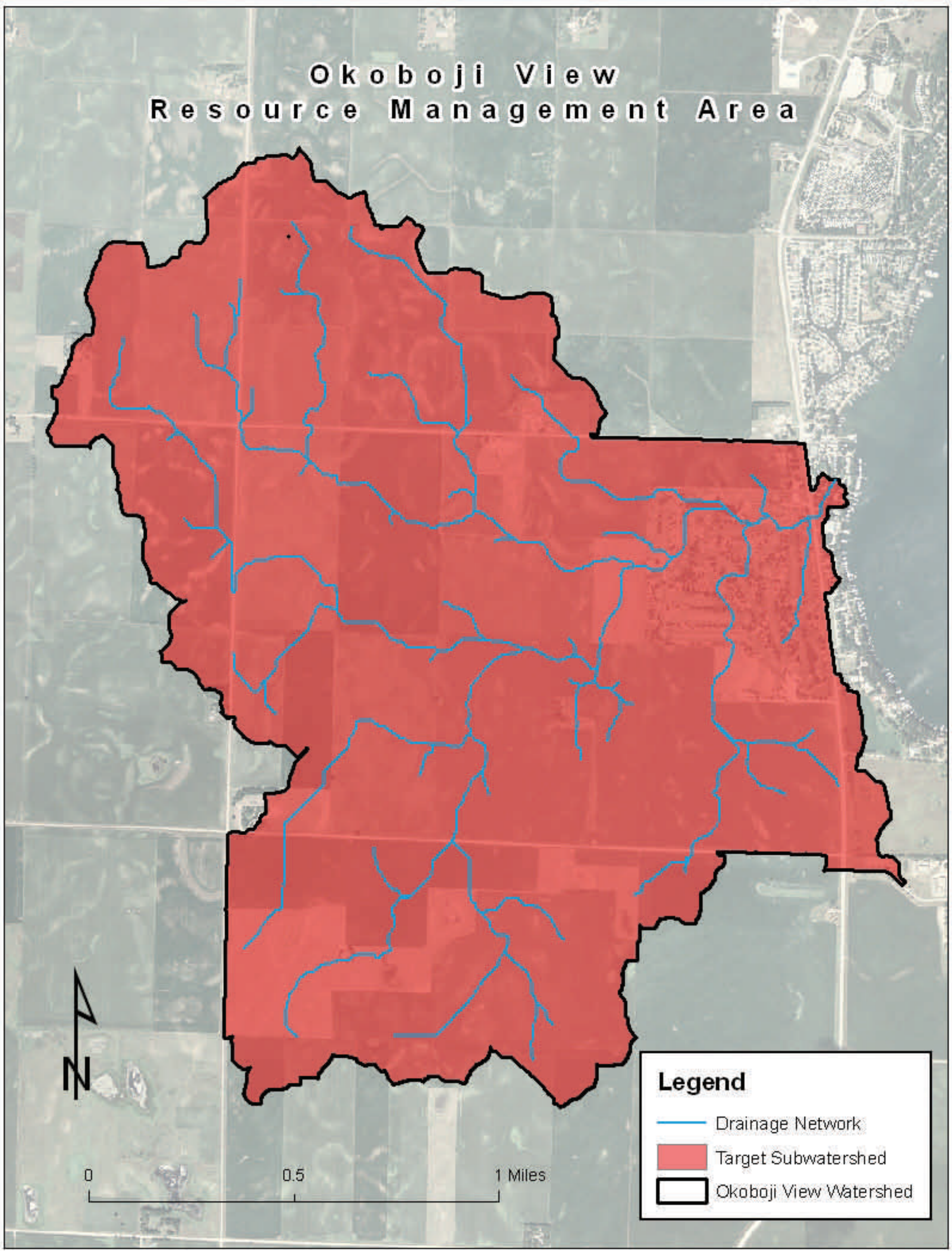


Figure 1.30 Okoboji View Resource Management Area

Okoboji View Watershed Wetland Prioritization

Wetland ID	Flows into	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
1156	1140	1164	1175	Lake				7.2	149.2	20.8	1
1158	1156	1140	1164	1175	Lake			14.5	120.8	8.3	2
1089	Lake							13.4	102.8	7.7	3
1258	Lake							24.2	61.3	2.5	4
1193	1164	1175	Lake					5.5	50.9	9.2	5
1081	1158	1156	1140	1164	1175	Lake		3.7	49.9	13.6	6
1327	Lake							6.0	38.9	6.5	7
1208	1202	Lake						1.8	24.6	14.1	8
1198	Lake							9.3	44.1	4.8	9
1291	1258	Lake						5.3	13.8	2.6	10
1090	Lake							9.6	32.4	3.4	11
1319	Lake							5.0	36.8	7.3	12
1108	Lake							2.1	15.8	7.7	13
1024	1089	Lake						2.2	17.6	7.9	14
1063	1090	Lake						1.8	22.9	12.5	15
1167	Lake							1.4	15.0	10.7	16
1259	Lake							1.3	31.6	24.9	17
1050	1081	1158	1156	1140	1164	1175	Lake	6.4	12.7	2.0	18
1042	1083	Lake						0.9	11.7	12.8	19
1065	1089	Lake						3.1	12.6	4.1	20
1183	1193	1164	1175	Lake				3.3	19.3	5.8	21
1237	Lake							0.6	12.6	21.7	22
1039	1042	1083	Lake					1.1	7.2	6.8	23
1176	1183	1193	1164	1175	Lake			3.1	13.1	4.2	24
1283	1291	1258	Lake					0.5	3.6	7.0	25
1280	1259	Lake						2.9	18.0	6.2	26
1188	1167	Lake						0.5	6.1	11.5	27
1072	1081	1158	1156	1140	1164	1175	Lake	0.6	4.9	7.7	28
1086	1158	1156	1140	1164	1175	Lake		0.3	4.9	17.3	29
1334	1319	Lake						0.8	9.5	11.6	30

Table 1.6 Wetland restoration priorities for the Okoboji View 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).

