

# **The Meeker County Comprehensive Local Water Plan**



*North Fork Crow River ~ Photo by Amy Wilde*

**January 2003 to December 2012**

**Focus Plan: 2003 to 2007**

*Prepared by Meeker County and the  
Mid-Minnesota Development Commission*

*“The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased, and not impaired, in value.”*

~ Theodore Roosevelt ~

## ACKNOWLEDGEMENTS

*A special thanks is extended to the following individuals who were involved in the preparation and development of this document. Meeker County greatly appreciates their participation!*

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## Common Acronyms

ACOE	Army Corps of Engineers
BMP	Best Management Practice
BWSR	Minnesota Board of Water and Soil Resources
CD	County Ditch
CLMP, CSMP	Citizen Lake (Stream) Monitoring Program
CLWP	Comprehensive Local Water Plan
CR	Clearwater River Watershed
CROW	Crow River Organization of Water
CRP	Conservation Reserve Program
CWI	County Well Index
CWP	Clean Water Partnership
DA	Ditch Authority
DNR	Minnesota Department of Natural Resource
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
FEMA	Federal Emergency Management Agency
HD	Highway Department
ISTS	Individual Sewage Treatment System
LAP	Lake Assessment Project
LGU	Local Governmental Unit
LMIC	Land Management Information Center
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
MGS	Minnesota Geological Survey
MPCA	Minnesota Pollution Control Agency
MRBJPB	Minnesota River Basin Joint Powers Board
NFCR	North Fork Crow River Watershed
NRCS	Natural Resource Conservation Service
OHWL	Ordinary High Water Level
PH	Public Health Department
PZ	Planning and Zoning Department
RIM	Reinvest in Minnesota Program
SFCR	South Fork Crow River Watershed
SR	Sauk River Watershed
SW	Solid Waste Department
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load
UMES	University of Minnesota Extension Service
USFWS	U.S. Fish and Wildlife Service
WCA	Wetland Conservation Act
WMA	Wildlife Management Area
WMLO	Watershed Management-like Organization
WPA	Waterfowl Production Area

## Common Agency Websites

Agency/ Office	Website	Telephone
Army Corps of Engineers	<a href="http://www.usace.army.mil/">http://www.usace.army.mil/</a>	(651) 290-5200
Environmental Protection Agency	<a href="http://www.epa.gov/">http://www.epa.gov/</a>	(800) 621-8431
Minnesota Board of Water and Soil Resources	<a href="http://www.bwsr.state.mn.us/">http://www.bwsr.state.mn.us/</a>	(800) 627-3529
Minnesota Department of Natural Resources	<a href="http://www.dnr.state.mn.us/index.html">http://www.dnr.state.mn.us/index.html</a>	(800) 657-3929
Minnesota Planning	<a href="http://www.mnplan.state.mn.us/">http://www.mnplan.state.mn.us/</a>	(651) 296-3985
Minnesota Pollution Control Agency	<a href="http://www.pca.state.mn.us/">http://www.pca.state.mn.us/</a>	(800) 657-3864
Natural Resource Conservation Service	<a href="http://www.mn.nrcs.usda.gov/">http://www.mn.nrcs.usda.gov/</a>	(651) 602-7900
Minnesota Department of Health	<a href="http://www.health.state.mn.us/">http://www.health.state.mn.us/</a>	(651) 215-5800
Minnesota Department of Agriculture	<a href="http://www.mda.state.mn.us/">http://www.mda.state.mn.us/</a>	(800) 967-2474
Minnesota Geological Survey	<a href="http://talc.geo.umn.edu/mgs/">http://talc.geo.umn.edu/mgs/</a>	(612) 627-4780
United States Fish and Wildlife Service	<a href="http://www.fws.gov/">http://www.fws.gov/</a>	(612) 713-5360
United States Geological Survey	<a href="http://www.usgs.gov/">http://www.usgs.gov/</a>	(763) 783-3100

## Glossary of Common Terms

**Aquifer:** A natural water-bearing geological formation (e.g., sand, gravel and sandstone) that is found below the surface of the earth.

**Best Management Practices (BMP):** A practice or practices that have been determined to be most effective, practical means of preventing or reducing pollution from nonpoint sources.

**Discharge:** The volume of water that passes a given location within a period of time.

**Erosion Rate “T”:** “T” is the soil lost per year yet productivity remains for crop growth indefinitely. “T” values range from 1 ton/acre/year to 5 ton/acre/year.

**Fecal Coliform Bacteria:** The portion of coliform group of bacteria that originates in the intestinal tract of warm-blooded beings. It is used as an indicator of fecal waste pollution and it indicates the presence of other disease organisms.

**Gauging Station:** A site on a stream or lake or other body of water where direct systematic observations of hydrologic data are obtained.

