## 7.0 Management Framework

This section presents the management philosophy and framework for the RLWD. The framework is organized into six distinct planning subwatersheds for implementation purposes (Figure 1). Basic characteristics of the subwatersheds are described in Table 10.

**Table 10**
**Planning Subwatershed Characteristics**

| SUBWATERSHED | AREA (SQ MI) | PRIMARY LAND USES CHARACTERISTCS | OTHER CHARACTERISTICS |
|---|---|---|---|
| Upper Red Lake River | 457 | Consists of a mix of agricultural land, forest, wetlands, urban and grassland. | No lakes. Wetland areas are scattered throughout the area. |
| Lower Red Lake River | 874 | Consists largely of agricultural land, but is also made up of forest, wetlands, urban and grassland | No lakes. Wetland areas are scattered throughout the area |
| Thief River | 1068 | Consists of a mix of agricultural lands, forest lands and wetlands, with very little grasslands, lakes or developed urban land | Contains seven named lakes. All lakes are shallow. Wetlands throughout. |
| Grand Marais | 317 | Consists largely of agricultural land (94 percent), but is also made up forest, wetlands, urban and grassland | There are no lakes in this subwatershed. Wetland areas are scattered throughout the area. |
| Clearwater River | 1362 | Consists largely of agricultural and forest land, but is also made up of wetland, urban and grassland | Contains many lakes. 28 are larger than 100 acres and 107 lakes are smaller than 100 acres. |
| Upper and Lower Red Lake | 1,929 | Consists largely of forest land, lakes and wetlands, with very little agricultural or developed land. | Contains 86 lakes, 18 of which are over 100 acres |

Management priorities, actions, roles and responsibilities are presented separately for each planning subwatershed in the following subsections. This was done for two primary reasons:

1. To make the document easier to use
2. Because of the watershed's overall size and complexity

Appropriate management approaches vary across the watershed because of variations in such things as setting, topography and land use. For example, the northern part of the watershed, north of the Upper and Lower Red Lake and the Red Lake River and the western regions of the RLWD, are rather flat, while other areas have much greater variations in topography. Having a subwatershed planning framework also allows management actions to focus on local basin

characteristics, while allowing resources managers and interested parties to quickly find applicable portions of the plan.

There are also significant differences in land use across the RLWD, with the western half being intensively farmed, while the eastern half is primarily grassland, swamps, forests and lake surfaces. The broad soil classifications also vary significantly across the RLWD in a west-to-east direction due to historic glacial activity and the location of glacial Lake Agassiz.

Flood damages and FDR also varies on a sub-basin level. Flooding in the glacial lakebed region of the basin is substantially affected by runoff timing and volume from upstream areas. Runoff timing and volume are, in turn, substantially affected by the topography, soils, precipitation and land use within different regions of the basin, as well as by the types and locations of FDR and NRE measures that may be implemented. A basin-wide FDR framework will better enable a coordinated approach to integrate various FDR and associated NRE measures that are most effective for achieving the overall goals envisioned by the Red River Basin Mediation Agreement adopted in December 1998. In addition, the hydrologic model (described in Section 6.0) uses subwatersheds so that results can be presented and implementation planning completed on a subwatershed basis.

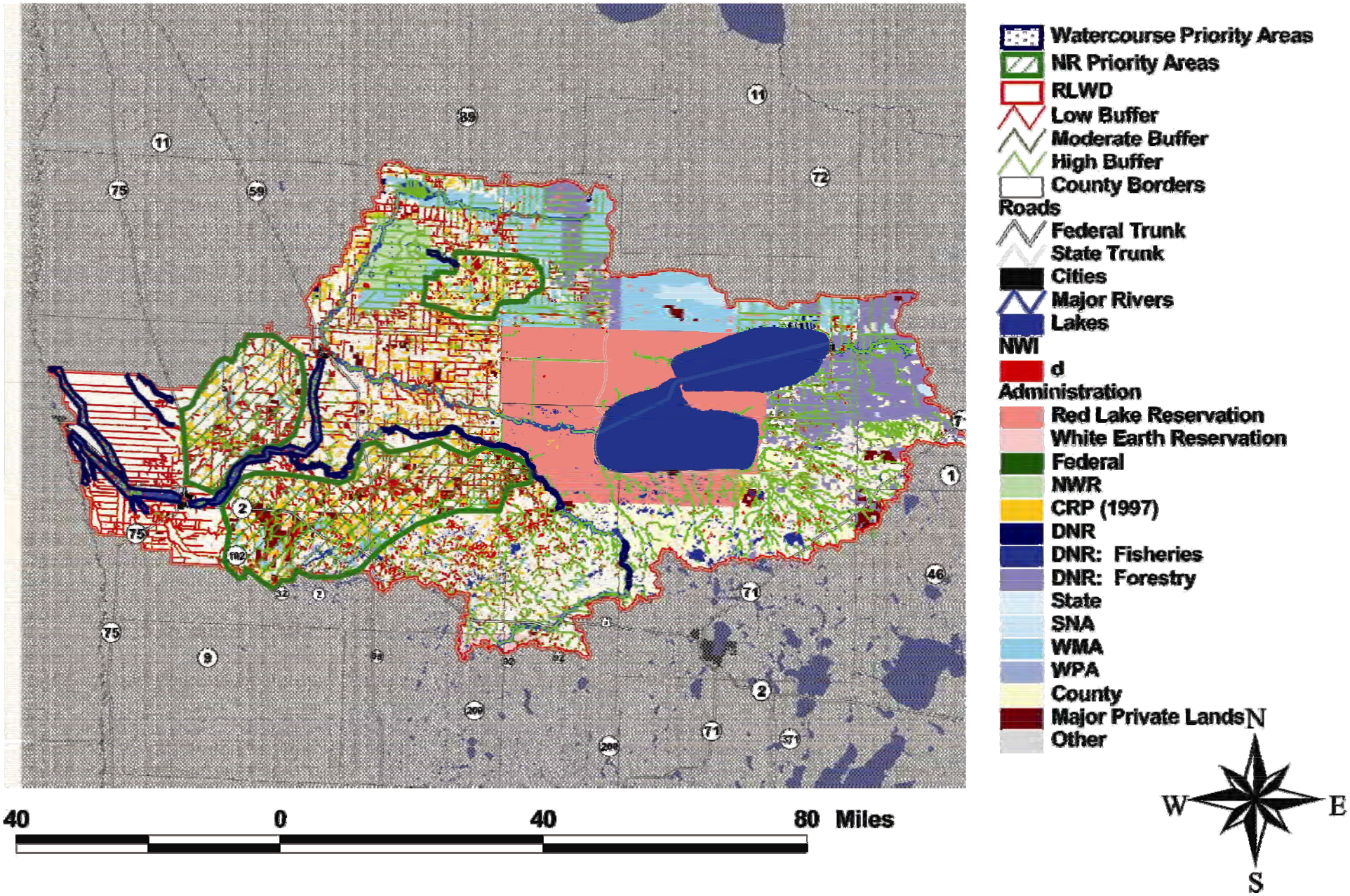
The goal of this framework is to implement various types of FDR measures individually, or in concert, at locations for which they are best suited to achieve FDR benefits locally and in the watershed, while also contributing to reduction of main stem flooding risk. This framework includes FDR measures that are also NRE measures, and promotes multi-purpose projects.

As was discussed in Section 6.0 of the plan, there are critical concepts about runoff timing and volume in relation to flood peaks on the main stem of the Red River, and facts about variations in topography, soils, precipitation and evaporation within the Minnesota portion of the basin, as foundations for defining the expected peak flow reduction effects of implementing various FDR measures within different areas of the RLWD. Available geologic, topographic, meteorologic and historical flood data, as well as computed runoff travel times, are used to illustrate these concepts and to define “early,” “middle,” and “late” runoff areas within the RLWD. This difference in the timing of the delivery of water also is reflected in the identification of the six planning subwatersheds.

In summary, for these and other similar differences in features across the RLWD, it was decided that the implementation activities portion of the plan would be best addressed both in general at a watershed scale and for specifics at a subwatershed scale. The action items and management

priorities in the following subwatershed sections reflect a "walk before you run" approach. This means that the subwatershed plans focus on priority issues. These issues and priorities were identified through numerous meetings of the TAC/CAC. The tables in Appendix 1 and Appendix 2 represent a compilation of the top ranked (i.e., numbers 1, 2 and sometimes 3) priority action items for FDR, water quality, erosion and natural resources from an overall watershed perspective and by subwatershed (Figure 24). These action items represent some of the top priorities for the RLWD to address in the upcoming decade. Project and activity implementation tables are found in Appendix 1 and Appendix 2. The complete priority rankings of the TAC/CAC are found in Appendix 5.

**Figure 24**
**Red Lake River Watershed District Priority Natural Resource Areas**



## 7.1 UPPER RED LAKE RIVER SUBWATERSHED PLAN

### 7.1.1 Introduction

This section presents the implementation plan for the Upper Red Lake River subwatershed (Figure 25). The plan is organized by first presenting a summary of important physical characteristics of the subwatershed. More detailed information is available in Sections 2.0-5.0 and in Appendix 7. The section also identifies the problems related to water management in the subwatershed and describes the proposed solutions in the form of goals and objectives to address these problems.

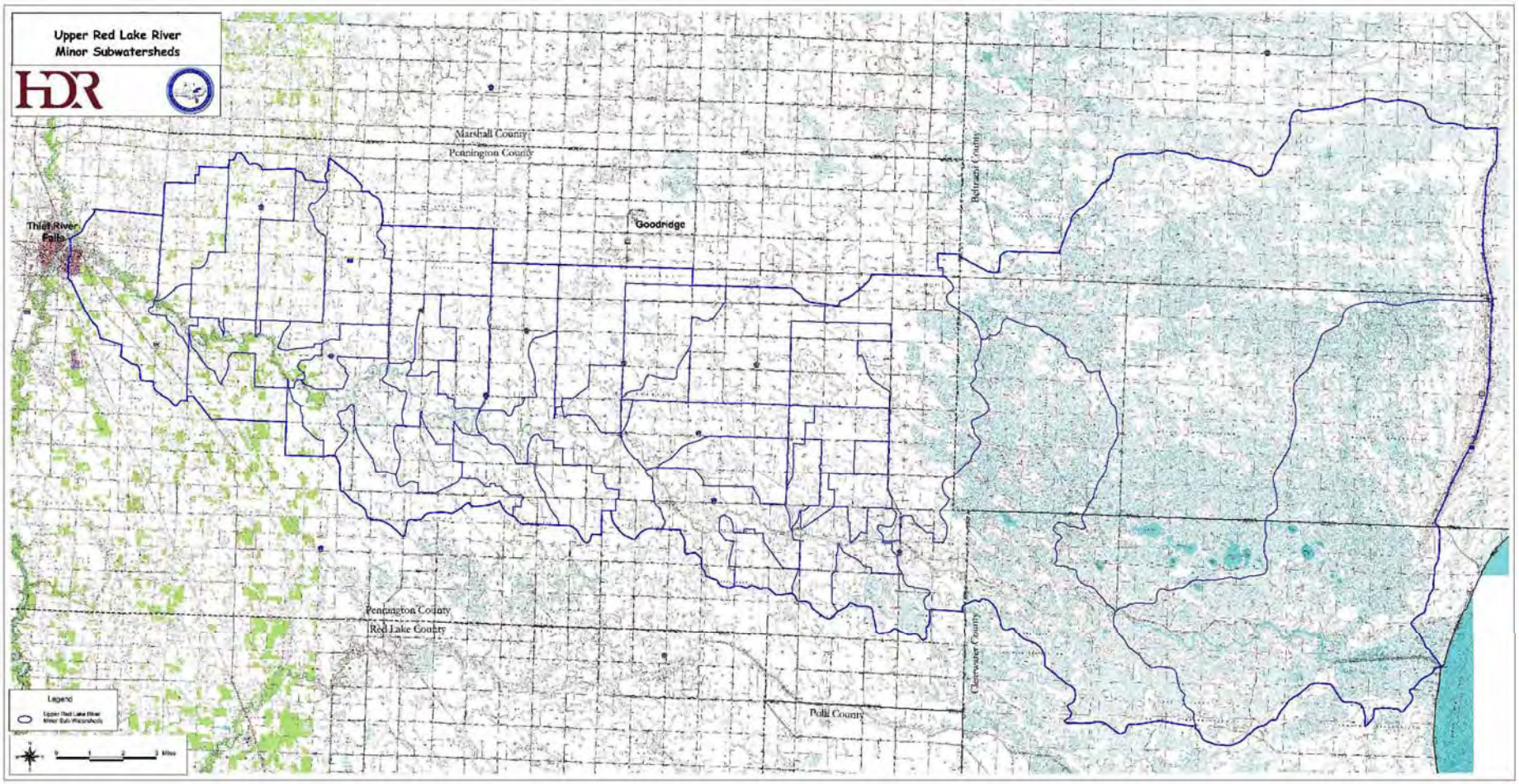
### 7.1.2 General Physical Characteristics

The Upper Red Lake River watershed consists of an approximately 457 square mile area. The watershed outlets into the Lower Red Lake River at Thief River Falls, and begins at the Lower Red Lake outlet control structure. The watershed is located entirely within the Glacial Lake Agassiz/Aspen Parklands and the Northern Minnesota Peatlands ecoregions. Soil textures range from fine loam in the western portion to coarse loam/sapric in the eastern portion of the watershed. The area consists of a mix of agricultural land, forest, wetlands, urban and grassland.

**Table 11**
**Land Use Characteristics of the Upper Red Lake River Subwatershed**

| CHARACTERISTIC | AREA |
|---|---|
| Basin Area (sq mi.) | 457 |
| Basin Area (acres) | 292,443 |
| Wetland Area NWI (acres) | 153,118 |
| **MINNESOTA WETLAND TYPE** | |
| 1 | 929 |
| 2 | 86,007 |
| 3 | 1,099 |
| 4 | 1,979 |
| 5 | 1,706 |
| 6 | 23,554 |
| 7 | 32,379 |
| 8 | 5,465 |
| Lakes/Rivers (acres) | 2,844 |
| **ECOREGIONS OF RLWD (ACRES)** | |
| Lake Agassiz, Aspen Parklands | 139,242 |
| Minnesota & NE Iowa Morainal | -- |
| N. Minnesota & Ontario Peatlands | 153,201 |
| N. Minnesota Drift & Lake Plains | -- |
| Red River Valley | -- |
| **LAND USE (ACRES)** | |
| Cultivated Land | 117,023 |
| Forest Land | 62,290 |
| Grass/Brushland | 11,440 |
| Mines | 40 |
| Water | 1,815 |
| Developed Land | 1,140 |
| Wetlands | 98,695 |
| Other | -- |

Figure 25
Upper Red River Lake Watershed Map



### 7.1.3 Surface Water Summary

The Upper Red Lake River subwatershed is bordered along its north side by the Thief River subwatershed. All of the drainage from within the smaller subwatersheds ends up in the Red Lake River at various points along the river.

There are no lakes in this subwatershed. Wetland areas are scattered throughout the area. The wetland areas are very dense in the eastern portion of the subwatershed, generally east of the Pennington/Clearwater county line. Many of the wetlands in west portion of this watershed have been altered by drainage for the purposes of agricultural production. The majority of the eastern wetlands have been left untouched. Remaining wetlands have been estimated to be 2-43 percent of pre-settlement extent.

Drainage systems in this subwatershed are a complex network of natural streams and legal ditch systems developed for agriculture. Generally, the ditch systems are under the administration of the county in which they reside or the RLWD. One notable exception within this watershed is the existing multi-purpose Good Lake project which is capable of storing 10,000 acre feet of water. The Good Lake project is sited on Red Lake Nation lands and is under the jurisdiction of the Red Lake Band of Chippewa Indians.

### 7.1.4 Groundwater Summary

The subwatershed is located in the Lake-Washed Till Plain physiographic area of the Red Lake River Watershed District. The surficial geology of the area is dominated by the lake-washed till. The till is described as a sandy, clay-silt loam containing fine to medium gravel with a scattering of boulders. The till is covered in areas to the west by very-fine to fine-grained, uniform glacial lake sand generally less than 20 feet in thickness. In the eastern portion of the subwatershed, the till is overlain by a thin covering of peat (only a few feet thick) that results from the water table being close to or at land surface, paired with poor drainage in the area. Localized peat deposits are also present in many closed depressions within the till.

Glacial sediment aquifers in the region provide very moderate amounts of groundwater. Suitable yields of 5 gallons per minute (gpm), or more for domestic use, can be found in sand lenses within the till. These lenses are often localized and yields can vary. The aquifer may accommodate municipal or industrial uses, possibly up to 250 gpm in some rare instances. Hardness of the groundwater is commonly greater than 180 milligrams per liter (mg/l).

Paleozoic sediments, consisting of shales and limestones, are discontinuous and underlie the glacial lake deposits along the western side of the subwatershed. Precambrian crystalline rocks

underlie the glacial sediments, forming the base of the groundwater reservoir for most of the watershed. The fractured surface of crystalline rocks may provide an adequate supply of groundwater for limited domestic use.

Information regarding the individual city wells, water quality analysis results and the aquifers that serve as the water supply can be obtained from the individual cities and the Minnesota Geological Survey.

### 7.1.5 Natural Resources Implementation Plan

The Upper Red Lake River subwatershed includes the lands adjacent to the Red Lake River from Thief River Falls to the outlet of lower Red Lake. The western and central portions of this watershed have diverse habitats including agriculture, grasslands, wetlands, brushlands and woodlands. The eastern portion of this watershed, located in the Red Lake Reservation, is dominated by wetlands. Public lands are not common in this subwatershed. Throughout the central and western portion of this watershed CRP lands account for a substantial amount of the habitat. These lands provide a mix of grasslands, wetlands and brushlands and provide seasonal and permanent habitats to a variety of species including game species such as white-tailed deer, waterfowl and sharp-tail grouse. Habitats in the eastern portion of this subwatershed also support moose and bear populations. The areas adjacent to the Red Lake River also provide a habitat corridor with a mix of woodlands, wetlands and pasture.

The Red Lake River is a great stream resource that provides a variety of habitats for many fish species. However, a large portion of this subwatershed has been channelized and the quality of this instream habitat has been substantially reduced. MnDNR fish sampling within the Upper Red Lake River subwatershed yielded a “fair” biotic integrity classification near Highlanding. Downstream dams reduce the productivity and recreational use of this river reach.

Natural resource problems and issues were identified using a questionnaire with resource agencies. Results of this questionnaire and the resource inventory were considered by a natural resources subcommittee. The Upper Red Lake River was identified as an important resource within the region that needs to be recognized and protected. Recreational activities including hunting, fishing, tubing, swimming etc. were all identified as being popular activities. The following are the major goals and actions recommended by the natural resources subcommittee.

#### *7.1.5.1 Natural Resources Problems*

- The dam at Thief River Falls eliminates fish passage to the 56 miles of river upstream.
- Stream bank erosion and a lack of buffers along tributary waterways limit habitat in these waterways and increases sediment loading to the Red Lake River.
- The Red Lake River is somewhat limited by its flashy hydrology, extended periods of low flow and sediment loading.
- Excessive snagging and clearing on the Red Lake River can reduce in-stream habitat. Woody debris provides habitat diversity for a variety of species.

#### *7.1.5.2 Improve Fish Habitat in the Red Lake River and its Tributaries*

- Support activities that reduce the flashiness and enhance base flows
- Stabilize stream banks in areas of accelerated erosion
- Provide fish passage at Thief River Falls
- Reduce sediment load in streams
- Buffer all watercourses
- Increase the amount of woody fish cover
- Implement agricultural BMPs to reduce wind and water erosion throughout the subwatershed
- Other strategies include improved ditches with side inlets, buffer and grassed waterways, residue management, tree plantings and reduce farming into road ditches

#### *7.1.5.3 Maintain and Improve Wildlife Habitat (indicators could be land base statistics or prairie chicken and sharp-tail population levels)*

- Re-establish habitat corridors along the Red Lake River
- Connect existing corridor woodland habitats
- Protect existing grassland habitats
- Identify and protect existing tracts of prairie
- Retain, increase, or implement CRP, Conservation Reserve Enhancement Program (CREP), Wetland Reserve Program (WRP) and CRP acres
- See MnDNR land management plan for some good targets and strategies

- Enhance existing grassland habitats
- Encourage active vegetation management that maintains grassland quality (prescribed burning, weed control, etc)
- Target CRP to increase number of large blocks of grassland habitats
- Protect existing wetland habitats
- Support efforts to retain WRP acres
- Support Wetland Conservation Act (WCA) enforcement
- Enhance existing wetland habitats
- Target wetland restorations in areas near existing restorations
- Encourage active vegetation management that maintains wetland quality (moist soil management, prescribed burning, weed control, etc)

#### *7.1.5.4 Increase Recreational Opportunities*

- Support efforts of the Red Lake River corridor project to raise awareness and increase recreational opportunities
- Partner with other groups to highlight existing opportunities
- Wildlife viewing/birding, hunting, trails

The Natural Resource Committee's recommendations were used by the RLWD to develop the following natural resource goals, objectives and specific action items are presented in Table 12.