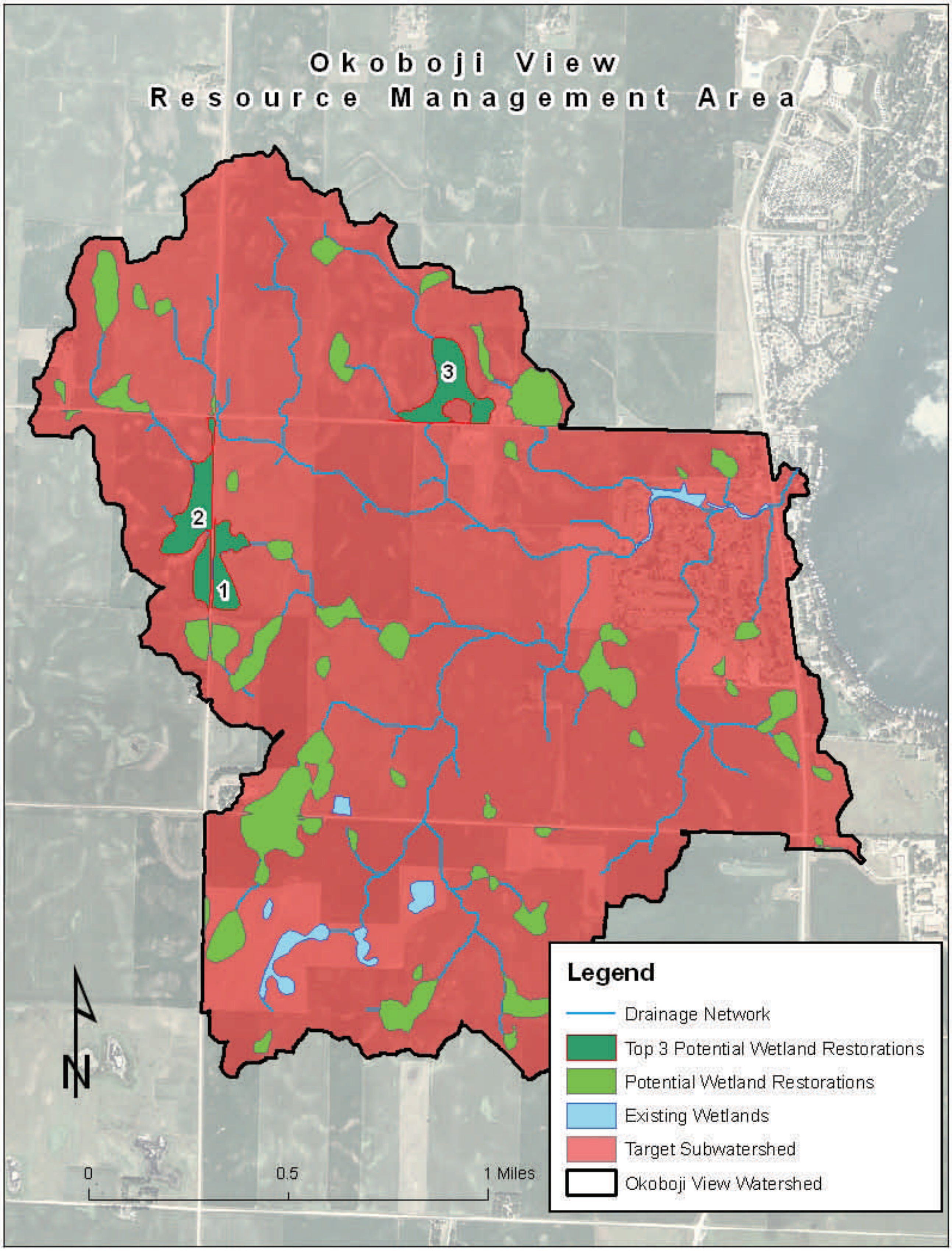


Figure 1.31 Okoboji View Priority Wetland Restoration Sites

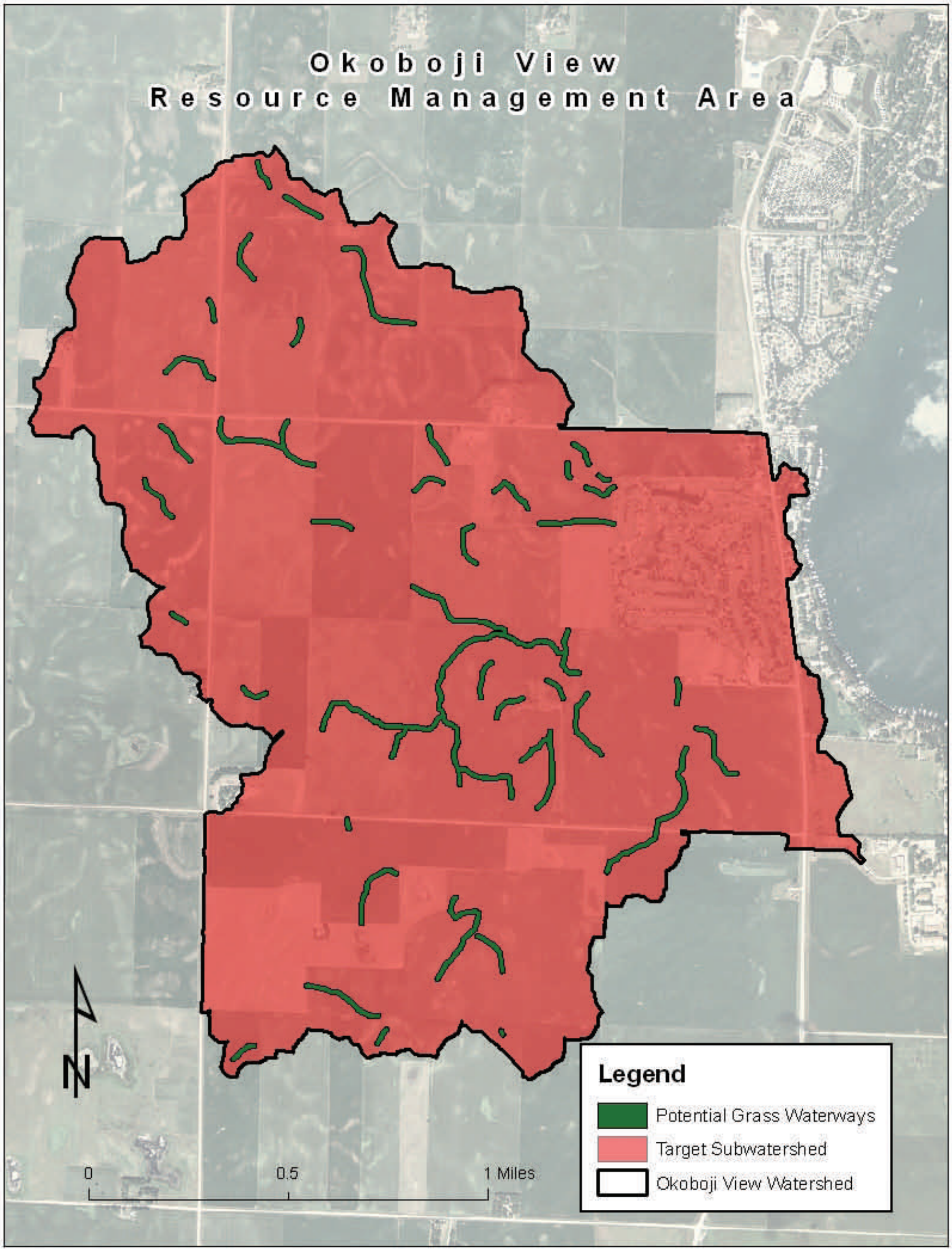


Figure 1.32 Okoboji View Ephemeral Gullies

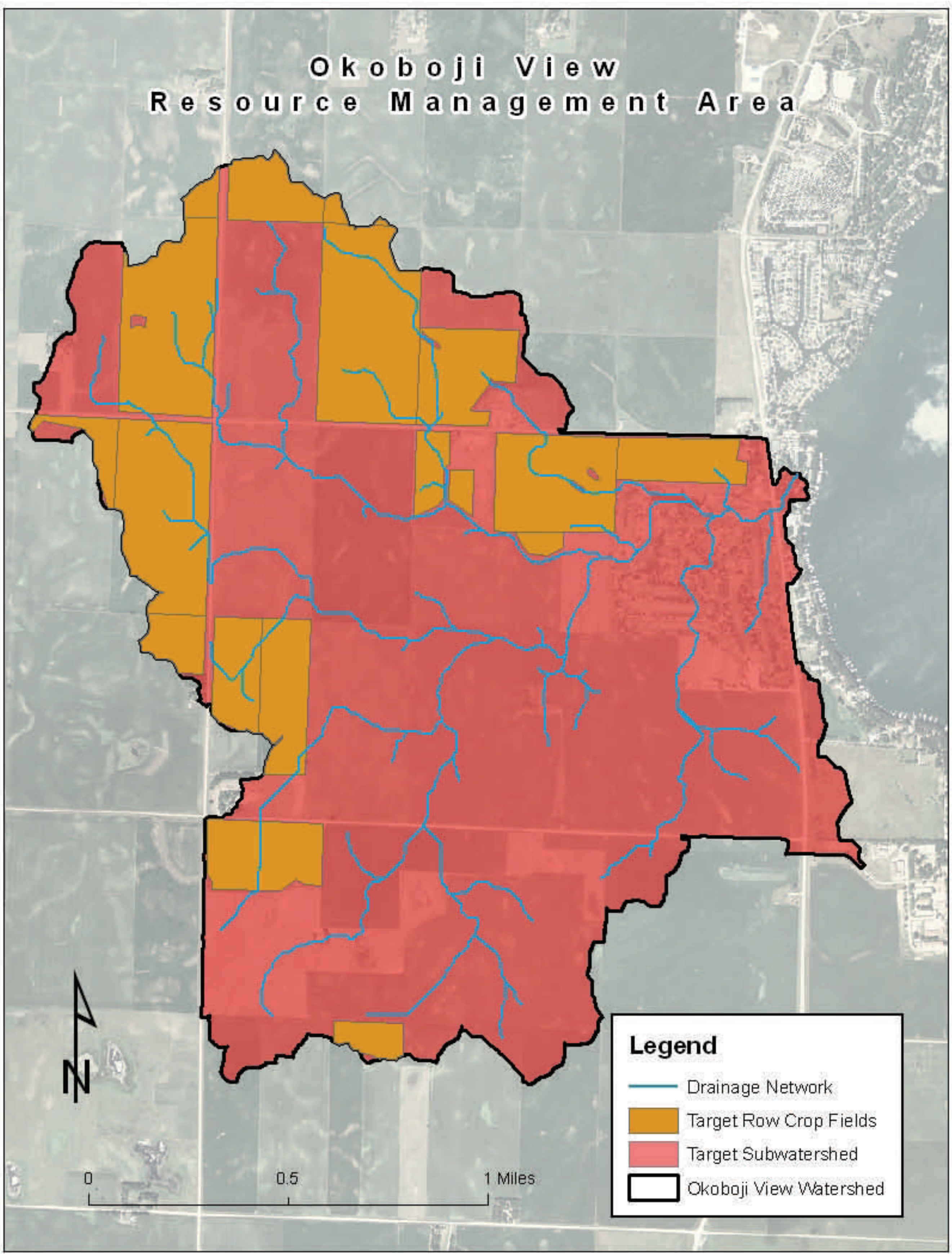


Figure 1.33 Okoboji View Target Row Crop Fields

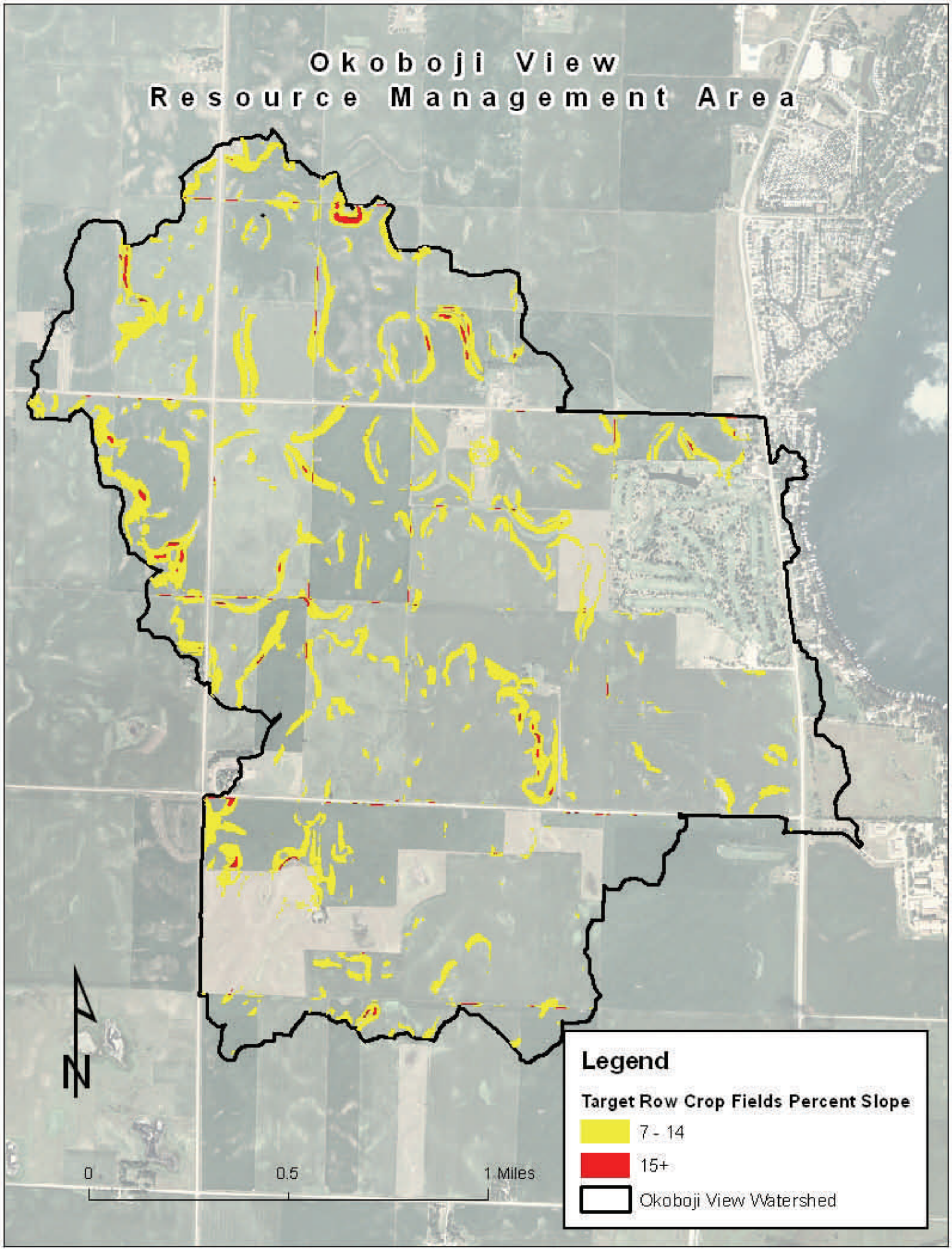


Figure 1.34 Okoboji View Target Row Slopes

Lazy Lagoon Resource Management Area (RMA)

Objective – Prevent heavy sediment loaded water reaching West Okoboji Lake via the ephemeral stream at Triboji. 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 Triboji 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 watershed very degraded. This watershed represents approximately 4% of the watershed of West Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to West 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 1.35)

Structural Sediment Trapping

- Analysis has identified three priority wetland restorations in this sub-watershed (Figure 1.36).
- These wetland restorations have the potential to effectively intercept 141 acres (21% of the priority sub-watershed) of primarily agricultural runoff (Table 1.7).
- 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 253.8 tons of sediment per year.

Gully Management

- Five miles of ephemeral gully erosion has been identified within agricultural fields (Figure 1.37).
- By installing grassed waterways within each of these ephemeral gullies, 46 acres of upland habitat can be created and sediment loss from these areas significantly reduced.
- Construction of these grassed waterways can reduce 506 tons of sediment per year.

Highly Erodible Fields—Conservation Tillage

- Four agricultural fields devoted to row crop production exceed sediment loss thresholds (Figure 1.38).
- These fields, totaling 201 acres, account for 50% of the sediment loss within the targeted watershed.
- Conservation tillage on these acres can reduce sediment by 402 tons per year.