**Groundwater:** The subsurface water supply in the saturated zone below the watertable.

**Hydrology:** The science of water, the study of water.

**Nitrate:** The NO<sub>3</sub> anion. Nitrate is the most oxidized form of nitrogen and is a form readily available to plants. Nitrate molecules are negatively charged and do not adhere to soil particles, so it is subject to leaching.

**Potable Water:** Water of a quality suitable for drinking.

**Rill Erosion:** Similar to sheet wash but flow is concentrated in subtle swale in the surface topography. Again when the rate of rainfall exceeds soil infiltration on patches of bare soil, sheet erosion converges toward the swale forming rills. Fine particles separated from the soil aggregates make their way down slope. The velocity of rill flow is too slow to create gullies.

**Sedimentation:** The process or manner in which minerals (displaced soil particles), dissolved or organic material comes to rest on the earth's surface after being transported by water.

**Sheet Erosion:** Bare soil is exposed to raindrops that break up soil aggregates. If the rate of rainfall exceeds soil infiltration, a film of water 2-3 mm thick develops and flows as a sheet to lower elevations. This slowly and nearly invisibly removes the topsoil.

**Total Maximum Daily Load (TMDL):** Is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. States, Territories and Tribes set water quality standards. They identify the use for each waterbody, for example, drinking water supply, contact recreation (swimming) and aquatic life support (fishing), and the scientific criteria to support that use. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the waterbody can be used for the purposes the State has designated. The calculation must also account for seasonable variation in water quality. The Clean Water Act, section 303, establishes the water quality standards and TMDL programs.

**Watershed:** That surface area, which drains to a specified point on a watercourse (outlet), usually a confluence of streams or rivers.

**Watershed Management-like Organizations:** Includes Clean Water Partnerships, Lake Associations, Watershed Districts and Watershed Projects.

## **INTRODUCTION TO THE MEEKER COUNTY COMPREHENSIVE LOCAL WATER PLAN**

### **Comprehensive Local Water Management Act**

The Comprehensive Local Water Management Act (Minnesota Statutes Sections 103B.301 to 103B.355) encourages counties to develop and implement a comprehensive water plan. Pursuant to the requirements of the law, this plan:

- Covers the entire area of the County;
- Addresses water problems in the context of watershed units and groundwater systems;
- Is based upon principles of sound hydrologic management of water, effective environmental protection and efficient management;
- Is consistent with comprehensive water plans prepared by counties and watershed management organizations wholly or partially within a single watershed unit or groundwater system; and
- The comprehensive water plan must specify the period covered by the comprehensive water plan and must extend at least five years, but no more than ten years, from the date the Board of Water and Soil Resources (BWSR) approves the comprehensive water plan. Comprehensive water plans that contain revision dates inconsistent with this section must comply with that date, provided it is not more than ten years beyond the date of BWSR approval. A two-year extension of the revision date of a comprehensive water plan may be granted by BWSR, provided no projects are ordered or commenced during the period of the extension.

To ensure that these objectives are realized, the Comprehensive Local Water Management Act further specifies the basic contents of the comprehensive water plan to contain:

- A description of the existing and expected changes to physical environment, land use and development in the County;
- Available information about the surface water, groundwater and related land resources in the County, including existing and potential distribution, availability, quality and use;
- Objectives for future development, use and conservation of water and related land resources, including objectives that concern water quality and quantity, and sensitive areas, wellhead protection areas, high priority areas for wetland preservation, enhancement, restoration, and establishment, stormwater management for developing areas, and related land use conditions, and a description of actions that will be taken in affected watersheds or groundwater systems to achieve the objectives;
- A description of potential changes in State programs, policies and requirements considered important to the management of water resources in the County;

- A description of conflicts between the comprehensive water plan and existing plans of other local units of government;
- A description of possible conflicts between the comprehensive water plan and existing or proposed comprehensive water plans of other counties in the affected watershed units or groundwater systems;
- A program for implementation of the plan that is consistent with the plan's management objectives and includes schedules for amending official controls and water and related land resources plans of local units of government to conform with the comprehensive water plan, and the schedule, components, and expected State and local costs of any projects to implement the comprehensive water plan that may be proposed, although this does not mean that projects are required by this section; and
- A procedure for amending the comprehensive water plan

### **Comprehensive Water Management Plan**

This plan is divided into seven major sections:

- Introduction
- Chapter 1: County Profile
- Chapter 2: Physical Environment, Land Use and Development
- Chapter 3: Hydrologic Inventory
- Chapter 4: Special Land Uses and Conditions
- Chapter 5: Issues, Goals, Objectives and Actions
- Chapter 6: Plan Administration

The introduction identifies the statutory components of a comprehensive water plan, a general overview of plan content and describes the planning process that was utilized in the development of the plan.

Chapter one provides a generalized profile of Meeker County. Information provided in this chapter includes the location of Meeker County, a population profile and a description of watershed management-like organizations within the County.