### 7.1.6 Water Quantity Implementation Plan

Due to terrain, draining of wetlands for cropland and other land use changes, the Upper Red Lake River subwatershed experiences frequent flooding throughout the subwatershed. Damages associated with this type of flood are to public infrastructure, personal property, cropland and public resources (fisheries, wildlife, soils and water quality). Agricultural flooding and rural, residential damages were identified as the highest priority flooding issues. In addition to projects shown in Figure 23, it is the RLWD's goal to address the following issues with the Upper Red Lake River subwatershed:

#### *7.1.6.1 Upper Red Lake River FDR Rankings*

- Agricultural crop damages.
- Inadequate agricultural drainage.
- Residential flooding in spring from Smiley Bridge to Thief River Falls.
- High landing flooding.
- City of Thief River Falls water supply.

#### *7.1.6.2 FDR Action Items*

1. The RLWD will pursue projects to create additional flood volume reduction and storage projects within the eastern portions of this subwatershed to reduce agricultural and residential flooding.
2. The RLWD will pursue projects that reduce bank erosion and still provide adequate agricultural drainage.
3. The RLWD will respond to petitions and other requests for the ditches that are actively managed by the RLWD. The RLWD will seek partnerships with the county and private landowners to improve the overall coordination and management of the public and private ditch system.
4. The RLWD will partner with member communities to promote projects that protect public water supplies. Table 12 provides a summary list of specific implementation actions for the subwatershed.
5. The RLWD will partner with local, state and federal agencies to implement 5,000 ac-ft of flood volume reduction projects within this subwatershed.

### 7.1.7 Water Quality Implementation Plan

A number of monitoring sites are located in the subwatershed. These include: a site at the Red Lake Dam, a site at Highlanding Bridge and a site at First Street Bridge in Thief River Falls. The RLWD also coordinates data gathering with other organizations. The RLWD currently coordinates sampling efforts with the MPCA, SWCDs, Red Lake MnDNR, the RRWMB and the Red River Basin Institute.

Water quality monitoring has been done by the RLWD at two sites associated with streams within the subwatershed. Monitoring has been done since as early as 1980 for several parameters, including field measurements for dissolved oxygen, pH, temperature, turbidity, transparency and conductivity. Laboratory analysis is performed on stream samples for fecal coliform, TSS, total dissolved solids, chemical oxygen demand, total phosphorus,

orthophosphorus, nitrates and nitrites, ammonia, total Kjeldahl nitrogen, alkalinity, dissolved oxygen, pH, temperature, turbidity, transparency and conductivity. Major locations for sampling include the Red Lake Dam Outlet and the Highlanding Bridge. The RLWD periodically prepares a water quality report, and results are available upon request in the RLWD office. There are no impaired stream reaches, as identified by the MPCA, in this subwatershed.

It is the RLWD's goal to address the following issues with the Upper Red Lake River subwatershed:

The planning process resulted in the following water quality rankings and action items.

#### *7.1.7.1 Upper Red Lake River Water Quality Rankings*

- Need for filter strips along the river and ditches.
- Turbidity and 303D impairment.
- Water Quality Assessment and concerns for development.
- Pasture lands along river and needs for alternate water sources.

#### *7.1.7.2 Water Quality Action Items*

1. The RLWD will actively partner with the MnDNR, USFWS, Red Lake Band of Chippewa Indians, USDA NRCS, USACE, MPCA and the SWCDs to seek to implement projects that reduce agricultural and bank erosion and improve water quality.
2. The RLWD will support the efforts of municipalities to identify and protect recharge areas and to improve surface water quality.
3. The RLWD will develop a TMDL implementation program in cooperation with other local, state and federal agencies.

Table 12 provides a summary list of specific implementation actions for the subwatershed.

### 7.1.8 Erosion and Sedimentation Implementation Plan

Erosion due to storm runoff is a serious problem in the subwatershed. During periods of high runoff, channel erosion causes bank stabilization concerns for this subwatershed. The severity depends on the land cover, duration and volume of water. Erosion is often worse in the spring due to the lack of vegetative cover on the fields. It is the RLWD's goal to address the following issues within the Upper Red Lake River subwatershed:

#### *7.1.8.1 Upper Red Lake River Erosion and Sedimentation Rankings*

- River and ditch bank failures.
- Ditches and tributary outlets to channels.

#### *7.1.8.2 Erosion and Sedimentation Action Items*

1. The RLWD will seek partnerships with landowners, SWCD and USDA NRCS to implement BMPs that reduce agricultural erosion and slow water down.
2. The RLWD will seek out grant opportunities to conduct an erosion assessment on the entire course of the Red Lake River from the Red Lake outlet on the reservation to the Red River.

Table 12 provides a summary list of specific implementation actions for the subwatershed.

### 7.1.9 Summary and Conclusions

This section presents an overall watershed management plan and overview of the Upper Red Lake River subwatershed. Goals and objectives for the subwatershed are presented above for the following plan elements: 1) Natural Resources, 2) Water Quantity, 3) Water Quality and 4) Erosion and Sedimentation. Table 12 provides a summary list of specific implementation actions organized by these same plan elements.

**Table 12**
**Upper Red Lake River Subwatershed Implementation Actions**

| ACTION/GOAL | PLAN ELEMENT | SCHEDULE | CONCEPTUAL COST |
|---|---|---|---|
| Create additional flood storage within eastern portions of subwatershed to reduce agricultural and residential flooding | Water Quantity Action Item | Years 1-5 | $5,000,000 |
| Reduce bank erosion and provide adequate agricultural drainage | Water Quantity Action Item | Years 6-10 | $300,000 |
| Respond to petitions and other requests for ditches actively managed by RLWD | Water Quantity Action Item | Ongoing | $50,000 |
| RLWD will partner with USDA NRCS USACE MPCA and SWCDs to implement projects to reduce agricultural and bank erosion and improve water quality | Water Quality Action Item | Years 1-5 | $100,000 |
| RLWD will support efforts of municipalities to identify and protect recharge areas and to improve surface water quality | Water Quality Action Item | Years 5-10 | $10,000 |
| RLWD will seek partnerships with landowners, SWCD and USDA NRCS to implement BMPs to reduce agricultural erosion and slow water down | Erosion and Sedimentation Action Item | Years 1-5 | $25,000 |
| RLWD will seek out grant opportunities to conduct an erosion assessment on the entire Red Lake River from the Red Lake outlet on the reservation to the Red River | Erosion and Sedimentation Action Item | Years 5-10 | $25,000 |
| Increase number of water quality monitoring sites | Watershed-wide Activity | Ongoing | $5,000 |
| Develop TMDL diagnostic studies | Watershed-wide Activity | Ongoing | $10,000 |
| Initiate TMDL implementation strategies | Watershed-wide Activity | Ongoing | $5,000 |
| Improve District website and education programs | Watershed-wide Activity | Ongoing | $5,000 |
| Reduce streambank erosion | Natural Resource Action Item | Ongoing | $5,000 |
| Install vegetative buffer strips | Natural Resource Action Item | Ongoing | $30,000 |

## 7.2 LOWER RED LAKE RIVER SUBWATERSHED PLAN

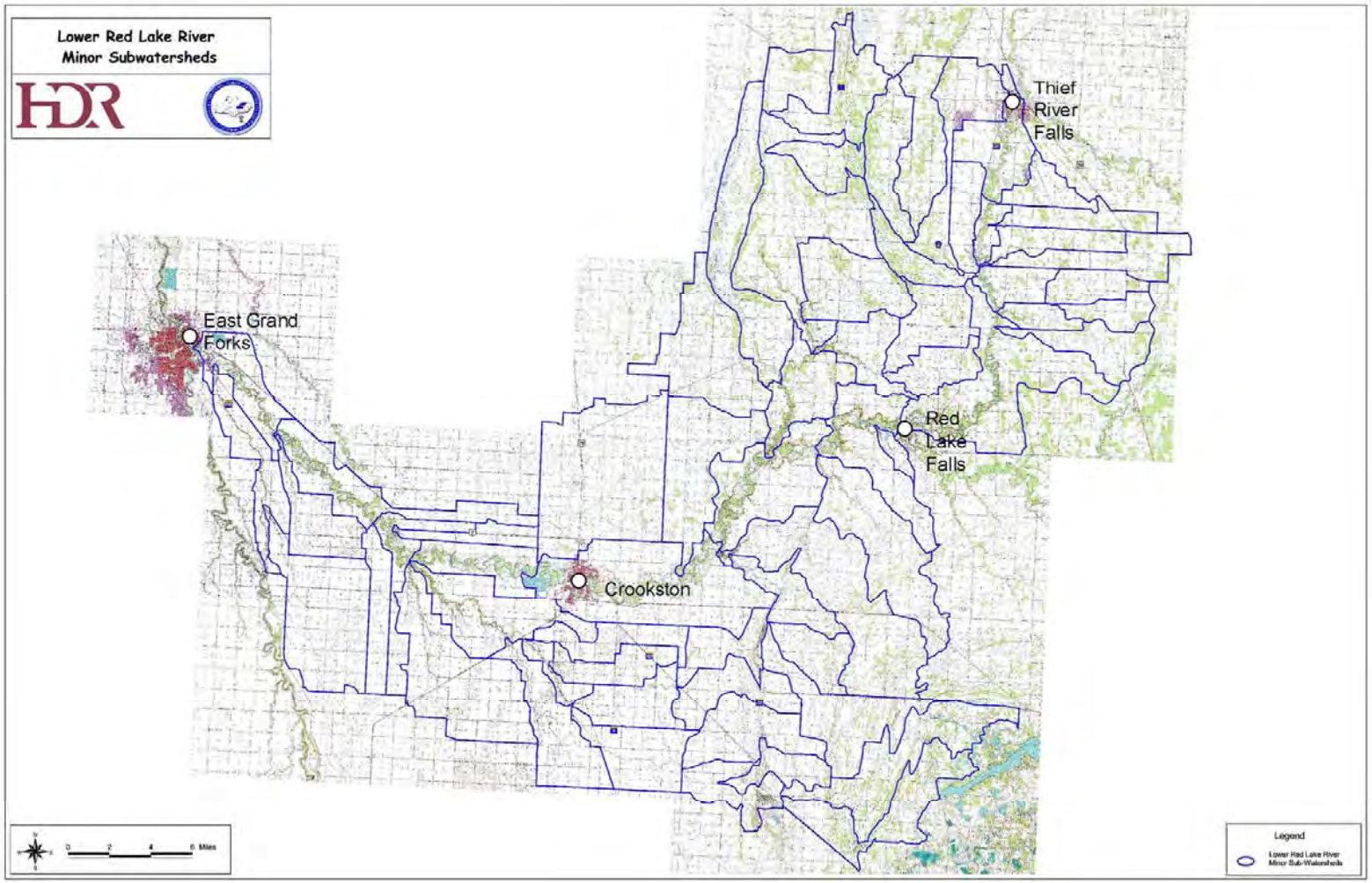
### 7.2.1 Introduction

This section presents the implementation plan for the Lower Red Lake River subwatershed. The plan is organized by first presenting a summary of important physical characteristics of the subwatershed (Figure 26). More detailed information on the subwatershed is available in Sections 2.0-5.0 and in Appendix 7. This section also identifies the problems related to water management in the subwatershed and describes the proposed solutions in the form of goals and objectives to address those problems.

The Lower Red Lake River planning basin includes the Heartsville Coulee, Burnham Creek and Lower Red Lake River minor subwatersheds. The Heartsville Coulee and most of the Burnham Creek watershed areas are dominated by lands in agricultural production. Small patches of woodland and grassland habitat exist near waterways and along the Red River. These areas provide limited habitat to some species including game species such as white tailed deer. The Lower Red Lake River watershed (generally east of U.S. Highway 9) and eastern portions of the Burnham Creek watershed have more diverse habitats including agriculture, grasslands, wetlands, brushlands and woodlands. Include in these areas are numerous WMAs, waterfowl protection areas (WPAs) and the Nature Conservancy Glacial Ridge project area (~24,000 acres). CRP lands are also common along State Highway 102 (until about 8 miles west of U.S. Highway 9) and in areas along and east of U.S. Highway 9. These lands provide seasonal and permanent habitats to a variety of species including game species such as white-tailed deer, sandhill crane, waterfowl, prairie chicken and sharp-tail grouse. The prairie chicken population has increased dramatically in recent years.

Burnham Creek and Heartsville Coulee provide some seasonal habitat for fish. The Lower Red Lake River provides a diversity of habitats year round. Many tributaries to these streams (natural and ditches) are unstable with large amounts of active erosion. Dams on the Red Lake River at Crookston and Thief River Falls limit fish passage and the potential for this watershed to produce fish. An important historical lake sturgeon spawning bed is located at the confluence of the Lower Red Lake and Clearwater rivers.

**Figure 26**
**Lower Red Lake River Subwatershed Map**



### 7.2.2 General Physical Characteristics

The Lower Red Lake River watershed consists of an approximately 874 square mile area. The watershed outlets into the Red River of the North at East Grand Forks, and begins just downstream of the dam in Thief River Falls. The watershed is located mainly within the Red River Valley and Glacial Lake Agassiz/Aspen Parklands ecoregions. Soil textures range from fine in the western portion of the watershed to sandy loam in the east portion of the watershed. There are two sand ridges west of Thief River Falls along what is commonly termed the Pembina Trail. The area consists largely of agricultural land, but is also made up of forest, wetlands, urban and grassland (Table 13). The following presents a general summary of surface water and groundwater in the subwatershed. The summary is followed by a discussion of the problems, goals and policies and the implementation actions for each of the four plan elements: 1) Natural Resources, 2) Water Quality, 3) Water Quantity and 4) Erosion and Sedimentation.

### 7.2.3 Surface Water Summary

This subwatershed is also comprised of two minor subwatersheds which outlet into the Red Lake River. They are the Heartsville Coulee and Burnham Creek minor subwatersheds. The Lower Red Lake River subwatershed is bordered along its north side by the Grand Marais subwatershed. The drainage from within the smaller minor subwatersheds ends up in the Red Lake River in the western half of the watershed. The Thief River and Upper Red Lake River subwatersheds are tributaries to the Lower Red Lake River subwatershed in Thief River Falls. The Clearwater River subwatershed is a tributary to the Lower Red Lake River in Red Lake Falls.

**Table 13**
**Land Use Characteristics of the Lower Red Lake River Subwatershed**

| CHARACTERISTIC | AREA |
|---|---|
| Basin Area (sq mi.) | 874 |
| Basin Area (acres) | 559,091 |
| Wetland Area NWI (acres) | 349,994 |
| **MINNESOTA WETLAND TYPE** | |
| 1 | 1,430 |
| 2 | 18,205 |
| 3 | 5,350 |
| 4 | 138 |
| 5 | 932 |
| 6 | 3,979 |
| 7 | 4,940 |
| 8 | 20 |
| Lakes/Rivers (acres) | 4,556 |
| **ECOREGIONS OF RLWD (ACRES)** | |
| Lake Agassiz, Aspen Parklands | 356,727 |
| Minnesota & NE Iowa Morainal | 3,358 |
| N. Minnesota & Ontario Peatlands | -- |
| N. Minnesota Drift & Lake Plains | -- |
| Red River Valley | 190,598 |
| **LAND USE (ACRES)** | |
| Cultivated Land | 456,095 |
| Forest Land | 40,927 |
| Grass/Brushland | 39,168 |
| Mines | 1,901 |
| Water | 4,331 |
| Developed Land | 7,744 |
| Wetlands | 8,882 |
| Other | 43 |

There are no lakes in this subwatershed. Wetland areas are scattered throughout the area. These wetland areas are somewhat denser in the extreme southeastern portion of the subwatershed, generally south of U.S. Highway 2 and east of State Highway 102. Many of the wetlands in this watershed have been altered by farm drainage for the purpose of agricultural production.

Drainage systems in this subwatershed are a complex network of natural streams and legal ditch systems. Generally the ditch systems are under the administration of the county or watershed district in which they reside.

### 7.2.4 Groundwater Summary

The subwatershed is located in the Lake Plain physiographic area of the RLWD. The surficial geology of the area consists of mainly clay with small regions of silt, sand, sand and gravel ridges and lake-washed till. Clay deposits dominate the Lower Red Lake River subwatershed and are characterized as being very dense, uniform and of low permeability. Thicknesses can range from a few feet in the eastern part of the watershed to more than 120 feet in the western portions. Nearly level topography in this region also relates to poor drainage. Sand and gravel ridges, known as beach ridges from Glacial Lake Agassiz, occur in mainly north-south trending ridges that range in thickness from a few feet to 30 feet in some areas. Drainage is good within the ridges, but can be poor in the inter-ridge areas where deposits of peat are evident. The fine sand or silt deposits in the area are fairly uniform and are underlain by till and clay. Thicknesses for both deposits are generally less than 20 feet. Lake-washed till deposits are described as sandy, clay-silt loam that contains fine to medium gravel with a scattering of boulders. The deposits are generally not well drained.

Glacial aquifers in the region only provide moderate amounts of groundwater. Suitable yields of 5 gpm, or more for domestic use, are mainly found in sand and gravel deposits in the till. Beach ridge deposits are limited in aerial extent and saturation is limited to a few bottom feet. Groundwater supplies from the smaller beach deposits are unreliable due to periods of limited precipitation. Groundwater supply for industrial use and irrigation is generally poor. Quantities and quality for such uses are inadequate. Hardness of the groundwater is commonly greater than 180 mg/l.

Paleozoic sediments consisting of shales and limestones are discontinuous and underlie the glacial lake deposits along the western side of the subwatershed. The western tip of the subwatershed near East Grand Forks contains Paleozoic limestone and sandstone that is thin and discontinuous. Paleozoic deposits contain highly saline groundwater. Precambrian crystalline rocks underlie most of the subwatershed, forming the base of the groundwater reservoir for most of the watershed. The fractured surface of crystalline rocks may provide an adequate supply of groundwater for limited domestic use.

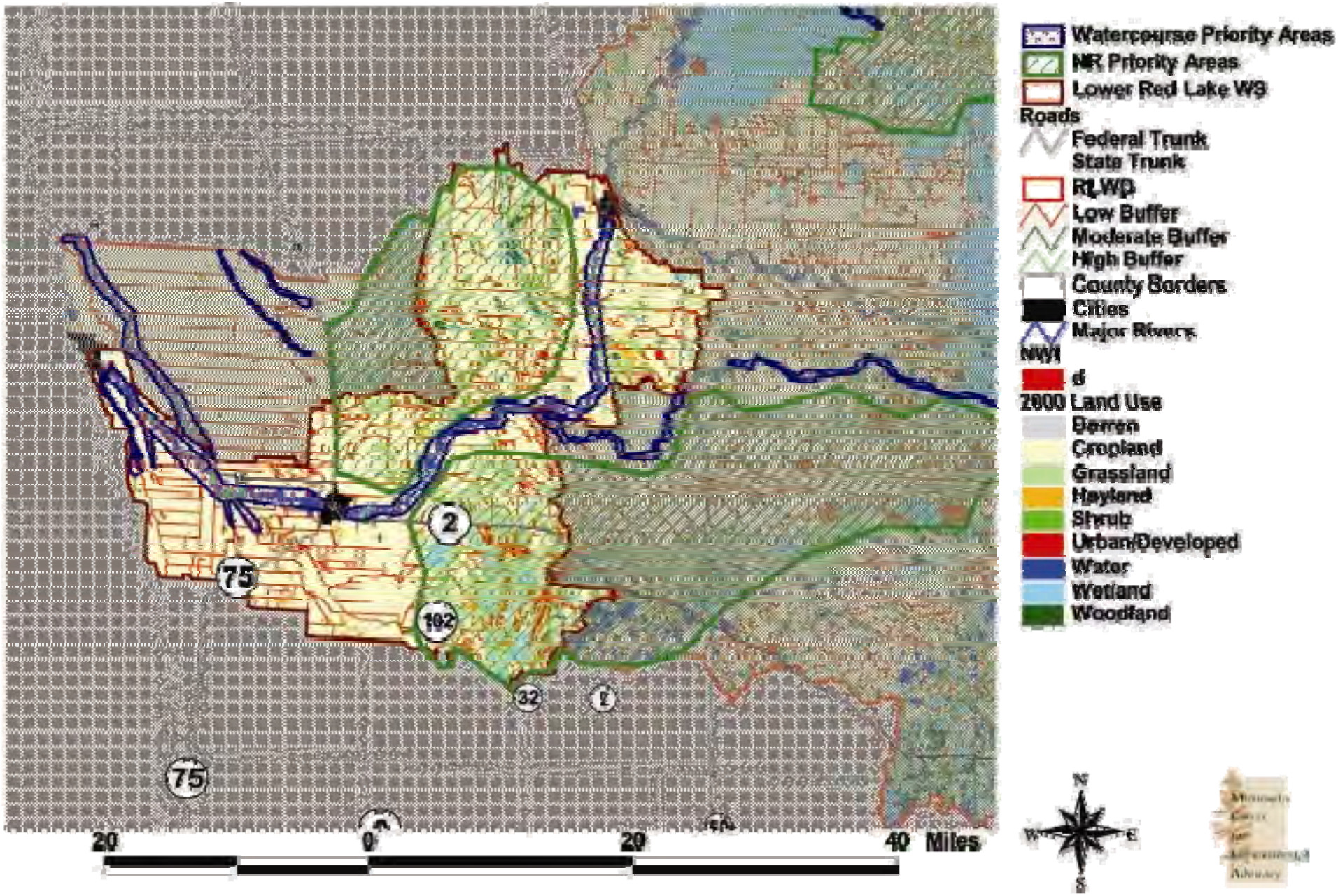
Information regarding the individual city wells, water quality analysis results and the aquifers that serve as the water supply can be obtained from the individual cities and the Minnesota Geological Survey.