Highly Erodible Fields—Permanent Vegetation

- Sediment loss can be reduced on 28 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.
- Another acre has been identified and should have alternate land practices implemented because their slope is greater than 15% (Figure 1.39).
- Permanent vegetation on these slopes can reduce sediment by 151 tons per year.

Nutrient Management

- A total of 133 acres are currently being utilized for the production of corn and soybeans within the targeted watershed of Triboji 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

West 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 1,500 pound reduction of phosphorous per year to be removed. This Management Plan will help meet that 1,500 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 Lazy Lagoon RMA is 300 pounds of phosphorous.

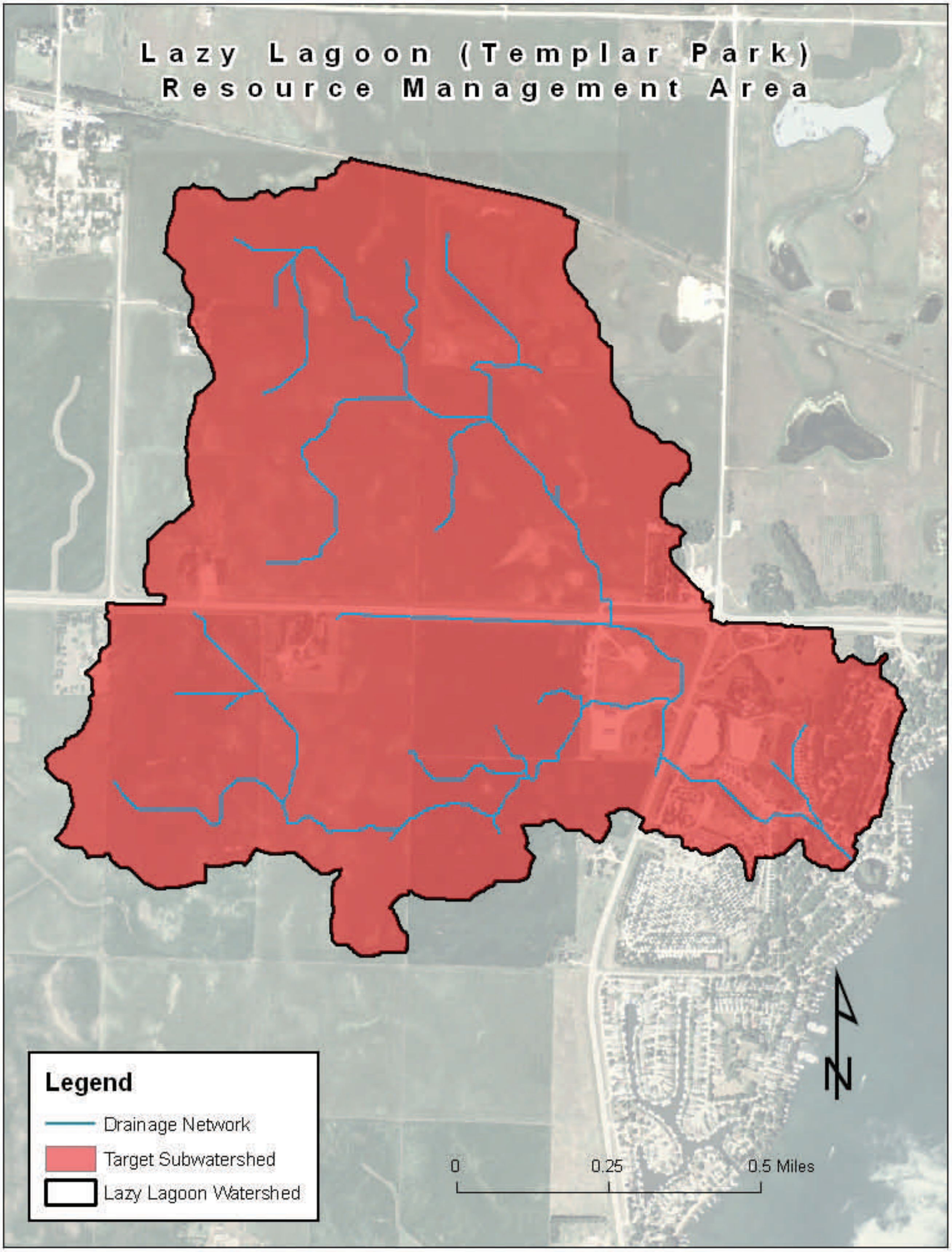


Figure 1.35 Lazy Lagoon Resource Management Area

Lazy Lagoon 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
941	956	946	Lake		6.9	44.7	6.5	1
850	946	Lake			7.4	47.1	6.4	2
894	946	Lake			2.4	32.8	13.6	3
902	894	946	Lake		1.4	20.4	14.2	4
986	946	Lake			7.8	21.5	2.8	5
921	946	Lake			2.3	13.9	6.2	6
914	902	894	946	Lake	3.2	8.6	2.7	7
901	946	Lake			2.3	19.8	8.5	8
971	Lake				3.2	5.0	1.5	9
954	986	946	Lake		1.0	3.4	3.3	10
1003	946	Lake			1.1	2.1	1.9	11
913	901	946	Lake		1.4	1.7	1.2	12
899	901	946	Lake		0.8	2.4	3.1	13
897	946	Lake			0.4	0.7	1.8	14
925	931	Lake			0.3	2.5	9.5	15

Table 1.7 Wetland restoration priorities for the Lazy Lagoon 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).