Physical environment, land use and development, which comprises chapter two, includes a profile and assessment of the County's existing environmental conditions. This profile contains descriptions of Meeker County's key natural resources, including information on the County's geology, topography, soils and watersheds. In addition, the County's physical development is outlined by examining current land use, major public investments (i.e. sewer, water, etc.) and conservation easements.

Chapter three, hydrologic inventory, contains information necessary to evaluate the condition of surface and groundwater resources in the County. The following information is included in this chapter: watershed boundaries, high, mean and low flows, established ordinary high water marks, permitted surface and groundwater withdrawals, conveyance systems and floodplains. In addition, both ground and surface water conflicts are identified in this chapter.

Chapter four, special land uses and conditions, inventories specific land uses that have the potential to impact water quantity and quality. Information discussed includes erodible soils, sedimentation, irrigation, drainage ditches, open dumps and landfills, feedlots, underground storage tanks, abandoned wells and hazardous waste generators. Wetlands, shoreland, and floodplains are presented in relation to existing conditions and current regulatory protection. Water-based recreation, fish and wildlife management and unique features and scenic areas conclude the chapter.

Issues, goals, objectives and actions comprise chapter five. This chapter reflects the purpose set forth in the Comprehensive Local Water Management Act and the desires of the County. Goals and objectives developed by the County define specific actions and provide a framework in which to address water management issues.

Chapter six contains information on plan administration, including plan coordination, implementation, schedule, role of the County in implementation, role of other agencies in implementation, recommended changes to State programs, intergovernmental conflicts/resolution process, major plan amendment procedure, minor plan amendment procedure and general information.

### **Description of the Planning Process**

A multiple step planning process was utilized in the development of this plan, with special emphasis placed on involving local constituents, local governments, bordering counties and State agencies. The initial phase of this process involved an informational meeting to identify issues and concerns of the public. Issues identified through the public informational meeting process were used to establish the basis for the development of goals, objectives and actions for the plan.

The second phase of this process involved the appointment of a special Water Plan Revision Committee. Members of the committee represented various local and State governmental units, private industries and special interests of the County. The committee was responsible for reviewing the comments from the public informational meeting and providing recommendations to the Water Plan Taskforce on the development of goals, objectives and actions for the plan.

Once in draft form, State and local agencies were provided a 60-day period to review the plan. Following this review period, the County held a public hearing. Upon conduction of the public hearing, the draft plan, State and local comments and proceedings of the public hearing were submitted to the Board of Water and Soil Resources (BWSR) for review and approval.

## **Executive Summary**

*Submitted by: Janice Manley, Meeker County Water Planner*

The Meeker County Comprehensive Local Water Plan (CLWP) was developed to identify and address issues surrounding water resources in the County. This involved the input of local constituents, local governments, bordering counties and State agencies. Once these issues were identified, an action plan was developed to deal with these issues.

The CLWP is reviewed annually by the County's Water Plan Taskforce, when it meets to prioritize the County's Natural Resource Block Grant (NRBG) funding requests in January. Proposed water planning activities and future needs are discussed and formalized at this meeting. The Water Plan Taskforce's recommendations are then forwarded to the County Board of Commissioners for approval.

### **Water Planning 1995 – 2000 Second Generation Accomplishments**

#### **EDUCATION AND INFORMATION**

The Meeker County Family Health Department participated in the following activities:

- Distributed test kits and well water brochures to pregnant women and families with newborns.
- Conducted public radio shows and submitted newspaper columns discussing well water testing and fish consumption advisories.
- Created a display for WIC/Immunization clinics.
- Distributed Fish Consumption Advisory at the County Fair, licensing sites, and Community Safety Fair.
- Provided onsite sewage education.

The Meeker County Extension Education Program participated in the following activities:

- Abandoned well education.
- Manure Management (Nonpoint Source) Education.
- Pesticide container pickup program.
- Distributed information on best management practices for farmers.
- Worked with the Meeker County Association of Lakes to produce a septic system handbook for lakeshore owners.
- Distributed information on nitrogen management for corn.
- Education efforts on shock chlorination for home water supplies.

## INVENTORY AND MAPPING

The Meeker County Planning and Zoning Office accomplished the following:

- Implemented a GIS mapping system.
- Mapped and computerized feedlot inventory information.
- Updated the Comprehensive Land Use Plan.
- Implemented base map pilot project for Litchfield Township.

## MONITORING/DATA COLLECTION

- Completed diagnostic/feasibility studies on Spring, Long, Dunns and Richardson Lakes.
- Monitoring efforts for Francis, Long, Minnie Belle, Collinwood and Stella Lakes.
- Infrared photography for Collinwood Lake.
- Purchased supplies and maintained countywide lake monitoring equipment.