### 7.2.5 Natural Resources Implementation Plan

Natural resource problems and issues were identified using a questionnaire with resource agencies. Results of this questionnaire and the resource inventory were considered by a natural resources subcommittee. The following are the major goals and actions recommended by the Natural Resources Subcommittee.

The Lower Red Lake River was identified as an important resource within the region, a resource that needs to be recognized and protected (see Figure 27). Recreational activities, including hunting, fishing, tubing and swimming, were all identified as being popular activities. The following are the major goals and actions recommended by the Natural Resources Subcommittee.

**Figure 27**
**Lower Red Lake River Priority Natural Resource Areas**



#### *7.2.5.1 Maintain and Improve Wildlife Habitat (indicators could be land base statistics or prairie chicken and sharp-tail population levels)*

- Re-establish habitat corridors along all major waterways
- Identify key areas and connect existing habitats along the corridors by promoting land use changes. Particularly Heartsville Coulee, Burnham Creek and the Red Lake River
- Connect existing corridor woodland habitats
- Protect existing grassland habitats
- Identify and protect existing tracts of prairie
- Retain or increase CRP acres in those areas that already have considerable amounts of CRP
- See MnDNR land management plan for some good targets and strategies
- Enhance existing grassland habitats
- Encourage active vegetation management that maintains grassland quality (prescribed burning, weed control, etc)
- Target CRP to increase number of large blocks of grassland habitats
- Protect existing wetland habitats
- Support WCA enforcement
- Enhance existing wetland habitats
- Support efforts at Glacial Ridge
- Target wetland restorations in areas near existing restorations. Particularly the high density of existing resources east of U.S. Highway 75.
- Encourage active vegetation management that maintains wetland quality (moist soil management, prescribed burning, weed control, etc)
- Support continuation of WRP

#### *7.2.5.2 Increase Recreational Opportunities*

- Support efforts of the Red Lake River Corridor project
- Partner with other groups to highlight existing opportunities
- Wildlife viewing/birding, Hunting, Trails
- Increased recreational opportunities near Glacial Ridge NWR and the numerous state lands in the eastern portion of this watershed

#### *7.2.5.3 Lower Red Lake River Watershed Natural Resource Goals and Objectives*

1. Improve existing riverine habitat conditions
   - Reduce the flashiness of stream flows
   - Stabilize stream banks in areas of accelerated erosion
2. Re-establish habitat corridors
   - Red River
   - Heartsville Coulee, Burnham Creek, Red Lake River
   - Connect existing corridor woodland habitats
3. Reduce erosion and resulting sedimentation in watercourses
   - Implement agricultural BMPs to reduce wind and water erosion throughout the Heartsville Coulee subwatershed, in western portions of the Burnham Creek subwatershed (west of State Highway 102) and in portions of the Lower Red Lake River subwatershed west of State Highway 32
   - Implement agricultural BMPs and land use changes in the eastern portion of the watershed and along the upper reaches of the Red Lake River
   - Stabilize the stream bed and banks on Heartsville Coulee and Burnham Creek, particularly in the lower reaches of these waterways where ditch outlets have accelerated erosion and deposition
4. Protect and enhance existing grassland habitats such as CRP
   - Protect existing tracts of prairie
   - Retain or increase CRP acres in those areas that already have considerable amounts of CRP
   - See MnDNR land management plan for some good targets and strategies

- Active vegetation management
- Maintain prairie chicken population

5. Wetland protection and enhancement
   - East of U.S. Highway 75 (complexes)
6. Protect existing high quality natural resource features
   - Beach ridge and inter-beach ridge areas
   - Protect existing tracts of prairie (e.g., Malberg Prairie)
   - Protect existing wetland complexes
   - Natural watercourses
7. Improve water quality
8. Increase recreational opportunities
   - See Red Lake River Corridor project
   - See Glacial Ridge plan

### 7.2.6 Water Quantity Implementation Plan

Due to terrain, draining of wetlands for cropland and/or under-designed structures, the Lower Red Lake River subwatershed experiences frequent flooding throughout the subwatershed. Spring flooding is almost an annual occurrence in this watershed. Damages associated with this type of flood are to public infrastructure, personal property, cropland and public resources (fisheries, wildlife, soils and water quality). Agricultural flooding and damages in the City of Crookston were identified as the highest priority flooding issues. In addition to projects shown in Figure 23, it is the RLWD's goal to address the following top priority issues within the Lower Red Lake River subwatershed:

#### *7.2.6.1 Lower Red Lake River FDR Rankings*

- Agricultural crop damages
- Residential flooding in the North East part of Crookston
- Bank sloughing in Crookston and Red Lake Falls
- Judicial Ditch 60 and lateral 4 of Judicial Ditch 60 flooding

- Overland flooding near Red Lake County Ditch 13
- Inadequate east-west ditches in the western half of the Lower Red Lake River subwatershed

#### *7.2.6.2 FDR Action Items*

1. The RLWD will pursue projects to create additional flood storage within the eastern portions of this subwatershed to reduce agricultural and residential flooding.
2. The RLWD will pursue projects that reduce bank erosion and still provide agricultural drainage.
3. The RLWD will respond to petitions and other requests for the ditches that are actively managed by the RLWD. The RLWD will seek partnerships with the County and private landowners to improve the overall coordination and management of the public and private ditch system.
4. The RLWD will partner with local, state and federal agencies to implement 5,000 ac-ft of flood volume reduction projects within this subwatershed.

Table 14 provides a summary list of specific implementation actions recommended by the TAC/CAC for the subwatershed.

### 7.2.7 Water Quality Implementation Plan

There are two impaired stream reaches as identified by the MPCA in this subwatershed as of 2004. They include:

- Red Lake River, Burnham Creek to Unnamed Creek (near East Grand Forks)
- Red Lake River, Unnamed Creek to Red River

Water quality monitoring has been done by the RLWD at six sites associated with streams within the subwatershed. Monitoring has been done since as early as 1984 for several parameters, including field measurements for dissolved oxygen, pH, temperature, turbidity, transparency and conductivity. Laboratory analysis is performed on stream samples for fecal coliform, TSS, total dissolved solids, chemical oxygen demand, total phosphorus, orthophosphorus, nitrates and nitrites, ammonia, total Kjeldahl nitrogen, alkalinity, dissolved oxygen, pH, temperature, turbidity, transparency, alkalinity and conductivity. The RLWD periodically prepares a water quality report and results are available upon request in the RLWD office.

The MPCA has identified the Lower Red Lake River as an impaired water body due to high levels of turbidity. The watershed will continue to assess the problem and the data available for

the next 303D assessment will likely extend the impairment upstream through Crookston. It is the RLWD's goal to address the following issues with the Lower Red Lake River subwatershed:

#### *7.2.7.1 Lower Red Lake River Water Quality Rankings*

- Turbidity and 303D impairment.
- Source water protection (East Grand Forks).

#### *7.2.7.2 Water Quality Action Items*

1. The RLWD will actively partner with the USDA NRCS, USACE, MPCA and the SWCDs to seek to implement projects that reduce agricultural and bank erosion and improve water quality.
2. The RLWD will support the efforts of municipalities to identify and protect recharge areas and to improve surface water quality.

Table 14 provides a summary list of specific implementation actions for the subwatershed.

### 7.2.8 Erosion and Sedimentation Implementation Plan

Erosion due to storm runoff and wind is another serious problem in the subwatershed. During periods of high runoff, channel erosion causes bank stabilization concerns for this subwatershed. The severity depends on the land cover, duration and volume of water. Erosion is often worse in the spring due to the lack of vegetative cover on the fields. Additionally, wind erosion is of concern in this area; however, it is dependent on conditions. It is the RLWD's goal to address the following issues with the Lower Red Lake River subwatershed:

#### *7.2.8.1 Lower Red Lake River Erosion and Sedimentation Rankings*

- Tributary bank instability at the outlets into the river.
- Erosion on Judicial Ditch 60 south of CR 11.
- Bank sloughing in Crookston and Red Lake Falls.
- Erosion on the last mile of Polk County Ditch 1 west of Crookston.
- Ditches outletting into natural streams and contributing sediment.

#### *7.2.8.2 Erosion and Sedimentation Action Items*

1. The RLWD will seek partnerships with landowners, SWCD and USDA NRCS to implement BMPs that reduce agricultural erosion and slow water down. Landowners will be discouraged from farming in ditches.
2. The RLWD will seek out grant opportunities to conduct an erosion assessment on the entire course of the Red Lake River from the Red Lake outlet on the reservation to the Red River.

Table 14 provides a summary list of specific implementation actions for the subwatershed.

### 7.2.9 Summary and Conclusions

This section of the overall watershed management plan presents an overview of the Upper and Lower Red Lake subwatershed. Goals and objectives for the subwatershed are presented above for the following plan elements: 1) Natural Resources, 2) Water Quantity, 3) Water Quality and 4) Erosion and Sedimentation. Table 14 provides a summary list of specific implementation actions organized by these same plan elements.

**Table 14**
**Lower Red Lake River Subwatershed Implementation Actions**

| Action/Goal | Plan Element | Schedule | Conceptual Cost |
|---|---|---|---|
| Improve existing riverine habitat conditions | Natural Resource Action Item | Ongoing | $30,000 |
| Re-establish habitat corridors | Natural Resource Action Item | Ongoing | $20,000 |
| Reduce erosion and sedimentation in watercourses | Natural Resource Action Item | Years 1-5 | $100,000 |
| Create additional flood storage within eastern portions of subwatershed to reduce agricultural and residential flooding | Water Quantity Action Item | Years 1-5 | $5,000,000 |
| Respond to petitions and other requests for the ditches actively managed by RLWD. Seek partnerships with County and private landowners to improve the overall coordination and management of the public and private ditch systems | Water Quantity Action Item | Ongoing | $100,000 |
| Partner with the USDA NRCS, USACE, MPCA and SWCDs to implement projects that reduce agricultural and bank erosion and improve water quality | Water Quality Action Item | Years 1-5 | $100,000 |
| Partner with the USDA NRCS, USACE, MPCA and SWCDs to implement projects that reduce agricultural and bank erosion and slow water down | Erosion and Sedimentation Action Item | Years 1-5 | $100,000 |
| Seek grant opportunities to conduct erosion assessment on the entire course of the Red Lake River from Red Lake outlet on the reservation to the Red River | Erosion and Sedimentation Action Item | Years 5-10 | $25,000 |

## 7.3 THIEF RIVER SUBWATERSHED PLAN

### 7.3.1 Introduction

This section presents the implementation plan for the Thief River subwatershed (Figure 28). The plan is organized by first presenting a summary of important physical characteristics of the Thief River subwatershed. More detailed information on the subwatershed is available in Sections 2.0-5.0 and in Appendix 7. The section also identifies the problems related to water management in the subwatershed and describes proposed solutions in the form of goals and objectives to address those problems.

The Thief River planning watershed includes the Moose River, Mud River and Thief River minor subwatersheds (Figure 28). Public lands in the eastern and western portion are dominant natural resource features in this subwatershed. The central portion of this subwatershed is primarily private lands used for agriculture. All these lands provide a large area of diverse habitats. Public lands include state wildlife management areas and acres of state forest

lands (Table 15). Prominent public land resource features include: Thief Lake WMA (7,000-acre basin, +WMA), Moose River Impoundment, the Randen Ridge area, Agassiz NWR and Elm Lake WMA.

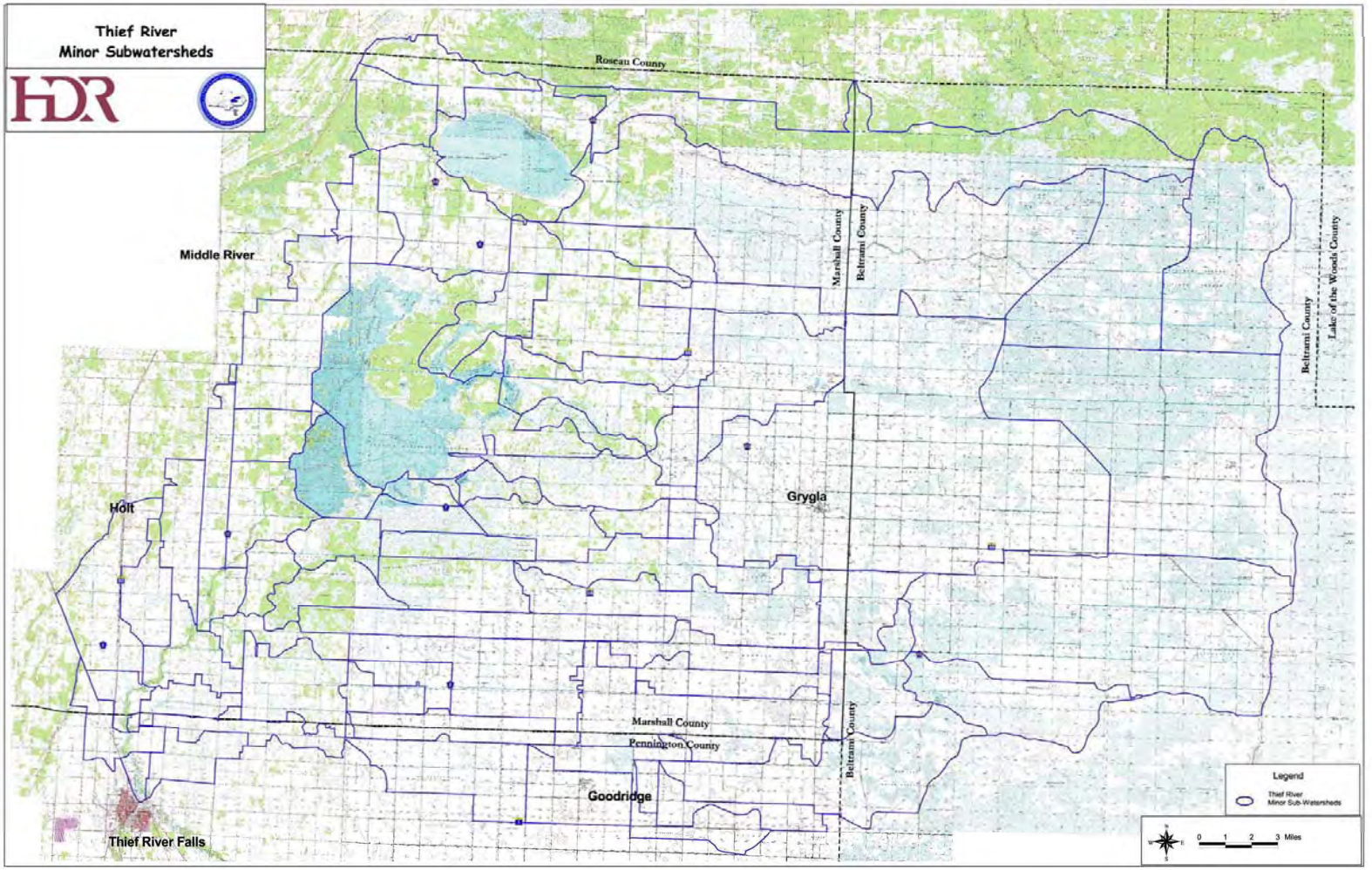
Quality habitats in this subwatershed primarily include forestlands, brushlands and wetlands (Figure 29). Type 6 and 7 wetlands are particularly abundant. Grasslands are of relatively less importance compared to some other planning basins. These habitats provide seasonal and permanent homes to a variety of species including game species such as white-tailed deer, moose, bear, waterfowl and sharp-tail grouse. Some areas provide important winter habitat for deer and migratory and breeding habitat for waterfowl and other birds (e.g., Thief Lake WMA, Agassiz NWR). One of Minnesota's two elk herds is also found in this subwatershed. Prime sharp-tail habitat is located near Grygla extending about 6 miles to the east and 10 to 15 miles west of Beltrami/Marshall county line. CRP lands, common throughout the central portion of the subwatershed, provide some quality habitats and also provide a habitat connection between public lands to the east and west. These lands are of particular importance because they contain a mix of relatively undisturbed areas of grassland, brushland and wetland. East and west of this area the habitat becomes more wooded or wet and less desirable for sharp-tail.

The Moose River, Thief River and Mud River are the primary waterways in this subwatershed. Portions of all of these rivers have been channelized. Dams at impoundment outlets and other impassable areas (e.g., culverts) fragment these stream systems. A network of drainage systems and a few natural waterways are tributaries to these waterways. The hydrology of these waterways has also been modified due to land use changes (flashy flows extended periods of low flow). All these changes have greatly reduced the potential of these waterways to support quality fish populations. The Thief River does provide some quality habitat for some species.

### 7.3.2 General Physical Characteristics

The Thief River subwatershed consists of an approximately 1,068 square mile area. The watershed outlets into the Red Lake River in Thief River Falls. The watershed is located mostly within the Lake Agassiz ecoregion with the extreme northeastern and southeastern areas fringing on the Northern Minnesota Peatlands ecoregion. Soil textures range from fine-loamy in the west to coarse-loamy in the east, with a strip of sandy soils along the northern boundary of the watershed. The area consists of a mix of agricultural lands, forest lands and wetlands, with very little grasslands, lakes or developed urban land (Table 15). The following presents a general summary of surface water and groundwater characteristics in the subwatershed. The summary is followed by a discussion of the problems, goals and policies and implementation actions for each of the four plan elements: 1) Natural Resources, 2) Water Quantity, 3) Water Quality and 4) Erosion and Sedimentation.

**Figure 28**
**Thief River Subwatershed Map**



### 7.3.3 Surface Water Summary

The Thief River subwatershed is also comprised of two smaller subwatersheds which outlet into the Thief River. They are the Moose River and Mud River/Agassiz subwatersheds. The Thief River subwatershed is the northernmost reach of the RLWD. All of the drainage from within the smaller subwatersheds flows into the Thief River and eventually outlets into the Red Lake River at Thief River Falls.

There are seven named lakes in the Thief River subwatershed. Major lakes for limited-use recreation include Thief Lake and Mud Lake/Agassiz. All lakes within this watershed typically support only waterfowl as they are too shallow to support a recreational fishery. Shoreline is typically undeveloped on the lakes.

Wetland areas are scattered throughout the area. These wetland areas are somewhat denser in the eastern portion of the subwatershed, especially east of the Beltrami county line. Many of the wetlands in the western portion of this watershed have been altered by farm drainage for agricultural production. Remaining wetlands in the eastern portion have been estimated to be 2-43 percent of pre-settlement extent.

Drainage systems in this subwatershed are a complex network of natural streams and legal ditch systems developed for agriculture. Generally, the ditch systems are under the administration of the county in which they reside or of the watershed district. Notable existing water management projects within this watershed include Thief Lake, Agassiz NWR, Elm Lake, Lost River Pool and the Moose River Impoundment, which collectively can store up to 138,000 acre feet of water.