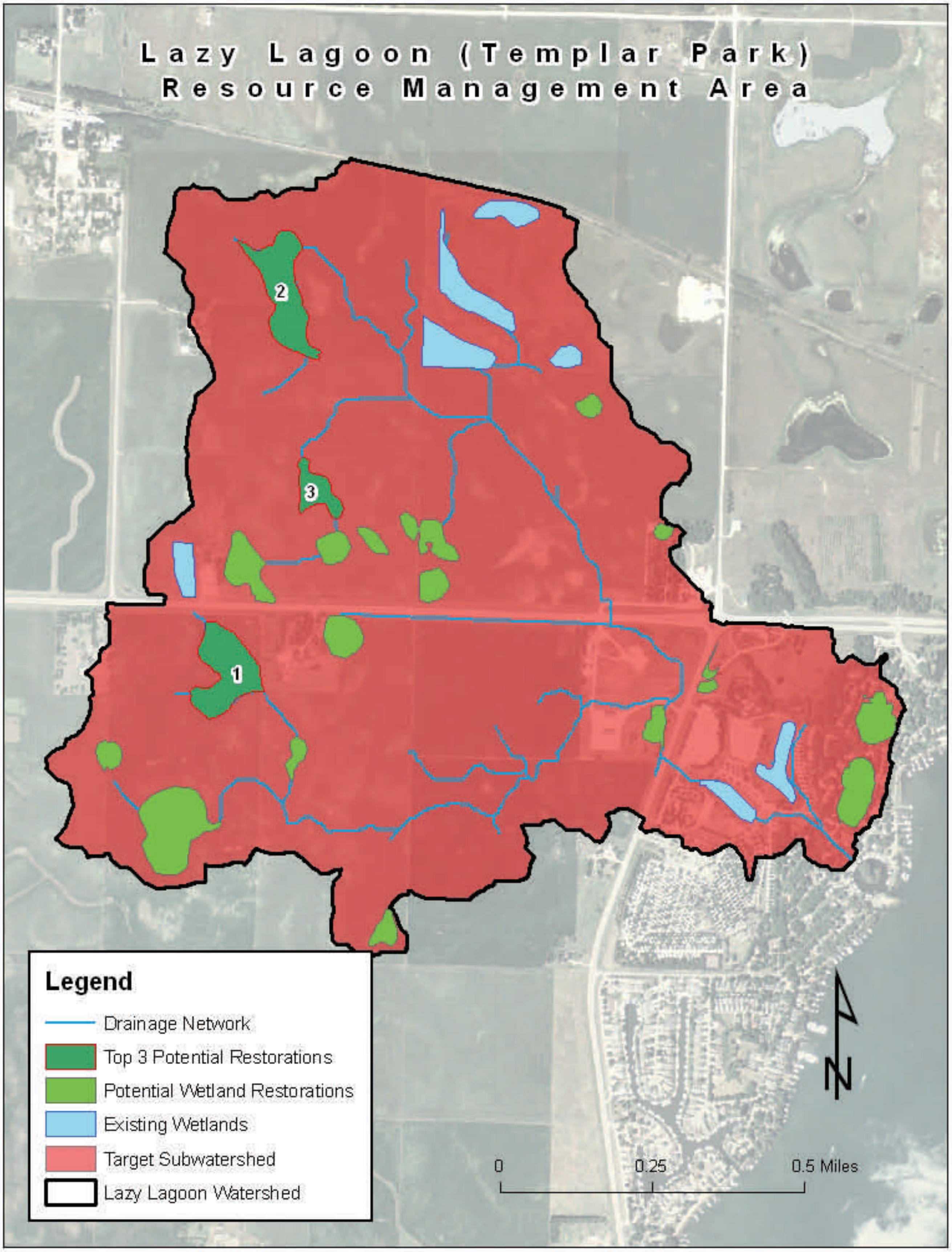


Figure 1.36 Lazy Lagoon Priority Wetland Restoration Sites

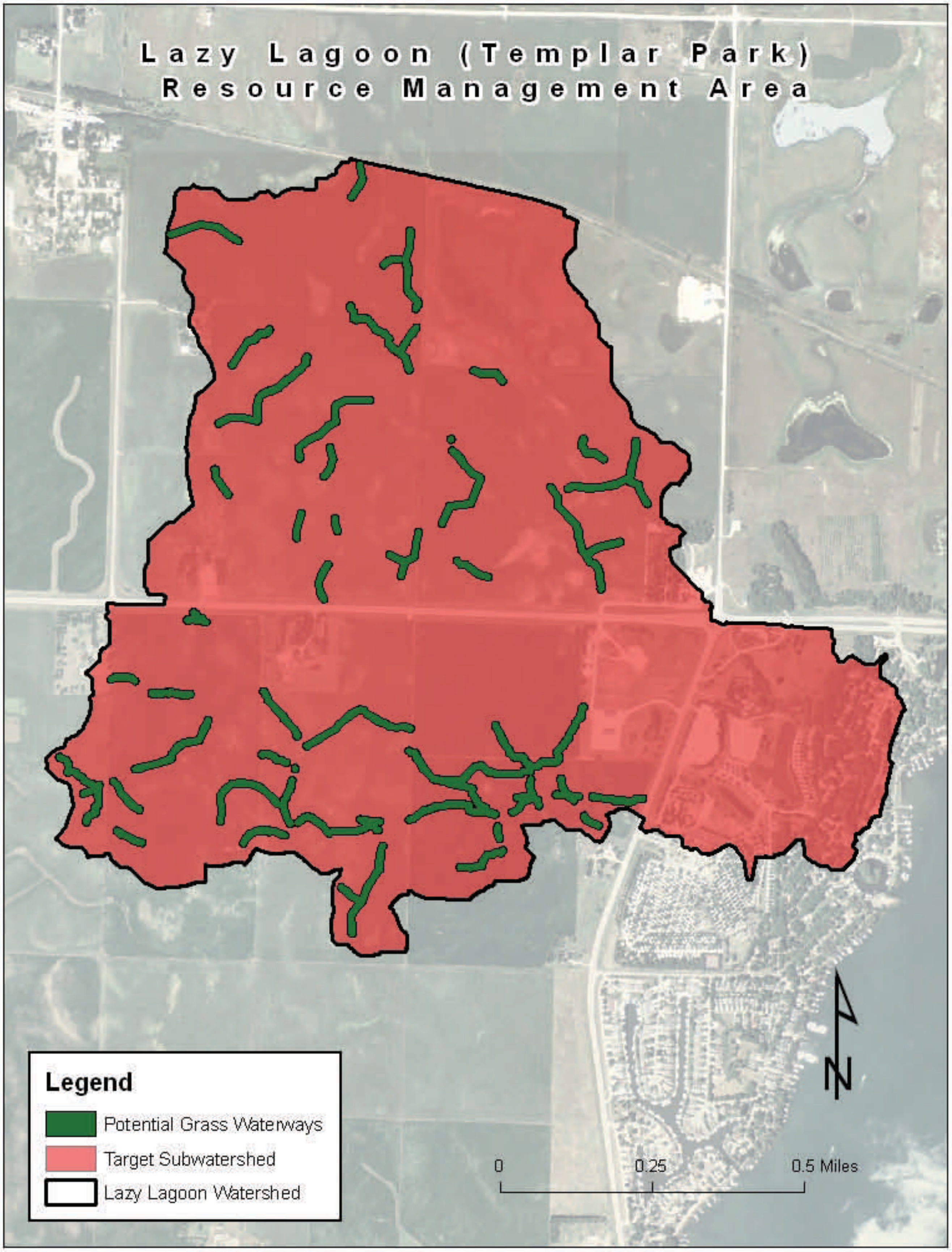


Figure 1.37 Lazy Lagoon Ephemeral Gullies

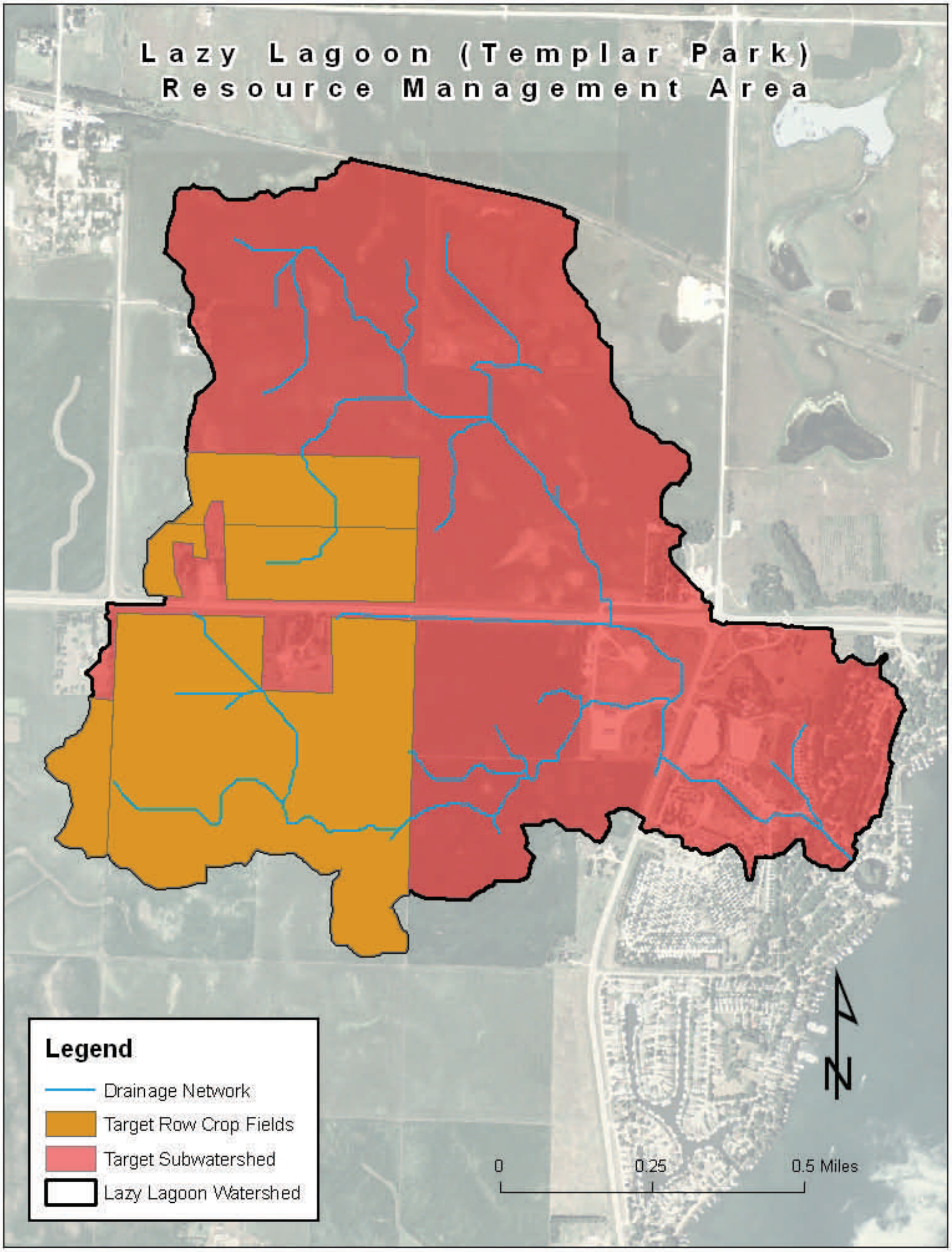


Figure 1.38 Lazy Lagoon Target Row Crop Fields

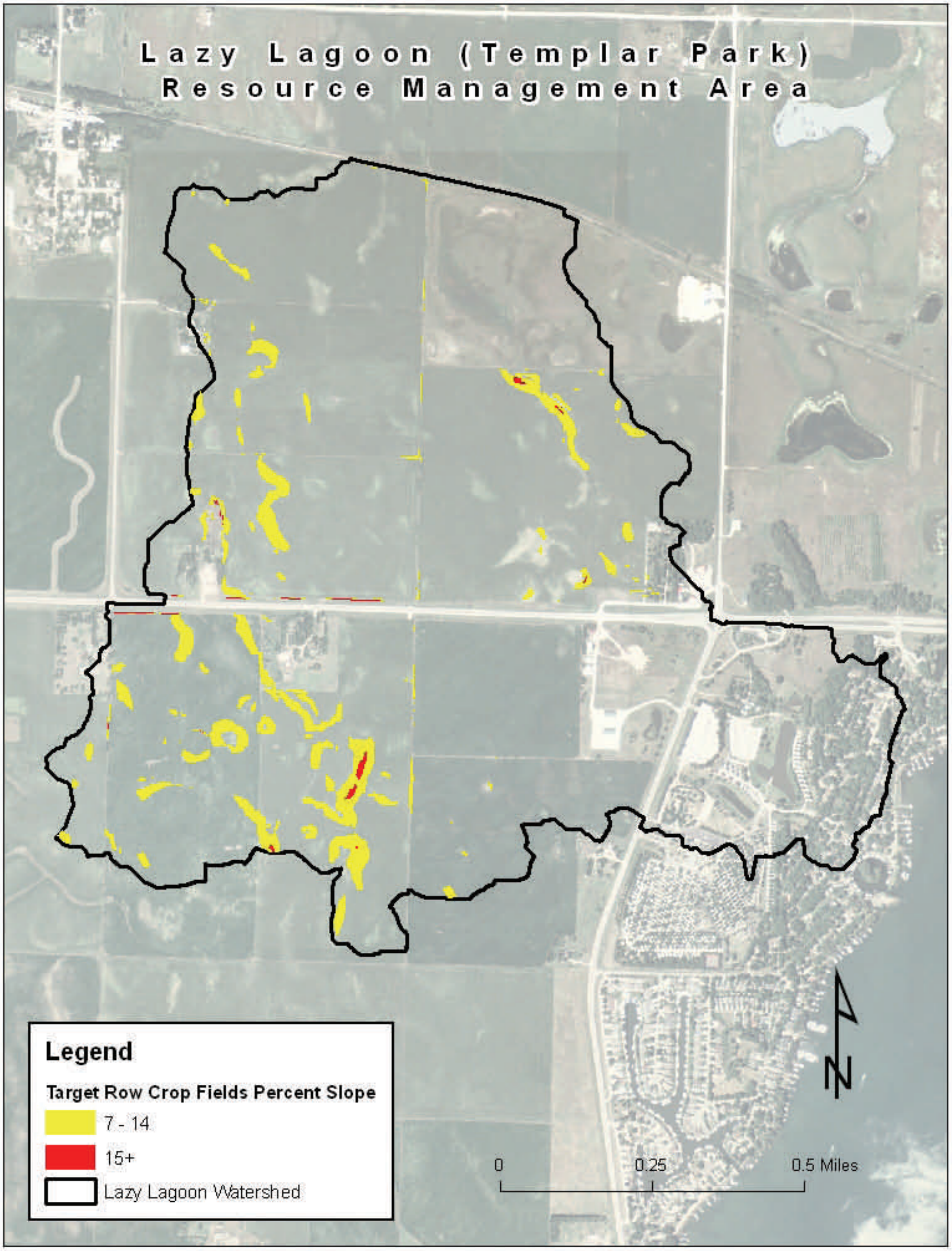


Figure 1.39 Lazy Lagoon Target Row Crop Slopes

Welch Lake Complex Resource Management Area (RMA)

Objective **–** Prevent heavy sediment loaded water reaching West Okoboji Lake via the ephemeral stream from the Welch Lake Complex. 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 **–** This 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 watershed very degraded. It represents approximately 16% of the watershed of West Okoboji Lake. Originally a long series of pothole wetlands provided important watershed protection to West 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