## LAND AND WATER TREATMENT

- Cosmos Lake Park aeration project.
- Star and Thompson Lakes aeration projects.
- Phase II Lake Minnie Belle project.
- Create wetland and test sediment for Dunns and Richardson Lakes.
- Clear Lake Wetlands Restoration projects.
- Lake Washington holding pond.
- Spring and Long Lakes Phase II grant assistance.
- Implemented countywide hazardous waste disposal days.
- Restructured tile inlet on Lake Minnie Belle.
- Joined with the City of Litchfield to create a 24-hour waste oil disposal site.

## REGULATION AND PLANNING

- Revised Zoning Ordinance to incorporated environmental protections.
- Encouraged changes in ISTS Ordinance.
- Created Conservation Subdivision Ordinance.
- Updated the Meeker County Solid Waste Ordinance.
- Created and hired a zoning specialist position.
- Developed a Feedlot Ordinance.

## PLAN COORDINATION

- Participated in the Crow River Organization of Water

### Summary of Water Related Grants Received (1992-2001)

PROJECT/GRANT NAME	COMMENT	AMOUNT
1992-2001 NRBG Local Water Planning Grant	This Grant is less now than in 1992	\$327,000
1992-2001 NBG Meeker County Grant/Match	(1) County matches more now than 1992	\$48,000
1993-2001 NRBG Wetland Conservation Act	State required us to enforce the Act Grant is exact same as in 1993	\$157,100
1994-2001 NRBG DNR Shoreland	We have to enforce State rules/laws Grant is exact same as in 1994	\$43,464
1993 Water Quality Challenge Grant	Used money to do well water testing	\$1,700
1993 Lake Minnie Belle Clean Water Partnership	(2) Phase I Study	\$19,139
1997 Lake Minnie Belle Clean Water Partnership	(2) Used Phase II to implement projects	\$76,225
1997 Lake Minnie Belle MPCA ISTS Loan	(2) Loans available for non-conforming IST	\$150,000
1993 Long & Spring Lakes C. W. P.	(2) Phase I Study	\$33,484
1999 Long & Spring Lakes C. W. P.	(2) Used Phase II to implement projects	\$26,689
1999 Long & Spring Lakes C. W. P.	(2) Additional projects will be completed	\$57,270
2000 Long & Spring Lake 319 Grant	Lake Association received grant	\$6,000
1999 Dunns & Richardson Lakes C. W. P.	(2) Phase I Study	\$33,750
2001 Crow River Watershed C. W. P.	(2) 10 County Phase I	\$390,000
Revolving Loan & ISTS Ag BMPs	Loans and Grants thru SWCD	\$43,500
<b>TOTAL FUNDS RECEIVED</b>		<b>\$1,413,321</b>

In 1991, Meeker County had one employee in the Planning and Zoning Office. Today, the County has four employees: a full-time ISTS Inspector, a full-time Wetlands Act/Water Planner, a full-time Secretary and a Zoning Administrator. The grant monies to fund these positions have decreased since 1993. The County, through additional levy monies and increasing fees for services, has covered the increased burden created by State mandates, with regards to ISTS, feedlots and wetlands.

On February 5, 2002, the Meeker County Water Plan Taskforce held a public informational meeting regarding the revision and update of the Water Plan. This meeting provided the public and all local governmental units, as well as State agencies, an opportunity to present information and concerns about water-related issues that they believed should be considered in the revision of the Water Plan. Based upon issues discussed at the informational meeting, the Water Plan Taskforce established goals, objectives and action items for the Ten-Year Implementation Plan. The Water Plan Taskforce also identified five high priority goals to be achieved within the next

five years for the protection and management of water and land resources. The high priority goals, which comprise the Five-Year Focus Plan, consist of the following objectives:

- Decrease the nutrient and sediment concentration of surface water to the 50<sup>th</sup> percentile of the Western Corn Belt Plains and North Central Hardwood Forests Ecoregions.
- Bring 125 nonconforming ISTSs into compliance per year.
- Through education and regulation, protect shoreland areas within the County.
- Through education and regulation, preserve existing wetlands within the County.
- Provide educational and technical assistance to landowners to restore 750 acres of wetlands within the County.
- Increase opportunities for agency and public involvement in water resource management within the County.

The updated third generation Comprehensive Local Water Plan will serve to guide water planning in the County through the year 2012. During this time, opportunities will exist to amend goals, objectives and the work plan, as needed, to incorporate new data and address issues as they emerge. Meeker County will continue to build on its past accomplishments and encourage new programs and opportunities for the effective management and protection of its water and land resources.

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## CHAPTER ONE: MEEKER COUNTY PROFILE



*A view of Butternut Lake*

Chapter one provides a generalized profile of Meeker County. Information provided in this chapter includes the location of Meeker County, as well as a population profile assessing historic population levels and future population and household projections. Also included in this chapter is a profile of the County's watershed projects, clean water partnerships, watershed districts and lake associations.