**Table 15**
**Thief River Subwatershed Characteristics**

| CHARACTERISTIC | AREA |
|---|---|
| Basin Area (sq mi.) | 1,068 |
| Basin Area (acres) | 683,408 |
| Wetland Area NWI (acres) | 349,665 |
| **MINNESOTA WETLAND TYPE** | |
| 1 | 3,450 |
| 2 | 79,077 |
| 3 | 37,816 |
| 4 | 5,218 |
| 5 | 9,563 |
| 6 | 106,567 |
| 7 | 93,398 |
| 8 | 14,574 |
| Lakes/Rivers (acres) | 10,133 |
| **ECOREGIONS OF RLWD (ACRES)** | |
| Lake Agassiz, Aspen Parklands | 513,680 |
| Minnesota & NE Iowa Morainal | - |
| N. Minnesota & Ontario Peatlands | 169,728 |
| N. Minnesota Drift & Lake Plains | - |
| Red River Valley | - |
| **LAND USE (ACRES)** | |
| Cultivated Land | 294,904 |
| Forest Land | 185,103 |
| Grass/Brushland | 60,241 |
| Mines | 185 |
| Water | 11,515 |
| Developed Land | 813 |
| Wetlands | 130,599 |
| Other | 50 |

*(Sources: EIS, Soil Survey, GIS information, reports, studies)*

### 7.3.4 Groundwater Summary

The subwatershed is located in the Lake-Washed Till Plain physiographic area of the RLWD. The surficial geology of the area is dominated by the lake-washed till. The till is described as a sandy, clay-silt loam containing fine to medium gravel with a scattering of boulders. The till is covered in areas by a very-fine to fine-grained, uniform glacial lake sand generally less than 20 feet in thickness. Throughout the subwatershed, the till is overlain by a thin covering of peat (only a few feet thick) that results from the water table being close to or at land surface, paired with poor drainage in the area. Localized peat deposits are also present in many closed depressions within the till.

Glacial sediment aquifers in the region provide very moderate amounts of groundwater. Suitable yields of 5 gpm, or more for domestic use, can be found in sand lenses within the till. These lenses are often localized, and yields can vary. The aquifer may accommodate municipal or industrial uses, possibly up to 250 gpm in some rare instances. Hardness of the groundwater is commonly greater than 180 mg/l.

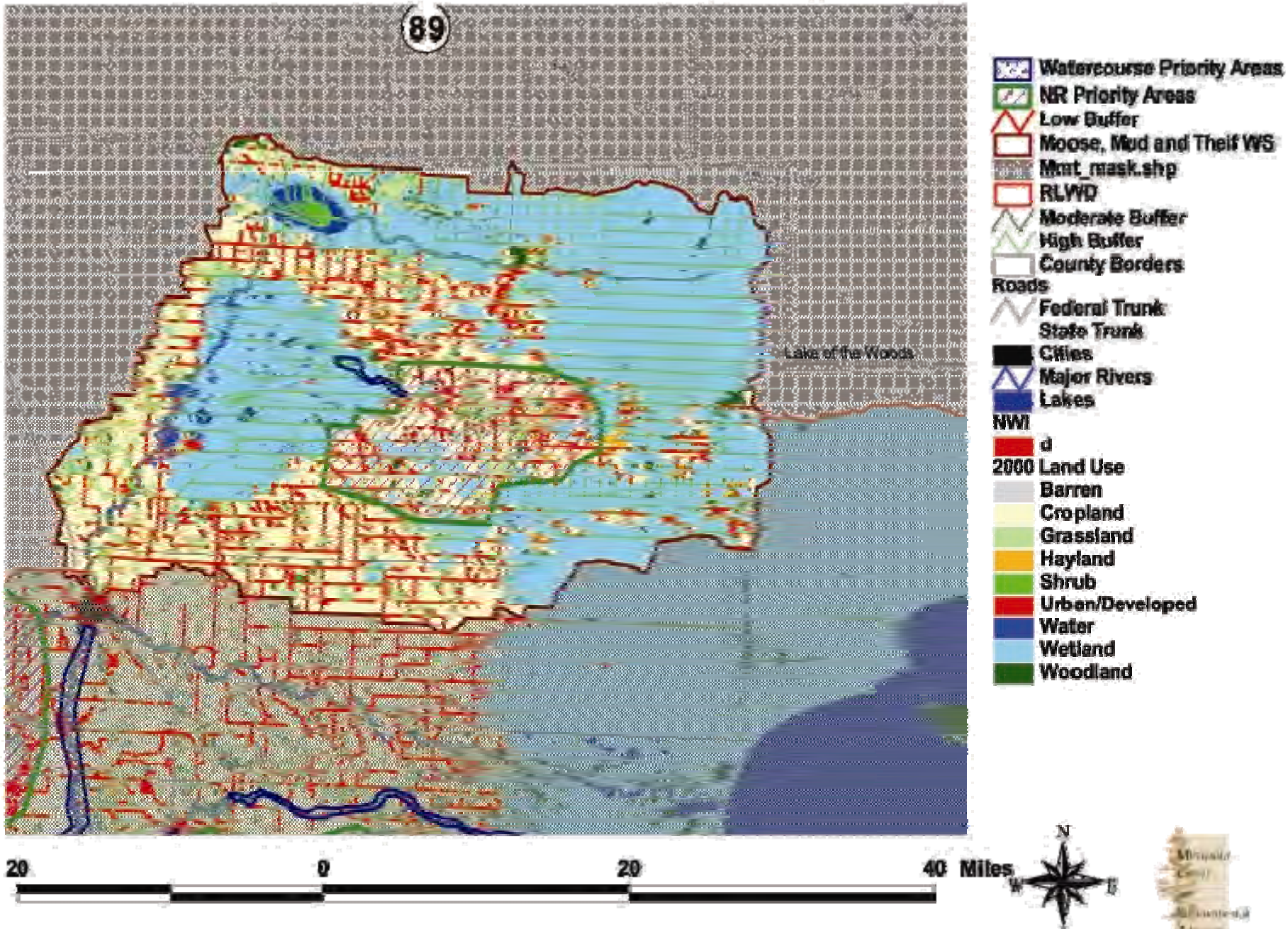
Paleozoic sediments consisting of shales and limestones are discontinuous and underlie the glacial lake deposits along the western side of the subwatershed. Precambrian crystalline rocks underlie the glacial sediments, forming the base of the groundwater reservoir for most of the watershed. The fractured surface of crystalline rocks may provide an adequate supply of groundwater for limited domestic use.

### 7.3.5 Natural Resources Implementation Plan

The Thief River was identified as an important resource within the region that needs to be recognized and protected. Recreational activities including hunting, fishing, tubing, swimming etc. were all identified as being popular activities. The following are the major goals and actions recommended by the Natural Resources Subcommittee. Figure 29 shows the Thief River Priority Natural Resource Areas.

Natural resource problems and issues were identified using a questionnaire with resource agencies. Results of this questionnaire and the resource inventory were considered by a Natural Resources Subcommittee. The following are the major goals and actions recommended by the Natural Resources Subcommittee.

**Figure 29**
**Thief River Priority Natural Resource Areas**



#### *7.3.5.1 Improve Fish Habitat in the Mud, Moose and Thief Rivers and their Tributaries*

- Support activities that reduce the flashiness and enhance base flows
- Stabilize stream banks in areas of accelerated erosion
- Rehabilitate the Mud River at the eastern edge of Agassiz and in the Eckvoll WMA where it is a ditch
- Reduce sediment load in streams
- Buffer all watercourses
- Active erosion has been of particular concern on the Moose River in Sections 1-6 of Northwood Township and Sections 1-12 of Whiteford Township (between MC 54 and bridge on Moose River Road). These areas are listed as local priority areas for the Environmental Quality Incentives Program funding
- Active erosion also south of the outlet of the Moose River impoundment (Sprucegrove Township)
- Reduce continual sloughing on ditch 20 and erosion on laterals
- Large deltas are forming on the east end of Thief Lake and in Agassiz NWR. This sediment has been contributed from the lands in the watershed above the lake
- Implement agricultural BMPs to reduce wind and water erosion throughout the subwatershed
- Other strategies include improved ditches with side inlets, buffer and grassed waterways, residue management, tree plantings, reduce farming into road ditches

#### *7.3.5.2 Maintain and Improve Wildlife Habitat (indicators could be land base statistics or sharp-tail population levels)*

- Re-establish habitat corridors along all major waterways
- Identify key areas and connect existing habitats along the corridors by promoting land use changes
- Where practical, create habitat corridors along some of the major east/west ditch systems such as ditch 20 and 200
- Connect existing corridor woodland habitats
- Protect and enhance existing brushland habitats
- Protect existing tracts of brushlands

- Manage vegetation actively to maintain brushlands and diversity
- Retain or increase CRP acres in those areas that already have considerable amounts of CRP
- Protect existing grassland habitats
- Encourage active vegetation management that maintains grassland quality (prescribed burning, weed control, etc)
- Target CRP to increase number of large blocks of grassland habitats
- Protect existing wetland habitats
- Support efforts to retain WRP acres
- Support WCA enforcement
- Enhance existing wetland habitats
- Target wetland restorations
- Encourage active vegetation management that maintains wetland quality (moist soil management, prescribed burning, weed control, etc)
- Reduce flows or change timing into Agassiz and Thief Lake to help optimize management of these waters for wildlife production and recreation
- Work with USFWS and MnDNR to identify concerns and develop potential strategies
- Reduce flows or change timing at Moose River to actively control vegetation within the impoundment

#### *7.3.5.3 Increase Recreational Opportunities*

- Partner with other groups to highlight existing opportunities
- Wildlife viewing/birding, hunting, trails

Due to terrain, draining of wetlands for cropland and/or under-designed structures, the Thief River subwatershed experiences frequent flooding throughout the subwatershed. Spring flooding is almost an annual occurrence in this watershed. Damages associated with this type of flood are to public infrastructure, personal property, cropland and public resources (fisheries, wildlife, soils and water quality). Agricultural flooding and damages in the City of Goodridge were identified as the highest priority flooding issues. In addition to projects shown in Figure 23, it is the RLWD's goal to address the following issues within the Thief River subwatershed:

#### *7.3.5.4 Thief River FDR Rankings*

- Agricultural crop damages.
- Overland flooding in Goodridge.
- Farmstead flooding.
- Flooding along ditch 20 and 200.

**FDR Action Items**

1. The RLWD, in partnership with local, state and federal agencies, will pursue projects to create an additional 10,000 ac-ft of flood volume reduction within the eastern portions of this subwatershed to reduce agricultural and residential flooding. Storage projects must carefully consider water management, timing of releases and adequacy of downstream outlets.
2. The RLWD will pursue projects that reduce bank erosion and still provide agricultural drainage.
3. The RLWD will respond to petitions and other requests for the ditches that are actively managed by the RLWD. The petitions will be evaluated thoroughly with respect to FDR principles, natural resource affects and upstream and downstream impacts. The RLWD will seek partnerships with the county and private landowners to improve the overall coordination and management of the public and private ditch systems. Ditches will be re-sloped, closed or abandoned, if petitioned for, and identified as appropriate considering all factors.
4. The RLWD will continue to actively promote the farmstead ringdike program.

### 7.3.6 Objectives and Conceptual Plan

In addition to the activities identified by the planning process, the RLWD formed a special team to look at this subwatershed. The Thief River Project Work Team was formed in March 1999 to address the flooding problems in the Thief River sub-basin in accordance with the provisions of the Red River Basin FDRWG's December 1998 Mediation Agreement. Although the Thief River Project Work Team's scope encompassed the entire Thief River sub-basin, one key focal point was the RLWD's efforts to resolve a conflict between:

- The desire of landowners along the State Ditch (SD) 83 portion of the Thief River to have State Ditch 83 repaired for FDR purposes and
- The interest of other natural resource-related agencies (e.g., MPCA) and special interest groups (e.g., Audubon Society) in finding environmentally-friendly alternatives to the proposed State Ditch 83 clean-out.

Therefore, the Thief River Project Work Team attempted to develop a sub-basin-wide conceptual framework that would meet or exceed the FDR performance of the proposed State Ditch 83 clean out, in a manner compatible with the broad FDR and NRE goals of the Mediation Agreement. Those FDR goals include natural resources enhancements, protection against a 100-year flood for urban areas (specifically the City of Thief River Falls) and protection against a 10-year summer storm event for intensively farmed rural areas.

#### *7.3.6.1 Conceptual Plan*

The Thief River Project Work Team 's conceptual plan includes four basic features:

- A diversion channel south from Elm Lake/Agassiz Natural Wildlife Refuge (NWR), routing around the east side of State Ditch 83's low-flow-capacity reach, and joining the Thief River four miles north of Thief River Falls. This diversion channel would be gated to keep flows in concert with downstream flow capacity. A wetland restoration project would be incorporated with the diversion feature along with timely drawdown of existing impoundments adding NRE aspects.
- Floodwater storage throughout the Thief River sub-basin. Particular attention would be paid to off-channel dry impoundments along C.D. 20. Releases would be timed to be compatible with downstream flow capacity. Storage sites, whether dry or wet, would provide NRE benefits to shorebirds, migratory waterfowl and native game and nongame species.
- Land use changes throughout the Thief River sub-basin. Incentives and education would be used to encourage land use changes intended to reduce the acreage of floodprone crops and to allow cropping in short-term storage sites. In some cases, alternate crops such as hybrid trees or wild rice would not only be flood tolerant, they would also increase evapotranspiration and, therefore, reduce runoff and storage requirements. In other cases, lands now in row crops might be retired or converted to pasture or natural grasslands. These land use changes would provide excellent habitat gains for resident wildlife. The relative cost effectiveness of ring levees, raising or relocations will have to be weighed in deciding the best solution for farmsteads and residences in floodprone areas.

- ❖ Spot cleaning of State Ditch 83 would be made where sedimentation or snags are major flow restrictions or deflect flows into riverbanks and cause serious erosion threats to roads, farmland or important ecosystem features, e.g., spawning areas or nesting cover and trees.

The above package of measures provides a balance of FDR and NRE benefits and the package is consistent with the Mediation Agreement.

Table 17 provides a summary list of specific implementation actions for the subwatershed.

### 7.3.7 Water Quality Implementation Plan

RLWD monitoring data has identified the Thief River as an impaired water body due to high levels of turbidity during high flows and low dissolved oxygen during periods of low flow. The watershed will continue to assess the problem and the data available for the next 303D assessment.

Water quality monitoring has been conducted by the RLWD at five sites associated with streams within the subwatershed. Monitoring has been done since as early as 1980 for several parameters, including field measurements for dissolved oxygen, pH, temperature, turbidity, transparency and conductivity. Laboratory analysis is performed on stream samples for fecal coliform, TSS, total dissolved solids, chemical oxygen demand, total phosphorus, orthophosphorus, nitrates and nitrites, ammonia, total Kjeldahl nitrogen and alkalinity. Major locations for sampling include the Hillyer Bridge and two sites on the Moose and Mud Rivers. Other organizations also complete monitoring in the subwatershed as described in Table 16.

The MPCA's 2005 assessment of the state's waters was the first assessment that used data from the RLWD's long-term monitoring program. This was the first year that any data was available to assess waters in the Thief River watershed. The 2006 Draft 303 (d) List of Impaired Waters (based upon the 2005 assessment) identifies several impaired reaches on the Thief and Moose Rivers. No impairments were found on the Mud River.

- ❖ Thief River from Agassiz Pool to the Red Lake River
  - – Impaired by low dissolved oxygen
  - – Impaired by high turbidity

- Thief River from Thief Lake to Agassiz Pool
  - Impaired by high un-ionized ammonia (This is a questionable impairment as it is based upon only two occasions where the standard was exceeded and the standard has not been exceeded for several years.)
  - There is enough exceedance rate in turbidity data (through 2005) to list this reach as being impaired by turbidity. However, it is not included on the Draft 303(d) List of Impaired Waters. The percent exceedance level is borderline and no exceedances of the state standard (25 NTU) have been recorded since 1997
- Moose River from Headwaters to Thief Lake
  - Impaired by low dissolved oxygen

**Table 16**
**Thief River Subwatershed Monitoring**

| | |
|---|---|
| **Watershed Name** | Thief River – Moose River – Mud River |
| **Impaired Waters** | Currently none – reach between Agassiz NWR and TRF most likely will be one |
| **Number of Stream Sampling Sites** | |
| **RLWD** | 5 |
| **SWCDs** | 8 |
| **River Watch** | 4 |
| **MPCA** | 1 |
| **Field Parameters** | dissolved oxygen, pH, water temperature, turbidity, transparency, conductivity |
| **Laboratory Parameters** | Total phosphorus, orthophosphorus, TSS, total dissolved solids, total Kjeldahl nitrogen, ammonia nitrogen, nitrates plus nitrates, fecal coliform and E. coli |
| **Earliest Sampling Data** | 1980 |
| **Key Sampling Locations** | Hillyer Bridge (USGS gauge GS-05-0760), Moose R. and Mud R. |
| **Other Notes** | The Hillyer Bridge monitoring site is also monitored by the MPCA. Noted problems with High TSS and Low Dissolved Oxygen between Agassiz and TRF |

It is the RLWD's goal to address the following issues with the Thief River subwatershed:

#### *7.3.7.1 Thief River Water Quality Rankings*

- Turbidity during high flows and low dissolved oxygen 303D impairments.

#### *7.3.7.2 Water Quality Action Items*

1. The RLWD will actively partner with the MnDNR, USFWS, USDA NRCS, USACE, MPCA, Marshall County Water Planner and the SWCDs to seek to implement projects that reduce agricultural and bank erosion and improve water quality.

Table 17 provides a summary list of specific implementation actions for the subwatershed.

### 7.3.8 Erosion and Sedimentation Implementation Plan

Erosion due to storm runoff is another serious problem in the subwatershed. During periods of high runoff, channel erosion causes bank stabilization concerns for this subwatershed. The severity depends on the land cover, duration and volume of water. Erosion is often worse in the spring due to the lack of vegetative cover on the fields. It is the RLWD's goal to address the following issues with the Thief River subwatershed:

#### *7.3.8.1 Thief River Erosion and Sedimentation Rankings*

- Tributary bank instability at the outlets into the river.
- Erosion on State Ditch 83.
- Channel and streambank erosion.
- Ditches outletting into natural streams and contributing sediment.

#### *7.3.8.2 Erosion and Sedimentation Action Items*

1. The RLWD will seek partnerships with landowners, SWCD and USDA NRCS to implement BMPs that reduce agricultural erosion and slow water down. Landowners will be discouraged from farming ditches.
2. The RLWD will seek out grant opportunities to conduct an erosion and water quality assessment on the entire course of the Thief River.

Table 17 provides a summary list of specific implementation actions for the subwatershed.

### 7.3.9 Summary and Conclusions

This section of the overall watershed management plan presents an overview of the Thief River subwatershed. Goals and objectives for the subwatershed are presented above for the following plan elements: 1) Natural Resources, 2) Water Quantity, 3) Water Quality and 4) Erosion and Sedimentation. Table 17 presents a summary list of specific implementation actions organized by these same plan elements.

**Table 17**
**Thief River Watershed Implementation Actions**

| ACTION/GOAL | PLAN ELEMENT | SCHEDULE | CONCEPTUAL COST |
|---|---|---|---|
| Create additional 10,000 acre-ft of flood volume reduction within eastern portion of subwatershed | Water Quantity Action Item | Years 1-5 | $10,000,000 |
| Reduce bank erosion and provide adequate agricultural drainage | Water Quantity Action Item | Ongoing | $20,000/yr |
| Promote farmstead ringdike program | Water Quantity Action Item | Ongoing | $50,000/yr |
| Partner with USDA NRCS, USACE, MPCA and SWCDs to reduce agricultural and bank erosion and improve water quality | Water Quality Action Item | Ongoing | $10,000/yr |
| Seek grant opportunities to conduct erosion and water quality assessment on the entire course of the Thief River | Erosion and Sedimentation Action Item | Years 1-3 | $15,000/yr |
| Improve fish habitat | Natural Resource Action Item | Ongoing | $10,000/yr |
| Install vegetative buffer strips | Natural Resource Action Item | Ongoing | $20,000 |

## 7.4 GRAND MARAIS

### 7.4.1 Introduction

The Grand Marais watershed is dominated by private lands in agricultural production and a series of ditches that drain into the Grand Marais Creek. The portion of this watershed west of U.S. Highway 75 is almost 100 percent agricultural land. West of U.S. Highway 75, narrow bands of natural lands are found along the Red River and along the Grand Marais Creek. East of U.S. Highway 75, there is a mix of grasslands and agricultural lands with some wetlands. Two WMAs in this area also provide some quality habitats; however, CRP lands provide the majority of grassland and wetland habitats. This area east of U.S. Highway 75 lies along the Campbell Beach Ridge.

Quality habitats in the western portion of this subwatershed are limited to the areas adjacent to Grand Marais Creek and the Red River. These habitats provide seasonal and permanent homes to a variety of species including game species such as white-tailed deer and waterfowl. Quality habitats in the eastern portion of the subwatershed include grasslands, wetlands and some brushlands. (Figure 31). These areas provide seasonal and permanent habitats to a variety of species including game species such as white-tailed deer, prairie chicken and sharp-tail grouse. The prairie chicken population has increased dramatically in recent years.