Watershed Practices

Sub-watershed of Concern (Figure 1.40)

Structural Sediment Trapping

- Analysis has identified three priority wetland restorations in this sub-watershed (Figure 1.41).
- These wetland restorations have the potential to effectively intercept 1,052 acres (36% of the priority sub-watershed) of primarily agricultural runoff (Table 1.8).
- 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 1,893.6 tons of sediment per year.

Gully Management

- 4.6 miles of ephemeral gully erosion has been identified within agricultural fields (Figure 1.42).
- 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 can reduce 473 tons of sediment per year.

Highly Erodible Fields—Conservation Tillage

- Eight agricultural fields devoted to row crop production exceed sediment loss thresholds (Figure 1.43).
- These fields, totaling 222 acres, account for 25% of the sediment loss within the targeted watershed.
- Conservation tillage on these acres can reduce 444 tons of sediment per year.

Highly Erodible Fields—Permanent Vegetation

- Sediment loss can be reduced on 226 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.
- Another 15 acres have been identified and should have alternate land practices implemented because their slope is greater than 15% (Figure 1.44).
- Permanent vegetation on these slopes can reduce 1,295 tons of sediment per year.

Nutrient Management

- A total of 894 acres are currently being utilized for the production of corn and soybeans within the targeted watershed of the Welch Lake Complex.
- 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

West 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 1,500 pound reduction of phosphorous per year to be removed. This Management Plan will help meet that 1,500 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 Welch Lake RMA is 300 pounds of phosphorous.