### **Location of Meeker County**

Founded in 1856, Meeker County is located in central Minnesota, approximately 40 miles west of the Minneapolis-St. Paul Metropolitan Area. As Map 1A shows, there are 9 cities and 18 townships in the County. The City of Litchfield, located near the center of the County, is the County Seat. Meeker County is characterized by numerous lakes, rolling hills and vast agricultural land. The County shares borders with Stearns County to the north, Wright County to the east, McLeod County to the southeast, Renville County to the southwest and Kandiyohi County to the west.

### **Historic Population Levels**

One of the most important aspects of a county's population to analyze is the historic rate of growth or decline that has been experienced. Table 1A provides U.S. Census population data for Meeker County's cities, Meeker County and the State of Minnesota since 1960. Eight out of nine Meeker County cities have experienced positive growth during the past forty years. Only the City of Cedar Mills experienced a decline in population over that same time frame. As a whole, Meeker County experienced an overall growth of 3,757 residents (19.9%) since 1960. While this is a significant increase, it is less than half of the 44.1 percent growth rate the State of Minnesota experienced over the same time frame.

**Table 1A:  
Meeker County's  
Population since 1960**

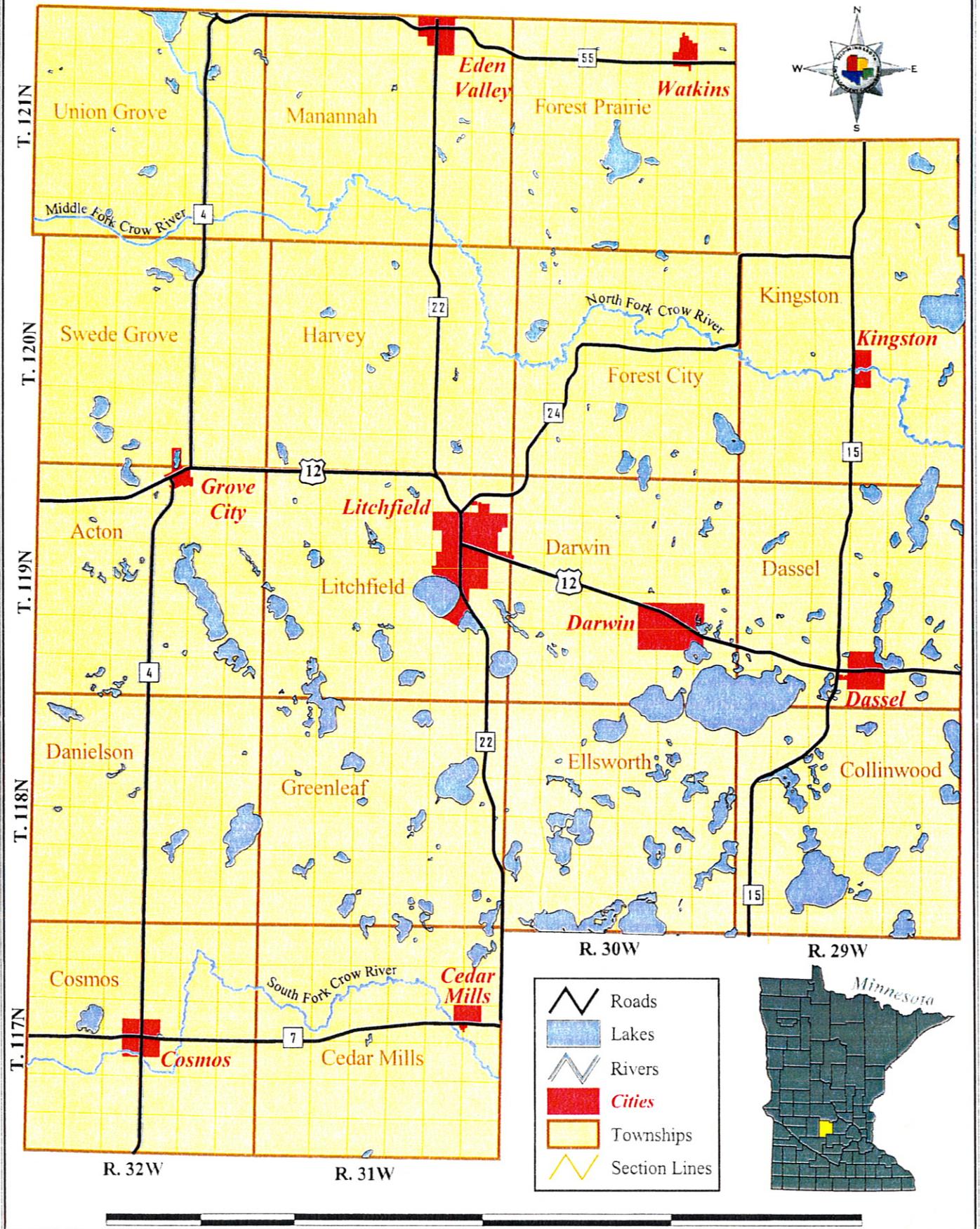
Area	U.S. Census Year					Change	
	1960	1970	1980	1990	2000	#	%
Cedar Mills	96	81	73	80	53	-43	-44.8%
Cosmos	487	570	571	610	582	95	19.5%
Darwin	273	361	282	252	276	3	1.1%
Dassel	863	1,058	1,066	1,082	1,233	370	42.9%
Eden Valley	793	776	763	732	866	73	9.2%
Grove City	466	531	596	547	608	142	30.5%
Kingston	NA	115	141	131	120	5	4.3%
Litchfield	5,078	5,262	5,904	6,041	6,562	1,484	29.2%
Watkins	744	785	757	849	880	136	18.3%
Meeker County	18,887	18,387	20,594	20,846	22,644	3,757	19.9%
State of Minnesota	3,413,864	3,804,971	4,075,970	4,375,099	4,919,479	1,505,615	44.1%