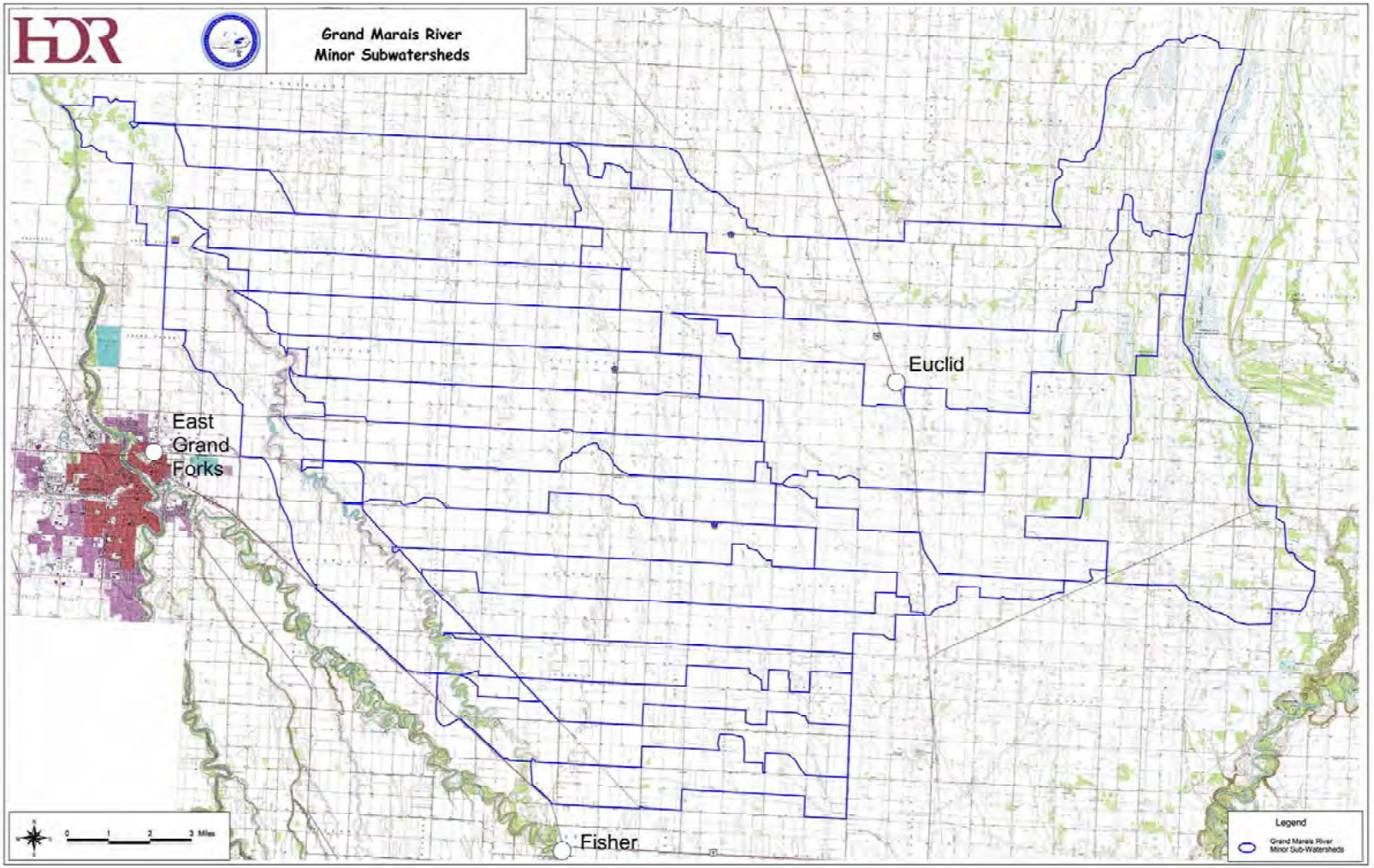
The Grand Marais Creek is the primary waterway in this subwatershed. The waterway provides limited seasonal habitat to a few fish species. The alignment of most of this creek has not been significantly changed but adjacent land use and its hydrology has significantly changed. Large drainage system ditches outlet directly into the Grand Marais at almost every mile and roads cross the waterway almost every mile. The natural outlet of the Grand Marais was bypassed and the waterway now flows straight west to the Red River. This outlet is unstable and has likely altered fish passage between the Red River and the Creek. The hydrology of this subwatershed has been modified due to drainage and land use changes (flashy flows extended periods of low flow). Historically, there is anecdotal evidence that the waterway and its corridor provided quality habitats for waterfowl nesting and production.

### 7.4.2 General Physical Characteristics

This section presents the implementation plan for the Grand Marais subwatershed (Figure 30). The plan is organized by first presenting a summary of important physical characteristics of the Grand Marais subwatershed. More detailed information on the subwatershed is available in Sections 2.0-5.0 and in Appendix 7. The section also identifies the problems related to water management in the subwatershed and describes the proposed solutions in the form of goals and objectives to address these problems.

The Grand Marais subwatershed consists of an approximately 317 square mile area. The watershed outlets into the Red River approximately nine miles north of East Grand Forks and begins just west of the Goose Lake Swamp area. The watershed is located mainly within the Red River Valley ecoregion with the extreme eastern potion entering the Glacial Lake Agassiz/Aspen Parklands ecoregion. Soil textures range from fine in the western two-thirds of the watershed to sandy-loam/fine-loam in the eastern third of the watershed. The area consists largely of agricultural land (94 percent), but is also made up forest, wetlands, urban and grassland. Elevations range from 1,000 mean sea level (msl) in the east to 800 feet msl along the Red River of the North (Table 18). The following presents a general summary of surface water and groundwater in the subwatershed. The summary is followed by a discussion of the problems, goals and policies and implementation actions for each of the four plan elements: 1) Natural Resources, 2) Water Quantity, 3) Water Quality and 4) Erosion and Sedimentation.

**Figure 30**
**Grand Marais Subwatershed Map**



### 7.4.3 Surface Waters Summary

The Grand Marais subwatershed is bordered along its north side by the Middle River Snake River Watershed District and by the Lower Red Lake River subwatershed on the south and east sides. There are 41 minor subwatersheds within the Grand Marais and each generally represents a legal ditch system. Overland flooding is common each spring.

There are no lakes in this subwatershed. Wetland areas are scattered throughout the area. These wetland areas are somewhat denser in the extreme eastern portion of the subwatershed, generally east of U.S. Highway 75. Many of the wetlands in this watershed have been altered by farm drainage, and many wetlands have been drained for the purposes of agricultural production, especially those in the western two-thirds of the subwatershed.

Drainage systems in this subwatershed are a complex network of legal ditch systems located at 1-2-mile intervals that drain east to west into natural streams. Generally, the ditch systems are under the administration of Polk County or the RLWD. One notable storage project within this watershed is the Parnell impoundment, which is capable of storing 3,600 ac-ft of water. Other impoundments include the Louisville –Parnell Impoundment and Flood Storage Easement Sites 1 and 2 (Figure 17).

The subwatershed is located in the Lake Plain physiographic area of the Red Lake River Watershed District. The surficial geology of the area consists of mainly clay with small regions of silt, sand, sand and gravel ridges and lake-washed till. Clay deposits dominate the Grand Marais Creek subwatershed and are characterized as being very dense, uniform and having low permeability. Thicknesses can range from a few feet in the eastern part of the watershed to more than 120 feet in the western portions. Nearly level topography in this region also relates to poor drainage. Sand and gravel ridges, known as beach ridges from Glacial Lake Agassiz, are located along the eastern portion of the subwatershed. They occur in mainly north-south trending ridges that range in thickness from a few feet to 30 feet in some areas. Drainage is good within the ridges, but can be poor in the inter-ridge areas where deposits of peat are evident. The fine sand or silt deposits in the area are fairly uniform and underlain by till and clay deposits. Thicknesses for both deposits are generally less than 20 feet. Lake-washed till deposits are described as sandy, clay-silt loam that contains fine to medium gravel with a scattering of boulders. The deposits are generally not well drained.

**Table 18**
**Land Use Characteristics of the Grand Marais Subwatershed**

| CHARACTERISTIC | AREA |
|---|---|
| Basin Area (sq mi.) | 317 |
| Basin Area (acres) | 202,663 |
| Wetland Area NWI (acres) | 3,236 |
| **MINNESOTA WETLAND TYPE** | |
| 1 | 264 |
| 2 | 1,173 |
| 3 | 1,121 |
| 4 | 22 |
| 5 | 37 |
| 6 | 194 |
| 7 | 424 |
| 8 | - |
| Lakes/Rivers (acres) | 1,947 |
| **ECOREGIONS OF RLWD (ACRES)** | |
| Lake Agassiz, Aspen Parklands | 44,472 |
| Minnesota & NE Iowa Morainal | - |
| N. Minnesota & Ontario Peatlands | - |
| N. Minnesota Drift & Lake Plains | - |
| Red River Valley | 165,553 |
| **LAND USE (ACRES)** | |
| Cultivated Land | 191,980 |
| Forest Land | 4,395 |
| Grass/Brushland | 3,163 |
| Mines | 58 |
| Water | 780 |
| Developed Land | 1,355 |
| Wetlands | 930 |
| Other | - |

### 7.4.4 Groundwater Summary

Glacial sediment aquifers in the region only provide moderate amounts of groundwater. Suitable yields of 5 gpm or more, for domestic use, are mainly found in sand lenses in the till or in beach ridge deposits. The extent of beach ridge deposits is limited, and sand lenses are often localized. Beach ridges are typically saturated in the lower few feet. Yields of more than 20 gpm can be obtained from the larger ridges, but supplies from the smaller ridges are unreliable and can dry up in late summer to fall. Groundwater supply for industrial use and irrigation is generally poor. Quantities and quality for such uses are inadequate. Hardness of the groundwater is commonly greater than 180 mg/l.

Paleozoic sediments consisting of shales and limestones are discontinuous and underlie the glacial sediments along the western side of the subwatershed. Precambrian crystalline rocks underlie glacial sediments in most of the watershed. The fractured surface of crystalline rocks may provide an adequate supply of groundwater for localized domestic use but are not a good commercial or municipal source of groundwater.

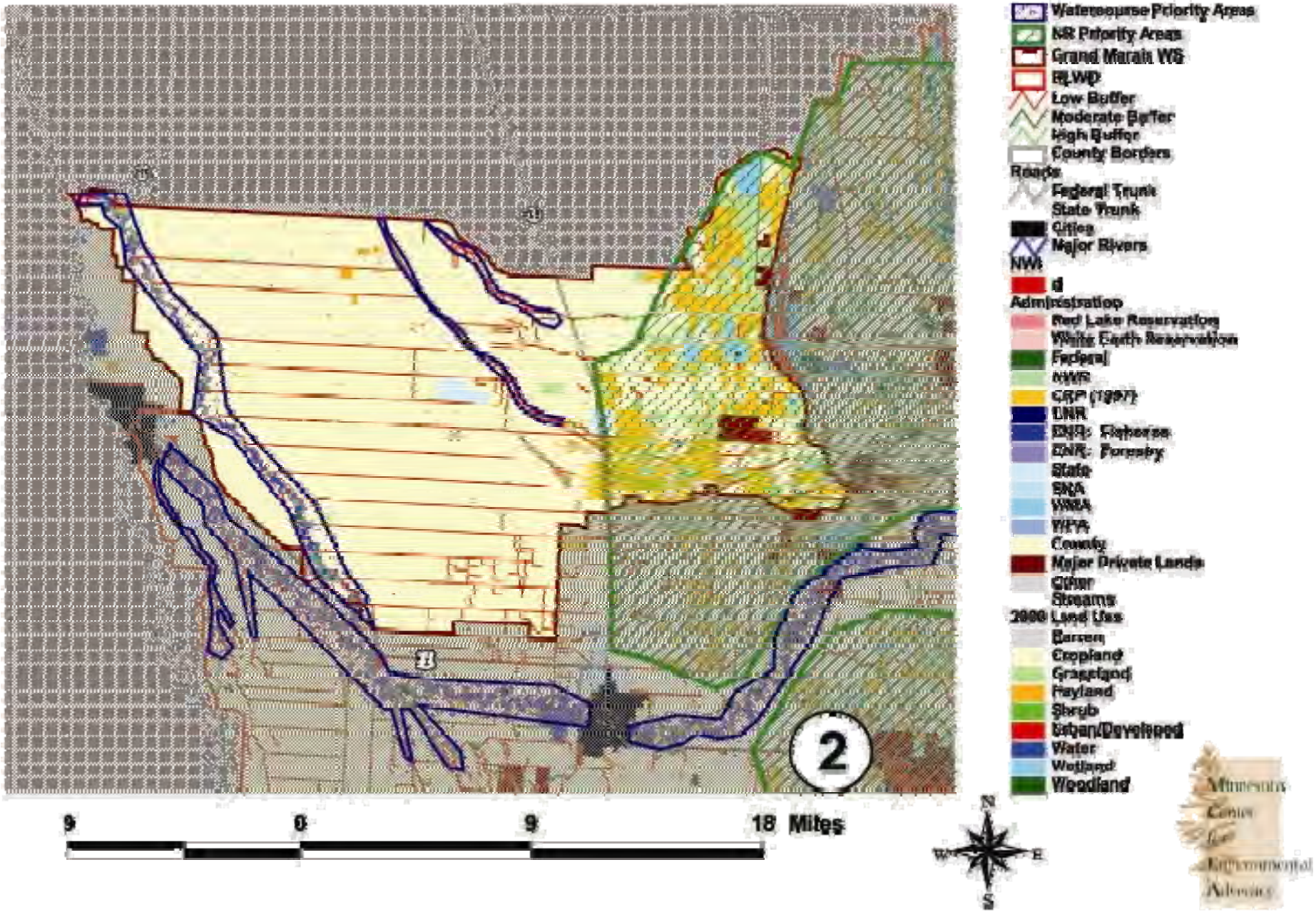
Information regarding the individual city wells, water quality analysis results and the aquifers that serve as the water supply can be obtained from the individual cities and the Minnesota Geological Survey.

### 7.4.5 Natural Resources Implementation Plan

The Grand Marais Creek subwatershed was identified as an important resource within the region that needs to be recognized and protected. Identified recreational activities were minimal due to highly intensive agriculture.

Natural Resources problems and issues were identified using a questionnaire with resource agencies. Results of this questionnaire and the natural resource inventory were considered by a Natural Resources Subcommittee. The Natural Resource Committee's recommendations were used by the RLWD to develop the following Natural Resource goals and objectives. Specific action items are presented in Table 20. The following are the major goals and actions recommended by the Natural Resources Subcommittee.

**Figure 31**
**Grand Marais Priority Natural Resource Areas**



#### *7.4.5.1 Improve Fish Habitat in the Grand Marais Creek and its Tributary Ditches*

- Implement activities that reduce the flashiness of the hydrograph
- Implement activities that enhance base flows
- Provide a stable outlet for the Grand Marais Creek
- Restore the natural outlet with the existing outlet improved and used as a high flow diversion
- Stabilize the existing outlet and provide for fish passage during most flow conditions
- Reduce sediment load in streams
- West of U.S. Highway 75, implement agricultural BMPs
- East of U.S. Highway 75, implement agricultural BMPs and land use changes. (Farm the west wisely and preserve the east). Strategies include improved ditches with side inlets, Polk County plan to buffer and grassed waterways, residue management, tree plantings, reduce farming into road ditches

#### *7.4.5.2 Maintain and Improve Wildlife Habitat*

- Re-establish a habitat corridor along Grand Marais Creek
- Re-establish the habitat corridor along the Red River
- Participate in Greenway along the Red project
- Maintain existing grassland and wetland areas east of U.S. Highway 75
- Support continuation of CRP, WRP and other programs
- Partner with SWCDs and USDA NRCS to target areas
- Identify and protect existing tracts of native prairie
- See MnDNR land management plan for some good targets and strategies
- Increase the number and size of grassland areas east of U.S. Highway 75
- Encourage active vegetation management that maintains grassland quality (prescribed burning, weed control, etc)
- Create managed impoundments for migratory bird habitat

#### *7.4.5.3 Provide Recreational Opportunities*

- Partner to highlight existing opportunities
- Wildlife viewing/birding, hunting, fishing

### 7.4.6 Water Quantity Implementation Plan

Due to terrain, draining of wetlands for cropland and/or under-designed structures, the Grand Marais subwatershed experiences frequent flooding throughout the subwatershed. Spring flooding is almost an annual occurrence in this watershed. Damages associated with this type of flood are to public infrastructure, personal property, cropland and public resources (fisheries, wildlife, soils and water quality). Agricultural flooding and damages in the City of Euclid were identified as the highest priority flooding issues. In addition to projects shown in Figure 23, it is the RLWD's goal to address the following issues within the Grand Marais subwatershed:

#### *7.4.6.1 Grand Marais Flood Damage Reduction Rankings*

- Grand Marais Flood Damage Reduction Project – Project 60
- Overall flooding section by section
- Flooding along County Ditch 2, County Ditch 66, County Ditch 126, Judicial Ditch 60, County Ditch 39 and County Ditch 25.
- Residential flooding.
- Flooding of infrastructure and roads.

#### *7.4.6.2 FDR Action Items*

1. The RLWD will also pursue projects to add buffers, farmland dikes and other restoration types of projects to slow down the delivery of water and lengthen the hydrographs to reduce flooding.
2. The RLWD will pursue projects that reduce bank erosion and still provide adequate agricultural drainage.
3. The RLWD will respond to petitions and other requests for the ditches that are actively managed by the RLWD. The RLWD will seek partnerships with the county and private landowners to improve the overall coordination and management of the public and private ditch system.
4. The RLWD's runoff volume reduction goal for the Grand Marais subwatershed is 5,000 acre-ft.

#### *7.4.6.3 Grand Marais Creek Flood Reduction Project (Project 60)*

In addition to the priorities established by the TAC/CAC, the RLWD has been actively pursuing the implementation of an FDR project within this subwatershed. This project is one of two identified in the Red River Valley. The Grand Marais Creek Flood Reduction Project builds off the flood damage efforts that are an outgrowth of a mediation agreement reached between the state and local governments in the Red River Valley. Selection of this project acknowledges that Governor Pawlenty's administration has placed a priority on FDR efforts. The project won't involve the state forcing or directing new regulations or efforts on locals. Instead, the state will work in concert with local governments and private partners.

The project costs are expected to be $5.2 million for the Brand and Euclid East impoundments, $2.6 million for ditch improvements (funded through local levies) and $2.2 million for the channel reconstruction project with USACE and other funding sources to be determined. Construction of the impoundments is scheduled to begin in 2006 (Figure 30).

**Project area:** The project area is located east of East Grand Forks, north of Crookston, south of Warren and west of Thief River Falls. Covering 300 square miles, the area has some of the most fertile farmland in the Red River Valley, yet is often flooded.

A system of ditches running east to west was constructed every mile around the early 1900s to settle and farm the area. Most of these ditches are undersized for their respective drainage areas and the farmland that was opened up over the last century. A typical ditch draining into the Grand Marais Creek has the capacity to handle runoff from a 1-2 year frequency event (2 inches in 24 hours). Because of the low capacity, flooding and crop losses occur on an almost annual basis.

#### *7.4.6.4 Project objectives and benefits:*

- Enhance fish and wildlife habitat through the implementation of 1,000 acres of wetland and prairie restorations.
- Protect more than 40 square miles of flood-prone farmland in the Polk County Ditch 2 drainage area, as well as roads and structures, from a 10-year frequency storm event (3.5 inches in 24 hours) through the development of 6,000 ac-ft of flood storage with the construction of the Brandt Impoundment, Euclid East Impoundment and ditch improvements.
- Improve the capacity of County Ditch 2 and County Ditch 66 (21 miles of public ditches) to a 5-year frequency storm event capacity (3 inches in 24 hours).

- ❖ Prevent erosion damages to land, reduce turbidity downstream and increase fish and wildlife habitat by reconstructing/restoring six miles of channel and the County Ditch 2 outlet that flows into the Grand Marais Creek.
- ❖ Reduce sediment loading by 20 percent from County Ditch 2 and County Ditch 66 through the installation of buffer strips and the implementation of agricultural BMPs over 50 percent of County Ditch 2, County Ditch 66 and Brand Channel drainage areas.

### 7.4.7 Water Quality Implementation Plan

RLWD monitoring data has found that the Grand Marais Creek has high levels of turbidity, total suspended solids TSS, nitrates and nitrites and low levels of dissolved oxygen. Officially, the MPCA's Draft 2006 303(d) List of Impaired Waters lists the Grand Marais Creek as being impaired by high turbidity and low dissolved oxygen from the headwaters to County Ditch 2 based upon RLWD monitoring data. This list also identifies a turbidity impairment from County Ditch 2 to the Red River that is based upon Red River Basin Monitoring Network (RRBMN) data.