### Population Projections

Future population and household growth has tremendous implications on the quality and availability of water resources in Meeker County. As population and household numbers increase, so does the level of demand that is placed on water resources to meet the needs these individuals. If growth and development is properly planned, the impact on water resources will be minimized. However, if growth and development occurs unplanned and unchecked the overall carrying capacity of a water resource can be diminished to the point that it no longer suits the needs of the residents of the area.

Tables 1B and 1C provide population projections for Meeker County based on historic levels of population change since 1960. In addition to the historic-based projections (referred to as “based on the last 40 years”), the tables also include a population projection that is based on a fast annual rate of population gain. This projection represents 150 percent of the historic rate of growth. For example, if the County gained 1,000 people over the last 20 years, the fast population projection would estimate another 1,500 people over the next 20 years. The combination of historic and fast population projections provide a realistic range of possibilities that could occur in Meeker County over the next 20 years.

# Map 1A: Meeker County's Location, Cities and Townships



**Table 1B:  
City, Township and County Population Projections**

<b>Based on the Last 40 Years</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>Change</b>
Cities	11,478	11,775	12,073	12,370	1,190
Townships	11,636	11,809	11,981	12,153	689
Meeker County	23,114	23,584	24,053	24,523	1,879
<b>Based on "Fast" Growth</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>Change</b>
Cities	11,626	12,073	12,519	12,965	1,785
Townships	11,723	11,981	12,240	12,498	1,034
Meeker County	23,349	24,054	24,758	25,463	2,819

Tables 1B and 1C suggest that Meeker County would stand to gain an additional 1,879 residents and 728 households by the year 2020, if it simply experiences the same growth rate over the next 20 years, as it has since 1960. However, because of development pressure from the Minneapolis-St. Paul Metropolitan Area, the fast projection rates should be used for planning purposes. At this rate, Meeker County would gain an additional 2,819 residents and 1,091 households over the next 20 years. Regardless of how fast Meeker County's population expands, proper planning of growth and development will be essential to preserve the County's water and other natural resources.

**Table 1C:  
City, Township and County Household Projections**

<b>Based on the Last 40 Years</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>Change</b>
Cities (2.47 people/household)	4,647	4,767	4,888	5,008	483
Townships (2.82 people/household)	4,126	4,188	4,249	4,310	245
Meeker County (2.64 people/household)	8,773	8,955	9,137	9,318	728
<b>Based on "Fast" Growth</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2020</b>	<b>Change</b>
Cities (2.47 people/household)	4,707	4,888	5,068	5,249	724
Townships (2.82 people/household)	4,157	4,249	4,340	4,432	367
Meeker County (2.64 people/household)	8,864	9,137	9,408	9,681	1,091

## Economic Mainstays

According to Minnesota Department of Economic Security (MDES) statistics, there was an available workforce of 9,413 people in Meeker County in the year 2000. The total employment within the County during the same year was 8,968 people. As a result of the workforce being greater than the number of employment opportunities, a total of 445 people, or 4.7 percent of Meeker County's workforce was unemployed.

Table 1D displays the employment by industry for Meeker County for the year 2000. According to the MDES, there are four industries that comprise a majority of the County's employment base. These industries include: manufacturing (1,590), government (1,247), retail trade (1,137) and services (968). This is a noticeable change from past decades, when the agricultural industry was amongst the predominant employers in Meeker County. However, due to poor commodity prices, fewer farms and farmers farming larger acreages, the number of people employed in the agricultural industry has steadily declined. This trend is likely to continue over the next ten years, unless one or more of these factors changes.

**Table 1D:  
Meeker County Employment By Industry**

Industry	People Employed
Manufacturing	1,590
Government	1,247
Retail Trade	1,137
Services	968
Agriculture	849*
Wholesale Trade	419
Construction	309
Transportation, Communication, Utilities	289
Finance, Insurance, Real Estate	182
Mining	NA

\* 2000 U.S. Census figure

## Clean Water Partnerships/Watershed Projects

The Clean Water Partnership (CWP) Program was created in 1987 to address pollution associated with runoff from agricultural and urban areas. The program is funded by the Minnesota Pollution Control Agency (MPCA) and provides local governments with resources to protect and improve lakes, streams and groundwater.