Water quality monitoring has been done by the RLWD at one site associated with streams within the subwatershed, on the Grand Marais Creek at State Highway 220. Monitoring has been done since 1985 for several parameters, including field measurements for dissolved oxygen, pH, temperature, turbidity, transparency and conductivity. Laboratory analysis is performed on stream samples for fecal coliform, TSS, total dissolved solids, chemical oxygen demand, total phosphorus, orthophosphorus, nitrates and nitrites, ammonia, total Kjeldahl nitrogen, alkalinity, dissolved oxygen, pH, temperature, turbidity, transparency, alkalinity and conductivity. Additional monitoring sites are operated by the MPCA and River Watch (Table 19).

Site 826 is the current RLWD long-term monitoring site on Grand Marais Creek, a tributary of the Red River of the North. The site is located at the State Highway 220 crossing. There is a primary monitoring site for the RRBMN located downstream of Site 826 that is monitored by the MPCA.

Water quality is very poor in Grand Marais Creek. In fact, it is normally one of the worst water quality sites within the RLWD. This muddy-looking river frequently has high conductivity, high total dissolved solids, high TSS and low dissolved oxygen readings. A predominately agricultural watershed and highly modified hydrology have had an adverse impact on water quality in the river. The altered hydrology consists of a high concentration of drainage ditches entering the river from the east and an actively eroding ditch downstream of Site 826 that diverts

water from Grand Marais Creek's natural ditch. Although there are farming operations within the watershed that maintain windbreaks, buffers and other BMPs to minimize erosion, there are many that do not. This is highly evident in the winter when fields are barren and the ditches next to fields without windbreaks are filled with soil from wind erosion while fields with windbreaks, cover crops or crop residue have little erosion. The high turbidity and low transparency of the water prevents the passage of light, so vegetation next to the river is killed whenever the river rises over its banks.

**Table 19**
**Grand Marais Water Quality Monitoring Sites Summary**

| | |
|---|---|
| **Watershed Name** | Grand Marais |
| **Impaired Waters** | Currently none, but the Grand Marais is likely to be on the next impaired waters list |
| **Number of Stream Sampling Sites** | |
| **RLWD** | 1 |
| **SWCDs** | 0 |
| **River Watch** | 3 |
| **MPCA** | 1 |
| **Field Parameters** | dissolved oxygen, pH, water temperature, turbidity, transparency, conductivity |
| **Laboratory Parameters** | Total phosphorus, orthophosphorus, TSS, total dissolved solids, total Kjeldahl nitrogen, ammonia nitrogen, nitrates plus nitrates, fecal coliform and E. coli |
| **Earliest Sampling Data** | 1985 |
| **Key Sampling Locations** | Grand Marais Creek at State Highway 220 |
| **Other Notes** | The MPCA monitors at the last road crossing before the Grand Marais. Some of the ditches flowing into the Grand Marais and the Grand Marais itself. Very high turbidity and TSS levels, low dissolved oxygen as well. |

#### *7.4.7.1 Grand Marais Water Quality Rankings*

- Turbidity, low dissolved oxygen and 303D impairments.

#### *7.4.7.2 Water Quality Action Items*

1. The RLWD will actively partner with the USDA NRCS, USACE, MPCA and the SWCDs to seek to implement projects that reduce agricultural and bank erosion and improve water quality.
2. The RLWD will support the efforts of municipalities to identify and protect recharge areas and to improve surface water quality.
3. The RLWD will actively promote the sharing of data amongst the RLWD, RRWMB, MPCA and River Watch to improve water quality and project funding.

Table 20 provides a summary list of specific information actions for the subwatershed.

### 7.4.8 Erosion and Sedimentation

Erosion due to storm runoff and wind is another serious problem in the subwatershed. During periods of high runoff, channel erosion causes bank stabilization concerns for this subwatershed. The severity depends on the land cover, duration and volume of water. Erosion is often worse in the spring due to the lack of vegetative cover on the fields. Additionally, wind erosion is of concern in this area, especially during the winter. It is the RLWD's goal to address the following top priority issues with the Grand Marais subwatershed:

#### *7.4.8.1 Grand Marais Erosion and Sedimentation Rankings*

- Bank failures on County Ditch 2
- Wind and water erosion
- Loss of windbreaks
- Conservation tillage
- Extreme erosion in the ditched portion where the river is diverted directly into the Red River

#### *7.4.8.2 Erosion and Sedimentation Action Items*

1. The RLWD will seek partnerships with landowners, SWCD and USDA NRCS to implement BMPs that reduce agricultural erosion and slow water down.
2. The RLWD will seek out grant opportunities to conduct an erosion assessment on the entire course of the Grand Marais.
3. The RLWD will pursue projects in the eastern portions of the overall watershed that retain and slow down the delivery of water.

Table 20 provides a summary list of specific implementation actions for the subwatershed.

### 7.4.9 Summary and Conclusions

This section of the overall watershed management plan presents an overview of the Grand Marais subwatershed. Goals and objectives for the subwatershed are presented above for the following plan elements: 1) Natural Resources, 2) Water Quantity, 3) Water Quality and 4) Erosion and Sedimentation. Table 20 presents a summary list of specific implementation actions organized by these same plan elements.

**Table 20**
**Grand Marais Subwatershed Implementation Actions**

| ACTION/GOAL | PLAN ELEMENT | SCHEDULE | CONCEPTUAL COST |
|---|---|---|---|
| Create additional 5,000 ac-ft of flood storage volume reduction within eastern portion of subwatershed to reduce agricultural and residential flooding (Project 60) | Water Quantity Action Item | Years 1-5 | $5,000,000 |
| Add buffers, farmland dikes and other restoration projects to slow delivery of water and lengthen hydrographs to reduce flooding | Water Quantity Action Item | Years 5-10 | $100,000 |

| ACTION/GOAL | PLAN ELEMENT | SCHEDULE | CONCEPTUAL COST |
|---|---|---|---|
| Partner with USDA NRCS, USACE, MPCA and SWCDs to implement projects that reduce agricultural and bank erosion and improve water quality | Water Quality Action Item | Ongoing | $25,000/year |
| Promote sharing data amongst the RLWD, RRWMB, MPCA and River Watch to improve water quality and project funding | Water Quality Action Item | Ongoing | $10,000/year |
| Seek partnerships with landowners, SWCD and USDA NRCS to implement BMPs to reduce erosion and slow water down | Erosion and Sedimentation Action Item | Ongoing | $5,000/year |
| Seek out grant opportunities to conduct erosion assessment on entire course of the Grand Marais | Erosion and Sedimentation Action Item | Ongoing | $5,000/year |
| Retain grasslands east of U.S. Highway 75 | Natural Resource Action Item | Years 1-5 | $125,000 |

## 7.5 CLEARWATER RIVER SUBWATERSHED PLAN

### 7.5.1 Introduction

This section presents the implementation plan for the Clearwater River subwatershed (Figure 32). The plan is organized by first presenting a summary of important physical characteristics of the Clearwater River subwatershed. More detailed information on the subwatershed is available in Sections 2.0-5.0 and in Appendix 7. The section also identifies the problems related to water management in the subwatershed and describes the proposed solutions in the form of goals and objectives to address those problems.

The Clearwater planning basin includes Upper and Lower Badger creeks, Clearwater River, Hill River, Lost River and Poplar River minor subwatersheds. The landscapes in these subwatersheds provide a diversity of habitats with farmlands, grasslands, woodlands, wetlands, riparian areas and lakes. Public lands with quality habitats include numerous WMAs, WPAs and Rydell NWR. The majority of these lands are in the beach ridge areas. These include a mix of

uplands and wetlands with some woodland areas. These lands provide seasonal and permanent habitats to a variety of species including game species such as white-tailed deer, sandhill crane, waterfowl, prairie chicken and sharp-tail grouse. CRP lands are present throughout the watershed with a concentrated band running east to west generally along the southeast border of Red Lake County (along a beach ridge area). These CRP lands are primarily grasslands. Several wild rice operations also provide some migratory wildlife habitat.

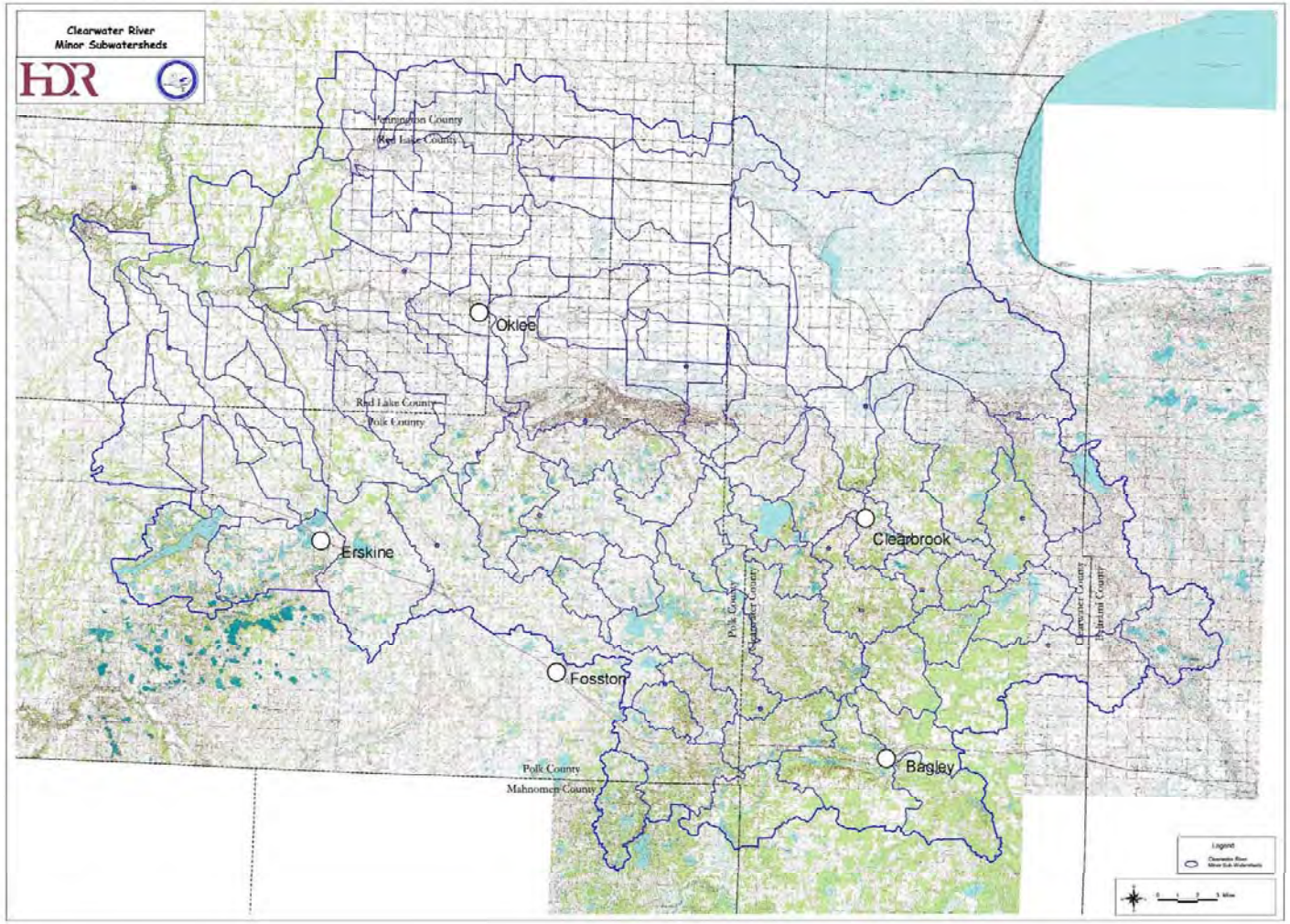
Lakes are prominent and important resources in this watershed. In particular, a number of small lakes are found throughout the southern half of the watershed. These include a mix of fishing and natural environment lakes that provide seasonal and migratory habitat for a variety of species.

Six natural waterways and their tributary networks are also important natural resource features of this watershed. These streams provide a variety of permanent and seasonal habitats for a variety of fish species. The Clearwater River is a trout stream from Clearwater Lake to the east Clearwater county line. The stream is somewhat degraded upstream from this area. From lake to confluence with ruffy brook the stream is in good shape. Pasture and woodlands form its corridor. Some wild rice production is present near its confluence with Ruffy Brook and there is an ongoing USACE project in the reach from Ruffy Brook to about five miles east of Plummer. The Poplar River, Hill River, Lost River and Upper and Lower Badger Creek are smaller systems than the Clearwater and primarily provide spawning and rearing habitat for fish. In most areas they have intact corridors that include some pasture areas. Portions of some streams have been dredged in the past but have become naturalized (e.g., Lost River between Oklee and Gully).

### 7.5.2 General Physical Characteristics

The Clearwater River subwatershed consists of an approximately 1,362 square mile area. The watershed outlets into the Red Lake River at Sportsman's Park in Red Lake Falls, MN. The Lost, Hill and Poplar rivers are minor tributaries to the Clearwater River. The watershed is located mainly within the Glacial Lake Agassiz/Aspen Parklands and Glacial Moraine ecoregions, but is bordered by the Northern Minnesota Drift and Lake Plains ecoregion. Soil textures range from loamy-skeletal in the southeastern portion of the watershed to sandy in the west portion of the watershed. The area consists largely of agricultural and forest land, but is also made up of wetland, urban and grassland (Table 21). The following presents a general summary of surface water and groundwater in the subwatershed. The summary is followed by a discussion of the problems, goals, policies and implementation actions for each of the four plan elements: 1) Natural Resources, 2) Water Quantity, 3) Water Quality and 4) Erosion and Sedimentation.

**Figure 32**
**Clearwater River Subwatershed Map**



### 7.5.3 Surface Water Summary

This subwatershed is also comprised of five smaller subwatersheds which outlet into the Clearwater River. These five subwatersheds include the Beau Gerlot Creek, Badger Creek, Hill River, Lost River and Poplar River subwatersheds. The Clearwater River subwatershed is bordered along its north side by the Upper Red Lake River subwatershed. All of the drainage from within the smaller subwatersheds ends up in the Clearwater River. All of the water comes together in the Clearwater River and outlets at the confluence with the Red Lake River in Red Lake Falls.

There are many lakes in the Clearwater River subwatershed. There are 28 lakes larger than 100 acres and 107 lakes smaller than 100 acres. Major lakes for recreation include Maple, Cameron, Badger, Clearwater, Pine, Oak, Cross, Turtle, Buzzel and Whitefish. The larger lakes typically support a fishery, with the majority of smaller lakes only supporting waterfowl hunting as a recreation. Much of the shoreline is developed on the larger lakes, and the majority of small lakeshores are undeveloped.

Wetland areas are scattered throughout the area. These wetland areas are considerably denser in the extreme northeastern portion of the subwatershed, especially within the Red Lake Reservation, where the original wetlands are intact. Many of the wetlands have been altered by farm drainage, and many wetlands have been drained for the purposes of agricultural production.

**Table 21**
**Land Use Characteristics for the Clearwater River Subwatershed**

| CHARACTERISTIC | AREA |
|---|---|
| Basin Area (sq mi.) | 1,362 |
| Basin Area (acres) | 871,387 |
| Wetland Area NWI (acres) | 144,460 |
| **MINNESOTA WETLAND TYPE** | |
| 1 | 2,324 |
| 2 | 40,319 |
| 3 | 25,968 |
| 4 | 1,820 |
| 5 | 19,663 |
| 6 | 36,740 |
| 7 | 9,660 |
| 8 | 7,965 |
| Lakes/Rivers (acres) | 23,454 |
| Total Wetlands/Lakes/Rivers | 167,914 |
| **ECOREGIONS OF RLWD (ACRES)** | |
| Lake Agassiz, Aspen Parklands | 384,431 |
| Minnesota & NE Iowa Morainal | 304,853 |
| N. Minnesota & Ontario Peatlands | 55,386 |
| N. Minnesota Drift & Lake Plains | 126,687 |
| Red River Valley | 29 |
| **LAND USE (ACRES)** | |
| Cultivated Land | 471,450 |
| Forest Land | 245,555 |
| Grass/Brushland | 60,435 |
| Mines | 1,078 |
| Water | 24,738 |
| Developed Land | 7,101 |
| Wetlands | 60,944 |
| Other | 86 |

### 7.5.4 Groundwater Summary

The subwatershed is located in parts of the Lake-Washed Till Plain and Moraine physiographic area of the RLWD. The surficial geology of the area consists of mainly glacial tills to the south, peat to the northeast, lake-washed till to the northwest and sand to the southwest. The glacial till deposits consist of sandy, clay-silt loam containing fine to medium gravel with a scattering of boulders. The peat deposits are generally only a few feet thick, accompanied by the poor drainage and the water table at or near the land surface. Sand deposits are described as being very-fine to fine and commonly less than 20 feet thick. The lake-washed till deposits have a

composition similar to the glacial till and are overlain in many local low areas by thin deposits of clay, silt, sand and peat. In the southern section of the subwatershed, just north of Bagley (and other small regions to the north), deposits of sand and gravel from outwash and ice contact features are present. The deposits consist of fine sand to medium gravel, with thicknesses ranging from a few feet to almost 100 feet. Local topography is generally hilly, with improved drainage over other areas in the watershed.

Glacial sediment aquifers in the region provide moderate amounts of groundwater. Suitable yields of 5 gpm or more for domestic use can be found in sand lenses within the till. These lenses are often localized and yields can vary and may accommodate municipal or industrial uses. Outwash and ice-contact sand and gravel aquifers are the best source in the watershed for a large groundwater supply. Yields can reach several hundred gpm. The areal extent of the aquifer is fairly large, and water quality is adequate for municipal, industrial, domestic and irrigation use. Hardness is generally greater than 180 mg/l, and iron content may be high.

Paleozoic sediments consisting of shales and limestones are discontinuous and underlie the glacial sediments along the western side of the subwatershed. Precambrian crystalline rocks underlie glacial sediments in most of the watershed. The fractured surface of crystalline rocks may provide an adequate supply of groundwater for localized domestic use but are not a good commercial or municipal source of groundwater.

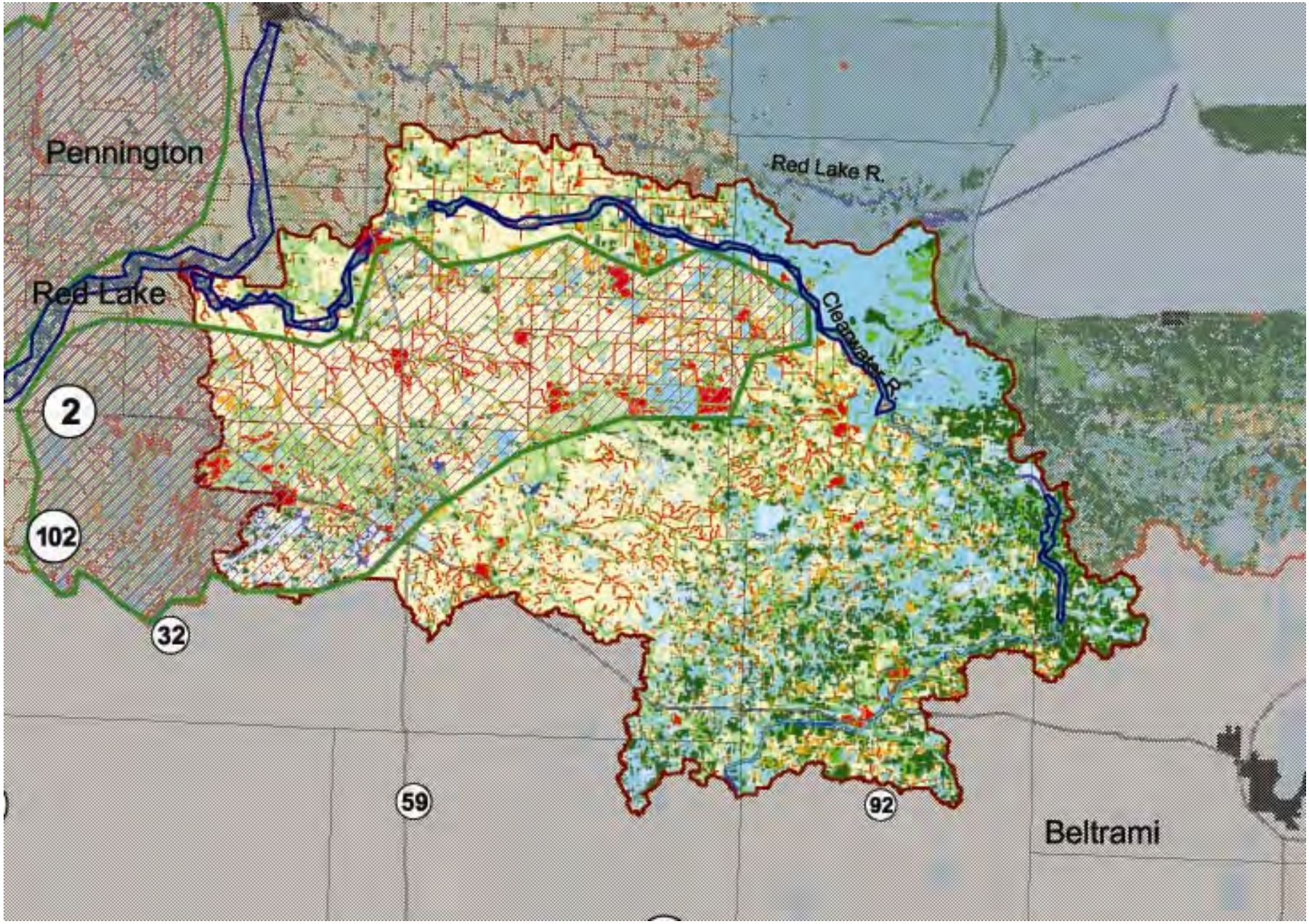
Information regarding the individual city wells, water quality analysis results and the aquifers that serve as the water supply can be obtained from the individual cities and the Minnesota Geological Survey.