CWP projects begin with a desire by a local government to improve a water resource that has been polluted by land-use-related activities. Local leadership and expertise, combined with technical and

financial resources from the State, create an effective program for controlling pollution and restoring water quality.

Funding for CWP is awarded in two phases. In the first, or resource investigation phase, a diagnostic study and implementation plan are completed. As part of the diagnostic study, local sponsors work with the MPCA to collect data and information on the water resource and its drainage area. This information is used to identify pollution problems and their causes and define water quality goals and objectives. The final step of the resource investigation phase is the development of an implementation plan that identifies the combination of education, management practices and other activities needed to protect or restore water quality.

The second phase, called project implementation, involves putting in place the best management practices (BMPs) identified in the first phase. BMPs may include sedimentation ponds, manure management, conservation tillage, terraces, new ordinances, wetland restoration, fertilizer management, education or other methods designed to reduce nonpoint source pollution.

Projects may be completed either partially or completely through the CWP program. To be eligible for CWP funding, the entire project must meet program requirements. This means that if the project sponsor intends to seek CWP funding for later phases (e.g., implementation), the MPCA must first approve a diagnostic study and an implementation plan.

The financial assistance available through the CWP program falls into two categories: grants and low-interest loans. Grants are available for up to 50 percent of project costs. Loans can only be used for the project implementation phase, and can cover the entire cost of implementation or supplement a grant. Local governments can also use loans to set up their own programs to provide pass-through loans to private parties. Local governments with the authority to generate cash revenues and adopt and enforce official controls are eligible to sponsor CWP projects and receive grant funding. To be eligible for a loan, a local government must also be able to secure the loan with a general obligation promissory note. In addition, the water of concern must be addressed in an approved local water plan.

According to the MPCA, there have been 7 CWP funded projects in Meeker County. A brief description of each of the projects is given below:

- ***Crow River Watershed Water Quality Enhancement Project*** (formal project title). A 319 Project. Major watershed: # 18 North Fork and # 19 South Fork. Project sponsor: Prairie Country Resource Conservation and Development Council, Randy Nelson, Willmar. Start date: October 1, 1999. End date: September 30, 2003. Grant amount: \$453,790. MPCA project manager: Roger Ramthum, Phone # (651) 296-9262.
- ***Crow Watershed Phase I Clean Water Partnership (CWP) Study*** (not formal project name). A phase I study for # 18 North Fork and # 19 South Fork of the Crow River. Project sponsors: Crow Joint Powers Board. Grant amount: \$398,415. MPCA project manager: Ken LaVoir, Brainerd, Phone # (218) 828-2668.

- ***Dunns and Richardson Lakes Phase I Study.*** A diagnostic/feasibility study. Start date: March 23, 1999. End date: March 22, 2002. Project representative/sponsor: Meeker County/Paul Virnig. Grant amount: \$33,750. MPCA project manager: Roger Ramthun, Phone # (651) 296-9262.
- ***Minnie Belle CWP Phase II continuation.*** A phase I diagnostic/feasibility study (EPA Clean Lakes Program money) was conducted from September 1991, through October 1997. CWP phase II Implementation start date: April 11, 1997. End date: April 10, 2001. Grant money spent: about \$50,000. Now working under a CWP phase II implementation (a CWP continuation). Start date: April 11, 2001. End date: April 10, 2004. Grant amount: \$43,500. This project has a State Revolving Fund (SRF) loan also. Loans are available for landowners in the Lake Minnie Belle watershed for septic systems and other best management practices. Loan amount: \$150,000. MPCA project manager: Roger Ramthun, Phone # (651) 296-9262.
- ***Long Lake and Spring Lake CWP Phase II Implementation*** (a continuation) and 319. CWP project sponsor/representative: Meeker County/Paul Virnig, Phone # (320) 693-5201. 319 project sponsor/representative: Dassel Area Environmental Association/Bob Pieti, Phone # (320) 275-2032 or Dan Carlson (320) 275-3166. CWP phase II grant amount: \$26,689. 319 grant amount: \$15,000. CWP phase II continuation grant amount: about \$65,000. MPCA project manager: Roger Ramthun, Phone # (651) 296-9262.
- ***Lake Ripley Clean Lakes Program Diagnostic/Feasibility Study.*** Start date: June 1, 1987. End date: September 30, 1993. Did not apply for further grants.
- ***Rice and Koronis Lakes Clean Lakes Program Phase I and Phase II Implementation grants.*** Both projects are believed to be completed. The Rice Lake and Koronis Lake watersheds are included in the Crow River Watershed Water Quality Enhancement Project and the Crow Watershed Phase I Clean Water Partnership (CWP) study. MPCA project manager: Pat Shelito, MPCA Brainerd, Phone # (218) 828-2493.