### 7.5.5 Natural Resources Implementation Plan

The Clearwater River was identified as an important resource within the region that needs to be recognized and protected. Recreational activities, including hunting, fishing, tubing and swimming, were all identified as being popular activities. It is important to note that a large portion of the Clearwater River has been channelized and instream habitat quality and channel stability have been substantially reduced, both within and downstream of the channelized segment.

Natural resources problems and issues were identified using a questionnaire with resource agencies. Results of this questionnaire as the resource inventory were considered by a National Resources subcommittee. Priority natural resource areas are shown in Figure 33. The following are the major goals and actions recommended by the Natural Resources subcommittee.

**Figure 33**
**Clearwater Priority Natural Resources Areas**



#### *7.5.5.1 Improve Fish Habitat in the Clearwater River and its Tributaries*

- Support activities that reduce the flashiness and enhance base flows
- Maintain smallmouth bass fishing in the lower portion of the Clearwater and downstream segments of Lost and Poplar rivers
- Maintain stream connectivity. Sampling efforts before and after the modification of the Crookston dam has demonstrated a substantial increase in channel catfish in the Red Lake River. It is likely that channel catfish will move into streams within the Clearwater River subwatershed and establish a fishery
- Stabilize stream banks in areas of accelerated erosion
- Buffer corridors
- Increased habitat complexity, especially within channelized stream segments
- Reduce sediment load in streams
- Strategies include improved ditches with side inlets, buffer and grassed waterways, residue management, tree plantings, reduce farming into road ditches

#### *7.5.5.2 Maintain and Improve Existing Lake Quality*

- Implement consistent shoreland zoning
- Develop lake watershed plans
- Participate in shoreland development planning
- Improve stormwater planning in lake watersheds

#### *7.5.5.3 Maintain and Improve Wildlife Habitat (indicators could be land base statistics or prairie chicken and sharp-tail population levels)*

- Re-establish habitat corridors along all major waterways
- Identify key areas and connect existing habitats along the corridors by promoting land use changes
- Protect existing grassland habitats
- Identify and protect existing tracts of prairie
- Retain or increase CRP acres in those areas that already have considerable amounts of CRP. Care must be taken to reduce fire risk associated with uncontrolled burning of peat fires
- See MnDNR land management plan for some good targets and strategies
- Enhance existing grassland habitats

- Encourage active vegetation management that maintains grassland quality (prescribed burning, weed control, etc)
- Target CRP to increase number of large blocks of grassland habitats
- Protect existing wetland habitats
- Support efforts to retain WRP acres
- Support WCA enforcement
- Enhance existing wetland habitats
- Target wetland restorations in areas near existing restorations
- Encourage active vegetation management that maintains wetland quality (moist soil management, prescribed burning, weed control, etc)
- Target CRP and WRP to increase number of wetland complexes

#### *7.5.5.4 Increase Recreational Opportunities*

- Partner to highlight existing opportunities
- Wildlife viewing/birding, hunting and trails
- Increased recreational opportunities in the area around Maple Lake and Rydell NWR

The Natural Resources Committee's recommendations were used by the RLWD to follow the following Natural Resources goals, objectives and specific action items are presented in Table 23 at the end of the section.

### 7.5.6 Water Quantity Implementation Plan

Due to terrain, draining of wetlands for cropland and/or under-designed structures, the Clearwater River subwatershed experiences frequent flooding throughout the subwatershed. Spring flooding is almost an annual occurrence in this watershed. Damages associated with this type of flood are to public infrastructure, personal property, cropland and public resources (fisheries, wildlife, soils and water quality). Agricultural flooding and damages in the cities of Bagley, Clearbrook and Mentor were identified as the highest priority flooding issues. In addition to projects shown in Figure 23, it is the RLWD's goal to address the following issues within the Clearwater River subwatershed:

#### *7.5.6.1 Clearwater River FDR Rankings*

- Agricultural crop damages.
- Overland flooding in Clearbrook, Bagley and Mentor.
- Farmstead flooding.

#### *7.5.6.2 FDR Action Items*

1. The RLWD will partner with the Red Lake Band of Chippewa Indians, local, state and federal agencies to implement 10,000 ac-ft of flood volume reduction projects within this subwatershed. Care will be taken to avoid impacts to the environment in the Red Lake Nation.
2. The RLWD will coordinate with wild rice producers to determine a mutually beneficial approach to utilizing rice paddy storage volume for FDR downstream.
3. The RLWD will pursue projects that reduce bank erosion and still provide adequate agricultural drainage.
4. The RLWD will respond to petitions and other requests for the ditches that are actively managed by the RLWD. The RLWD will seek partnerships with the county and private landowners to improve the overall coordination and management of the public and private ditch system.
5. The RLWD will continue to actively promote the farmstead ringdike program.
6. The RLWD will work with the cities of Bagley, Clearbrook and Mentor to secure grant funding to implement projects and address overland flood problems.

### 7.5.7 Water Quality Implementation Plan

The MPCA has identified the Clearwater River as an impaired water body due to high levels of turbidity, TSS, fecal coliforms and low dissolved oxygen during periods of low flow.

Water quality monitoring has been done by the RLWD at 19 sites associated with streams since 1984 and more recently at four other sites on lakes within the subwatershed. Lakes being monitored include Clearwater Lake (1993), Cameron Lake (2003) and Maple Lake (2004). The parameters measured included field measurements for dissolved oxygen, pH, temperature, turbidity, transparency and conductivity. Laboratory analysis is performed on stream samples for fecal coliform, orthophosphorus, nitrates and nitrites, ammonia, total Kjeldahl nitrogen and alkalinity. Lakes monitoring data includes Secchi depth readings, as well as total phosphorus and chlorophyll-a analysis. The RLWD periodically prepares a water quality report. Results are available upon request in the RLWD office.

The MPCA 2006 Draft List of Impaired Waters identifies aquatic life or aquatic recreation. Since mercury impairments (aquatic consumption impairments) were found throughout the entire RLWD and are not something that can be managed at the local level, they are excluded from this list.

- Clearwater River
  - Headwaters to T148 R36W S36 east line (Beltrami/Clearwater County Border)
    - Low dissolved oxygen
  - Ruffy Brook to Lost River
    - Fecal coliform
    - Low dissolved oxygen
  - Lower Badger Creek to Red Lake River
    - Turbidity
- County Ditch 57
  - Low dissolved oxygen
- Lost River
  - Anderson Lake to Hill River
    - Fecal coliform
  - T148 R38W S17 south line to Pine Lake
    - Low dissolved oxygen
- Poplar River
  - Spring Lake to U.S. Highway 59
    - Low dissolved oxygen
- Poplar River Diversion
  - Unnamed ditch to Badger Lake
    - Low dissolved oxygen
- Silver Creek
  - Headwaters to Anderson Lake
    - Fecal coliform
- Unnamed Creek – Eighteen Lake to Bee Lake
    - Low dissolved oxygen
- Unnamed Creek – Mitchell Lake to Badger Lake
    - Low dissolved oxygen
- Walker Brook
  - Walker Brook Lake to Clearwater River
    - Low dissolved oxygen

Clearwater Lake straddles the Clearwater County and Beltrami County border along the path of the Clearwater River. The water quality within this lake is normally quite good. High algae

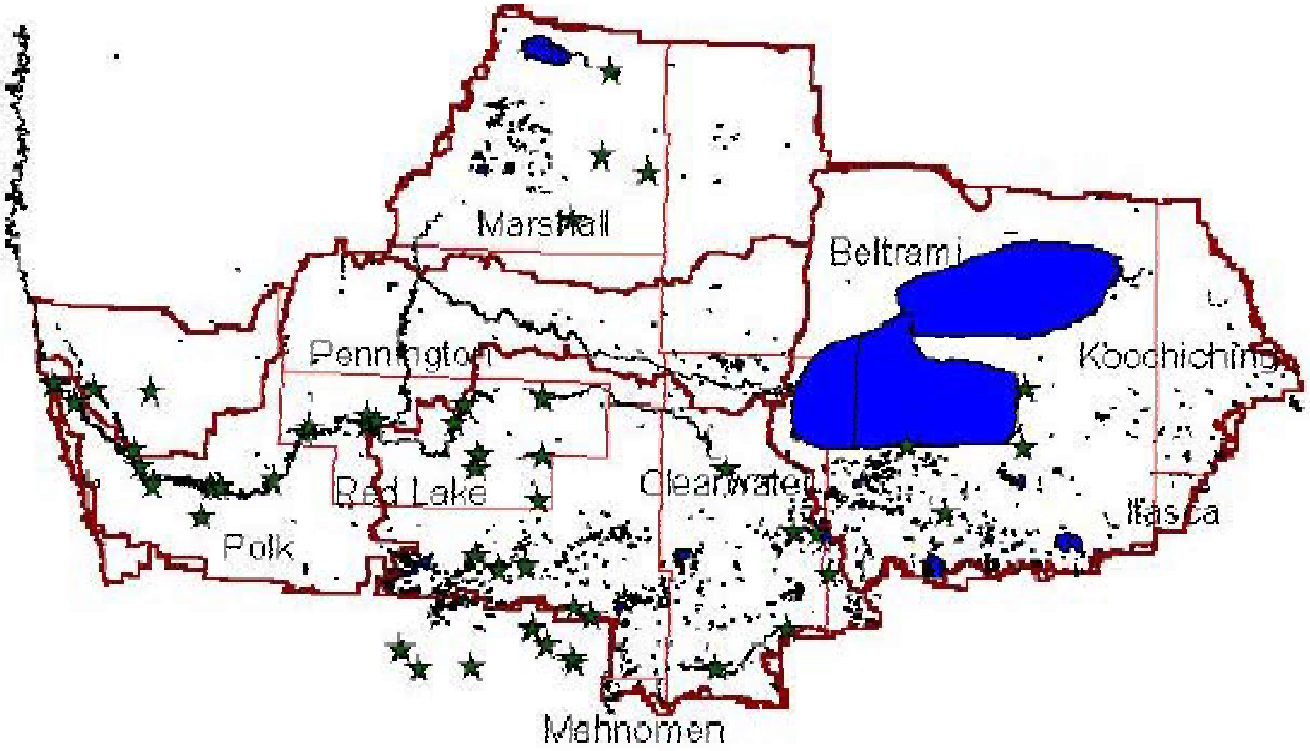
blooms and a sharp increase in the trophic state of the lake in 1997 increased local concern over the water quality of the lake. These water quality problems were most likely caused by high flows in the watershed and untreated wastewater bypassed by the overloaded Bagley wastewater treatment facility. In 2003, the Clearwater Lake Water Quality Model Study and the Clearwater Lake Management Plan were completed. The study found that the water quality within the lake has recovered since 1997, and the average trophic state levels are at a desirable level within the mesotrophic range. After 1997, there was a weed problem on the lake. The amount of floating vegetation has decreased since then, but the amount of rooted vegetation has increased in recent years, making access to the lake difficult from some docks and nearly blocking entrance to the southeast bay of the lake. This increased growth in vegetation may be due to phosphorus that has settled to the bottom of the lake. Clearwater Lake is monitored by the RLWD in cooperation with the Clearwater Lake Area Association (CLAA) and is also monitored once every three years by the Clearwater SWCD. The Clearwater Lake Management Plan sets goals for protecting and improving water quality within the lake.

The RLWD also sponsors River Watch programs for nine schools. The goals of the program are to develop baseline water quality data, provide hands on "real world" science opportunities for students and promote greater citizen awareness and understanding of watersheds and the role of watershed districts. Senior high students from participating schools perform the monitoring, including field collection and lab analysis. Field measurements of dissolved oxygen, water temperature, pH, conductivity, transparency, turbidity, stage, water depth and stream width are collected at each site along with appearance and recreational suitability observations. Each school collects data at least once per month. River Watch groups prepare reports based upon monitoring results. These reports are then presented at area River Watch forums. In addition to the schools listed below, Bagley started a River Watch program in 2004. Some schools plan on adding or changing monitoring sites as well.

**Table 22**
**River Watch Sites (2004)**

| | SITE NAME | RIVER |
|---|---|---|
| Clearbrook/Gonvick | CG 40 | Clearwater River |
| Clearbrook/Gonvick | CG 20 | Clearwater River |
| Clearbrook/Gonvick | CG 50 | Clearwater River |
| Clearbrook/Gonvick | CG 30 | Clearwater River |
| Clearbrook/Gonvick | CG 35 | Clearwater Lake outlet |
| Clearbrook/Gonvick | CG 10 | Clearwater River |
| Red Lake County Central | OK 10 | Clearwater River |
| Red Lake County Central | PL 10 | Clearwater River |
| Red Lake County Central | PL 20 | Clearwater River |
| Red Lake Falls | CL 10 | Clearwater River |

**Figure 34**
**River Watch Sites within the Red Lake Watershed District**



#### *7.5.7.1 SWCD Monitoring Locations*

Several SWCDs within the RLWD conduct monitoring programs of their own. The Pennington and Red Lake SWCDs all conduct stream monitoring. The Clearwater SWCD conducts their own lake monitoring programs and has assisted the RLWD with stream monitoring for special studies.

The list of past and present RLWD special projects includes the Clearwater River Intensive Low Flow Monitoring, Cross Lake and Turtle Lake Water Quality Study, Beaver Pond Water Quality Study, TMDLs on the Clearwater River, Clearwater Lake monitoring, Maple Lake monitoring and Clearwater Lake Water Quality Model projects.

Current special studies include the Red River Basin Buffer Initiative, Maple Lake Monitoring and the Clearwater River Small Cities Stormwater Project. The Red River Basin Buffer Strip Initiative project involves monthly monitoring at the Silver Creek long-term monitoring site (#81). The extra monitoring at this site is conducted as part of a cost share agreement between the RLWD and the Red River Basin Commission.

The watershed will continue to assess the problem and the data available for the next 303D assessment. It is the RLWD's goal to address the following issues with the Clearwater River subwatershed.

#### *7.5.7.2 Clearwater River Water Quality Rankings*

- Turbidity, TSS, fecal coliform and low dissolved oxygen 303D impairment.
- Potential impacts of TMDLs on wild rice operations.
- Maple Lake water quality.

#### *7.5.7.3 Water Quality Action Items*

1. The RLWD will actively partner with the USDA NRCS, USACE, MPCA and the SWCDs to seek to implement projects that reduce agricultural and bank erosion and improve water quality.

The Clearwater River Small Cities Stormwater Project is being conducted in order to determine the need for stormwater retention in the cities of Clearbrook and Gonvick. Stormwater modeling will be conducted to determine the ideal size and location of stormwater retention ponds in the cities. The sediment and nutrient reduction estimates will be compared to monitoring results.

The RLWD is currently participating in a TMDL study on two impaired reaches within the Clearwater River watershed. The trout stream portion of the Clearwater River is listed as

impaired for fecal coliform. Walker Brook, a tributary that enters the Clearwater River near Bagley, is impaired for dissolved oxygen. Both listings were based upon data collected for the Clearwater Nonpoint Study in 1992 and 1993. The Clearwater River was monitored intensively once again in 2002 for the Clearwater Lake Water Quality Model Project. The Clearwater SWCD also collected fecal coliform samples in late summer and fall of 2002. The new data shows that the reach is no longer impaired for fecal coliform. Only one set of samples exceeded the standard of 200 coliforms/100 ml. These samples were collected during a large rainfall and runoff event. The results of the study will recommend that the trout stream reach of the Clearwater River be de-listed. The Walker Brook impairment, on the other hand, is still impaired by low dissolved oxygen levels. Ancient, oxygen depleted groundwater is a major source of water for this stream. The stream also flows through organic soils and fens. The decomposition occurring in these depletes oxygen further.

Table 23 provides a summary list of specific implementation actions for the subwatershed.

### 7.5.8 Erosion and Sedimentation

Erosion due to storm runoff is another serious problem in the subwatershed. During periods of high runoff, channel erosion causes bank stabilization concerns for this subwatershed. The severity depends on the land cover, duration and volume of water. Erosion is often worse in the spring due to the lack of vegetative cover on the fields. It is the RLWD's goal to address the following issues with the Clearwater River subwatershed:

#### *7.5.8.1 Clearwater River Erosion and Sedimentation Rankings*

- Tributary bank instability at the outlets into the river.
- Lost River channel and streambank erosion.
- Ditches outletting into natural streams and contributing sediment.

#### *7.5.8.2 Erosion and Sedimentation Action Items*

1. The RLWD will seek partnerships with landowners, SWCD and USDA NRCS to implement BMPs that reduce agricultural erosion and slow water down.
2. The RLWD will seek out grant opportunities to conduct an erosion assessment on the entire course of the Clearwater River.

Table 23 provides a summary list of specific implementation actions for the subwatershed.

### 7.5.9 Summary and Conclusions

This section of the overall watershed management plan presents an overview of the Clearwater River subwatershed. Goals and objectives for the subwatershed are presented above for the following plan elements: 1) Natural Resources, 2) Water Quantity, 3) Water Quality and 4) Erosion and Sedimentation. Table 23 provides a summary list of specific implementation actions organized by these same plan elements.

**Table 23**
**Clearwater River Subwatershed Implementation Actions**

| ACTION/GOAL | PLAN ELEMENT | SCHEDULE | CONCEPTUAL COST |
|---|---|---|---|
| Partner with the USDA NRCS, USACE, MPCA and the SWCDs to seek to implement projects that reduce agricultural and bank erosion and improve water quality | Water Quality Action Item | Years 1-5 | $25,000 |
| Seek partnerships with landowners, SWCD and USDA NRCS to implement BMPs that reduce agricultural erosion and slow water down | Erosion and Sedimentation Action Item | Years 1-5 | $10,000 |
| Seek grant opportunities to conduct an erosion assessment on the entire course of the Clearwater River | Erosion and Sedimentation Action Item | Ongoing | $25,000 |
| Retain or Increase CRP acres | Natural Resource Action Item | Ongoing | $50,000 |
| Pursue 10,000 ac-ft of flood volume reduction, including use of rice paddies | Water Quantity Action Item | Years 1-10 | $10,000,000 |
| Improve District website and education programs | Watershed-wide Activity | Ongoing | $10,000 |
| Continue/expand River Watch program | Watershed-wide Activity | Ongoing | $10,000 |
| Develop monitoring locations (TMDL) | Watershed-wide Activity | Ongoing | $20,00 |
| Implement lake restoration projects | Watershed-wide Activity | Ongoing | $250,000 |
| Promote comprehensive ditch management strategies | Watershed-wide Activity | Ongoing | $25,000 |

## 7.6 RED LAKES – UPPER AND LOWER

### 7.6.1 Introduction

This section presents the implementation plan for the Upper and Lower Red lakes subwatershed (Figure 35). The plan is organized by first presenting a summary of the important physical characteristics of the Upper and Lower Red lakes subwatershed. More detailed information on the subwatershed is available in Sections 2.0-5.0 and in Appendix 7.

The Red Lakes are the most significant natural resource feature in this subwatershed. These lakes historically have provide a tremendous walleye fishery. Current plans being implemented to rehabilitate this fishery appear on course. The current crappie fishery and northern pike fishery are outstanding. Tributary streams to the lakes provide spawning habitat. Some of these streams have erosion issues. Rice farms on Tamarac River and Shotley Brook, peatlands north of Red Lake and bog areas are also prominent aquatic features.

The remaining landscape in this planning basin is dominated by wetlands including peatlands, bogs and shrublands. These areas provide habitat for a diversity of species. Public lands are common and most of this area is within the boundary of the Red Lake Indian Reservation.

### 7.6.2 General Physical Characteristics

The Red Lakes watershed consists of an approximately 1,929 square mile area. The watershed outlets into the Red Lake River at the Red Lake Dam. The watershed is located entirely within the Northern Minnesota Peatlands and the Northern Minnesota Drift and Lake Plains ecoregions. Soil textures range from fine-loamy in the southern portion of the watershed to hemic/sapric in the northern portion of the watershed with a buffer strip of sandy soils around Lower Red Lake. The area consists largely of forest land, lakes and wetlands, with very little agricultural or developed land (Table 24).

The following presents a general summary of surface water and groundwater in the subwatershed. The summary is followed by a discussion of the problems, goals, policies and implementation actions for each of the four plan elements: 1) Natural Resources, 2) Water Quantity, 3) Water Quality and 4) Erosion and Sedimentation.

**Figure 35**
**Red Lakes Subwatershed Map**

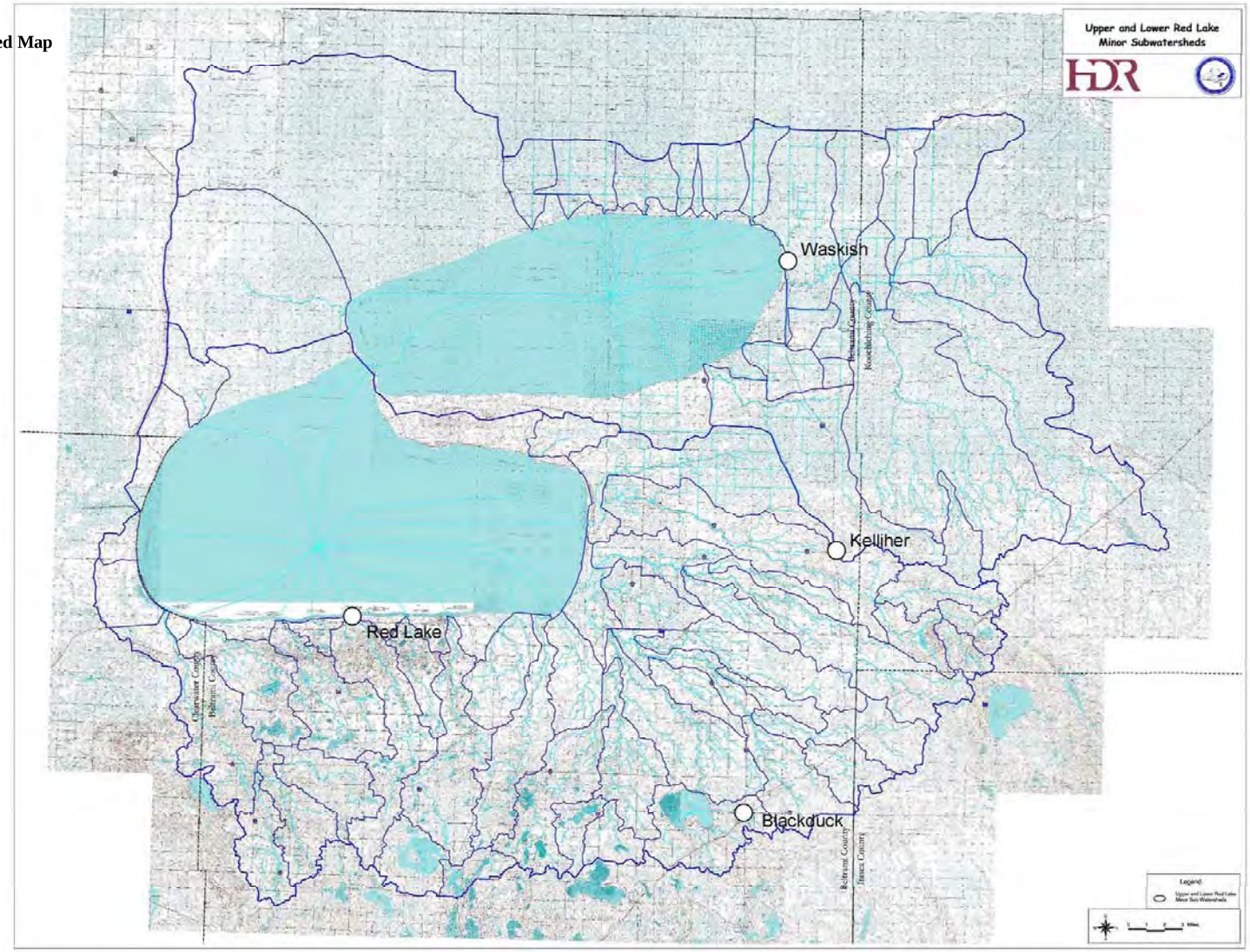


**Table 24**
**Land Use Characteristics for the Upper and Lower Red Lakes Subwatershed**

| CHARACTERISTIC | AREA |
|---|---|
| Basin Area (sq mi.) | 1,929 |
| Basin Area (acres) | 1,234,747 |
| Wetland Area NWI (acres) | 855,675 |
| **MINNESOTA WETLAND TYPE** | |
| 1 | 3,878 |
| 2 | 28,221 |
| 3 | 22,087 |
| 4 | 2,416 |
| 5 | 299,716 |
| 6 | 139,141 |
| 7 | 60,323 |
| 8 | 299,894 |
| Lakes/Rivers (acres) | 302,962 |
| Total Wetlands/Lakes/Rivers | 1,158,637 |
| **ECOREGIONS OF RLWD (ACRES)** | |
| Lake Agassiz, Aspen Parklands | 704 |
| Minnesota & NE Iowa Morainal | - |
| N. Minnesota & Ontario Peatlands | 988,851 |
| N. Minnesota Drift & Lake Plains | 254,191 |
| Red River Valley | - |
| **LAND USE (ACRES)** | |
| Cultivated Land | 62,972 |
| Forest Land | 610,310 |
| Grass/Brushland | 21,819 |
| Mines | 172 |
| Water | 304,735 |
| Developed Land | 3,579 |
| Wetlands | 240,160 |
| Other | - |

### 7.6.3 Surface Water Summary

The Red Lakes subwatershed is the uppermost reach of the RLWD. All of the drainage from within the smaller subwatersheds ends up in the Red Lakes and eventually outlets into the Red Lake River at the Red Lake Dam. Dam outflows are controlled by the USACE.

There are 86 named lakes in the Red Lakes subwatershed, of which 18 are over 100 acres. Major lakes for recreation include: the controlled eastern portion of the Upper Red Lake Basin, Bass,

Blackduck, Julia, Medicine, Island, Puposky, Sandy and White Fish Lakes. The larger lakes typically support a fishery, with the majority of smaller lakes only supporting waterfowl.

Wetland areas are scattered throughout the area. These wetland areas are somewhat denser in the northern and eastern portions of the subwatershed, especially within the Red Lake Reservation. The majority of the northern and eastern wetlands have been left untouched. Remaining wetlands have been estimated to be 53-95 percent of pre-settlement extent. Much of the northern and eastern areas of this watershed have been devoted to wildlife management areas.
Drainage systems in this subwatershed are a complex network of natural streams with a few legal ditch systems. Generally, the ditch systems are under the administration of the county in which they reside or of the Red Lake Band of Chippewa Indians.

Although there are not currently any monitoring locations within this subwatershed, the RLWD has past data available at one site associated with a stream from 1989 to 2002. The Red Lake Band of Chippewa Indians and MnDNR now monitor all major streams that enter the lakes as well as the lakes themselves within the subwatershed. The parameters measured included field measurements for dissolved oxygen, pH, temperature, turbidity, transparency and conductivity. Laboratory analysis is performed on stream samples for fecal coliform, TSS, total dissolved solids, chemical oxygen demand, total phosphorus, orthophosphorus, nitrates and nitrites, ammonia, total Kjeldahl nitrogen and alkalinity. Lakes monitoring data includes Secchi depth readings, as well as total phosphorous and chlorophyll-a analysis. The RLWD has past data available, but current data can be obtained from the Red Lake Department of Natural Resources (RLDNR). There are no impaired stream reaches as identified by the MPCA in this subwatershed.

### 7.6.4 Groundwater Summary

The subwatershed is located in the Moraine physiographic area of the Red Lake River Watershed District. The surficial geology of the area consists of mainly glacial tills in the southern region of the watershed and glacial sands and peat lands surrounding the Upper and Lower Red lakes to the north. The glacial till deposits consist of sandy, clay-silt loam containing fine to medium gravel with a scattering of boulders. The peat deposits are generally only a few feet thick, caused by the poor drainage and the water table at or near the land surface. Peat deposits also occur locally within closed depressions found in the moraine. Sand deposits are described as being very-fine to fine and commonly less than 20 feet thick. Drainage is improved over areas containing clays and silts. Deposits of both sand and peat are underlain by till in most places.

Glacial sediment aquifers in the region provide very moderate amounts of groundwater. Suitable yields of 5 gpm or more, for domestic use, can be found in sand lenses within the till. These lenses are often localized, and yields can vary and may accommodate municipal or industrial uses. Hardness of the groundwater is commonly greater than 180 mg/l.

Precambrian crystalline rocks underlie the glacial deposits throughout the watershed. The crystalline rocks do not provide an adequate supply of groundwater due to the few, localized, interconnected fractures in the bedrock.

Information regarding the individual city wells, water quality analysis results and the aquifers that serve as the water supply can be obtained from the individual cities and the Minnesota Geological Survey.

### 7.6.5 Natural Resources Implementation Plan

The Red River Flood Damage Reduction Mediation Agreement requires the protection and enhancement of natural resources be considered and incorporated into the next generation of watershed plans. To fill this gap in natural resource data, the BWSR contracted with the MCEA to provide natural resource assessments of the RLWD. The following subsection summarizes this natural resource assessment and incorporates the information into the subwatershed plan.

The Upper and Lower Red lakes were identified as being truly unique and significant natural resources. It was widely recognized that the RLWD, local, state and federal agencies and the Red Lake Band need to work together to ensure the long-term health and sustainability of this resource.

Natural resource problems and issues were identified using the questionnaire with resources agencies. Results of this questionnaire and the resource inventory were considered by a Natural Resources Subcommittee. The following are the major goals and actions recommended by the Natural Resources Subcommittee.

#### *7.6.5.1 Support Active Management of Red Lake Fish Populations*

See Recovery Plan for Red Lakes Walleye Stocks (MnDNR, Red Lake Band of Chippewa Indians).

#### *7.6.5.2 Improve Fish Habitat in Red Lake Tributaries*

- Manage water appropriation and discharge methods in a manner that is compatible with fish spawning and early life stage requirements
- Stabilize stream banks in areas of accelerated erosion
- Reduce sediment load in streams
- Buffer all watercourses
- Reduce sediment input into the Red Lakes
- Implement agricultural BMPs to reduce wind and water erosion throughout the subwatershed
- Other strategies include improved ditches with side inlets, buffer and grassed waterways, residue management, tree plantings, reduce farming into road ditches
- Maintain and improve wildlife habitat (indicators could be land base statistics or sharp-tail or deer or moose population levels)
- Maintain habitat corridors along all major waterways
- Identify key areas and connect existing habitats along the corridors by promoting land use changes
- Connect existing corridor woodland and wetland habitats
- Protect and enhance existing brushland habitats
- Protect existing tracts of brushlands
- Manage vegetation actively to maintain brushlands and diversity
- Retain or increase CRP acres in those areas that already have considerable amounts of CRP
- See MnDNR land management plan for some good targets and strategies
- Protect existing woodland habitats
- See MnDNR land management plan for some good targets and strategies
- Enhance existing woodland habitats
- Protect existing wetland habitats
- Support efforts to retain WRP acres
- Support WCA enforcement
- Enhance existing wetland habitats

- Target wetland restorations in areas near existing restorations
- Encourage active vegetation management that maintains wetland quality (moist soil management, prescribed burning, weed control, etc)

#### *7.6.5.3 Increase Recreational Opportunities*

- Partner with other groups to highlight existing opportunities
- Wildlife viewing/birding, hunting and trails

The Natural Resource Committee's recommendations were used by the RLWD to develop the following natural resource goals, objectives and specific action items are presented in Table 27.

### 7.6.6 Water Quantity Implementation Plan

The Red Lakes subwatershed is unique in that a large portion of the land is controlled by tribal interests and the outlet of the lake is controlled by the USACE. The discussions of water quantity centered on the outlet and the impacts on downstream interests. It is the RLWD's goal to address the following issues with the Red Lakes subwatershed:

#### *7.6.6.1 Red Lakes FDR Rankings*

- Cabin flooding.
- USACE operations of the outlet.
- Water release impacts to downstream Red Lake River.

#### *7.6.6.2 FDR Action Items*

1. The RLWD will seek to partner with the Red Lake Band of Chippewa Indians, MnDNR, Waskish Township, Upper Red Lake Area Association and the USACE to manage the outlet of Red Lake in a way that reduces flood damages and protects the resources of Upper and Lower Red lakes.

Table 27 provides a summary list of specific implementation actions for the subwatershed.

### 7.6.7 Water Quality Implementation Plan

There are no impaired stream reaches as identified by the MPCA in this subwatershed. Efforts, therefore, focus on monitoring to identify trends. The RLWD's Water Quality Project has been ongoing since 1984. The RLWD's commitment to this project reflects the recently heightened awareness and increased concern for water quality from the public and agencies alike.

Although not currently monitoring any locations within this subwatershed, the RLWD has available at one site past data associated with a stream from 1989 to 2002. The Red Lake MnDNR now monitors all major streams that enter the lakes as well as the lakes themselves

within the subwatershed. The parameters measured include field measurements for dissolved oxygen, pH, temperature, turbidity, transparency and conductivity. Laboratory analysis is performed on stream samples for fecal coliform, TSS, total dissolved solids, chemical oxygen demand, total phosphorus, orthophosphorus, nitrates and nitrites, ammonia, total Kjeldahl nitrogen and alkalinity. Lakes monitoring data includes Secchi depth readings, as well as total phosphorous and chlorophyll-a analysis. The RLWD has past data available, but current data can be obtained from the RLDNR.

**Table 25**
**Upper and Lower Red Lakes Water Quality Monitoring Sites Summary**

| | |
|---|---|
| **Watershed Name** | Upper and Lower Red Lakes |
| **Impaired Waters** | None |
| **Number of Stream Sampling Sites** | 9 historical sites, 1 monitored through 2002 |
| **RLWD** | 0 |
| **RLDNR** | at least 10 |
| **River Watch** | 4 |
| **MPCA** | 0 |
| **Field Parameters** | dissolved oxygen, pH, water temperature, turbidity, transparency, conductivity, total dissolved solids, stage |
| **Laboratory Parameters** | **Total phosphorus, orthophosphorus, TSS, total dissolved solids, total Kjeldahl nitrogen, ammonia nitrogen, nitrates plus nitrates, fecal coliform and E. coli** |
| **Earliest Sampling Data** | 1989 |
| **Key Sampling Locations** | Mud Creek in Redby |
| **Other Notes** | The Red Lake Department of Natural Resources monitors all the main streams that inlet to the lake, as well as the Red Lakes themselves |

It is not RLWD's intent to duplicate other testing programs within the district but to complement them. Since the RLDNR currently monitors sites within this subwatershed, this plan does not

call for the RLWD to duplicate that effort, but instead to coordinate with the RLDNR and use their data.

Standard methods have been created and are used from monitoring program to monitoring program to ensure that data is comparable. In 2002, the RLWD and RLDNR learned that both organizations had been monitoring the same sites for over 10 years. These sites were NEB-2 and the Lower Red Lake Dam (#740 on the Red Lake River) monitoring site. Site NEB-2 is in the City of Redby, at the crossing of State Highway 89/1 and Mud Creek. This site was monitored through 2002 by the RLWD. It was dropped for the 2003 sampling year because of duplication of sampling efforts between the RLWD and the RLDNR, a hazardous site location (narrow bridge) and a lack of water quality programs in the area. There is a fish hatchery downstream, and it has good dissolved oxygen levels.

The RLDNR also monitors water quality at all the inlets to the Upper and Lower Red lakes, as well as the Red Lake Dam. Below is a chart listing the portion of the RLDNR sites that are part of the EPA STORET database.

**Table 26**
**RLDNR Monitoring Sites from STORET**

| STATION ID | DESCRIPTION |
|---|---|
| RLI001 | BATTLE R AT PONEMAH RD 0.2 MI UPST OF THE MOUTH |
| RLI002 | BIG STONE LK AT SH-1, 300' UPST LOWER RED LAKE |
| RLI003 | BLACKDUCK R AT PONEMAH RD 7 MILES E REDBY |
| RLI004 | RED LAKE R AT LOWER RED LAKE OUTLET DAM |
| RLI005 | SANDY R AT SH-1 10 MILES W OF RED LAKE |
| RLI006 | SANDY R AT I.S.#6, 3/4 MI UPST FROM SH-1 |
| RLI007 | SHOTLEY BK 100 FEET UPST MOUTH AT UPPER RED LK |
| RLI008 | TAMARAC R UPST OF SH-72 AT WASHKISH |
| RLI009 | MAHNOMIN (sic) R 1/4 MI UPST MOUTH AT UPPER RED LAKE |
| RLI010 | PIKE CK AT I.S.#12 2 MI SE OF RED LAKE |
| RLI011 | PIKE CK 100' UPST MOUTH IN RED LAKE |
| RLI012 | PIKE CK S OF BIA MAINT. BLDG IN RED LAKE |
| RLI013 | MUD R 100 FT UPST LOWER RED LAKE AT REDBY |
| RLI014 | L ROCK CK 100 FT UPST LOWER RED LAKE 4 MI W RED |
| RLI015 | CLEARWATER R AT KIWOSAY INLLET DITCH ROAD |
| RLI016 | CLEARWATER R AT KIWOSAY WILD. AREA ACCESS RD. |

The water quality of the Upper and Lower Red lakes is relatively good. The need to implement BMPs on tributaries to the lakes was identified as the chief water quality concern. It is the RLWD's goal to address the following issues with the Red Lakes subwatershed:

#### *7.6.7.1 Red Lakes Water Quality Rankings*

- Need for filter strips along tributary rivers, creeks and ditches.
- Long shore drift clogging rivers.
- Pasture lands along river and needs for alternate water sources.

#### *7.6.7.2 Water Quality Action Items*

1. The RLWD will actively partner with the Red Lake Band, USDA NRCS, USACE, MPCA and the SWCDs to seek to implement projects that reduce agricultural and bank erosion and improve water quality. Coburn Creek has been identified by MnDNR fisheries as a potential source for significant impairment.

Table 27 provides a summary list of specific implementation actions for the subwatershed.

### 7.6.8 Erosion and Sedimentation

Erosion due to storm runoff is a serious problem in the subwatershed. During periods of high runoff, channel erosion causes bank stabilization concerns for this subwatershed. The severity depends on the land cover, duration and volume of water. It is the RLWD's goal to address the following issues with the Red Lakes subwatershed:

#### *7.6.8.1 Red Lakes Erosion and Sedimentation Rankings*

- River, creek and ditch bank failures.
- Ditches and tributary outlets to lakes.

#### *7.6.8.2 Erosion and Sedimentation Action Items*

1. The RLWD will seek partnerships with landowners, SWCD and USDA NRCS to implement BMPs that reduce agricultural erosion and slow water down.
2. The RLWD will seek out grant opportunities to conduct an erosion assessment and to provide alternate sources of water for livestock.

Table 27 provides a summary list of specific implementation actions for the subwatershed.

### 7.6.9 Summary and Conclusions

This section of the overall watershed management plan presents an overview of the Upper and Lower Red lakes subwatershed. Goals and objectives for the subwatershed are presented above for the following plan elements: 1) Natural Resources, 2) Water Quality, 3) Water Quantity and 4) Erosion and Sedimentation. Table 27 provides a summary list of specific implementation actions organized by these same plan elements.

**Table 27**
**Upper and Lower Red Lake Subwatershed Implementation Actions**

| ACTION/GOAL | PLAN ELEMENT | SCHEDULE | CONCEPTUAL COST |
|---|---|---|---|
| Re-establish functional habitat corridors along all watercourses | Natural Resources Action Item | Ongoing | $20,000/year |
| Protect existing high quality natural resource features | Natural Resources Action Item | Ongoing | $10,000/year |
| Partner with Red Lake Band and USACE to manage outlet of Red Lake to reduce flood damages and protect resources of Upper and Lower Red Lakes | Water Quantity Action Item | Years 1-3 | $25,000 |
| Partner with the Red Lake Band, USDA NRCS, USACE, MPCA and SWCDs to implement projects that reduce agricultural and bank erosion and improve water quality | Water Quality Action Item | Years 1-3 | $50,000 |
| Seek grant opportunities to conduct an erosion assessment and to provide alternate sources of water for livestock. | Erosion and Sedimentation Action Item | Ongoing | $5,000/year |