### **Crow River Organization of Water**

*Submitted by: Jenny Gieseke, Watershed Coordinator*

The Crow River Organization of Water (C.R.O.W.) is a Joint Powers Organization organized to preserve, protect and restore the Crow River. The C.R.O.W. Joint Powers Board was formed in 1999 and consists of one representative from each of the County Boards with land in the watershed (ten members in all). Counties involved within the organization include Carver, Hennepin, Kandiyohi, McLeod, Meeker, Pope, Renville, Sibley, Stearns and Wright.

The C.R.O.W. is currently working on a phase I diagnostic study for the entire watershed. Local, State and Federal agencies are cooperatively working with C.R.O.W. to conduct water quality monitoring on the Crow River from 2001 to 2003. The diagnostic study is needed in order to determine the extent to which rapid urban growth, new and expanding wastewater treatment facilities, erosion and drainage from agricultural lands and other land uses are affecting the Crow River.

The main objectives of the phase I diagnostic study are to:

- Identify water, nutrient and sediment loss rates along the Crow River.
- Identify river water quality patterns by river segment and tributary.
- Increase awareness among citizens and landowners in the watershed of water quality issues.

The study began in April of 2001 with the establishment of approximately 28 monitoring sites on the Crow River and its tributaries. The monitoring sites are set up and supervised through a cooperative effort between the C.R.O.W., the Minnesota Department of Natural Resources (DNR), Minnesota Pollution Control Agency (MPCA), North Fork of the Crow River Watershed District and the Buffalo Creek Watershed District. As part of the study, samples will be tested for total phosphorus, orthophosphate, ammonia, nitrite, nitrate, total suspended solids and total Kjeldahl nitrogen. A limited number of samples will also be tested for biological oxygen demand, fecal coliform bacteria, chloride, alkalinity, hardness, turbidity and chlorophyll a. A Sonde will be used to measure pH, dissolved oxygen, temperature and conductivity as well. The C.R.O.W. has also been working in cooperation with the MPCA to establish a Citizens Stream Monitoring Program focused on the Crow River. Approximately 35 volunteers have enrolled in the program so far.

When completed, the phase I diagnostic study should help to identify problem areas in the watershed and to identify site-specific best management practices (BMPs) that will maximize pollution reduction. Solutions will likely be applied to smaller, subwatersheds. The C.R.O.W. plans to work closely with local water planners, soil and water conservation districts (SWCDs) and Natural Resource Conservation Service (NRCS) offices to educate citizens and encourage the use of appropriate BMPs throughout the watershed. Potential projects could include buffer strips, filter strips, replacement of open tile inlets, wetland restorations, stormwater detention basins, upgrading of septic systems and agricultural feedlots, among others.

## **Watershed Districts**

### **North Fork of the Crow River Watershed District**

*Submitted by: Mark Schmisek, Water Quality Technician*

The North Fork of the Crow River (NFCR) Watershed District was formed in 1985. The boundaries for the NFCR Watershed District are based upon the hydrological boundaries of the North Fork Crow River. The District covers a total of 348 square miles within Kandiyohi, Meeker, Pope and Stearns Counties.

The mission of the District is to “improve and enhance water quality, to control water flow, to reduce erosion and sediment, to promote wise public, private and natural use of water, while maintaining, enhancing and preserving public and private drainage for present and future residents”.

A Phase I equivalent study of the area encompassed by North Fork of the Crow River Watershed District is being conducted for 2001-2002. The purpose of the study is to determine the sources of point and nonpoint pollution that degrade water quality within the boundaries of the District.

## **Sauk River Watershed District**

*Submitted by: James Loecken, District Administrator*

The Sauk River Watershed District (SRWD) was established in 1986. The primary purpose of the District is to protect and enhance the quality and quantity of surface and groundwater within its boundaries. Since the formation of the SRWD, there has been a significant reduction (approximately 50 percent) of phosphorus loading to the Sauk River. Through grants, State Revolving Loan Funds, as well as special assessments, the SRWD has spent nearly \$3 million in water quality projects. This does not include the technical and financial assistance from the local, State and Federal agencies (Planning and Zoning offices, Soil and Water Conservation Districts, Natural Resource Conservation Service, Board of Soil and Water Resources, Minnesota Department of Natural Resources, etc.) which exceeds several million dollars in the past 14 years. The SRWD has developed a strong partnership with the local, State and Federal agencies.

In 2000, the Minnesota Pollution Control Agency established a list of impaired waters. Numerous segments of streams and lakes within the Sauk River Watershed have been included on this list. To address this issue, the SRWD has formed a partnership with local, State and Federal agencies to develop a plan of action. The SRWD has also submitted grant applications to the state to obtain implementation funding. Local residents have also shown support of the efforts of the SRWD. In 2000, the District received over \$20,000 in cash pledges to clean up Sauk Lake and its tributaries and to purchase electronic monitoring equipment needed for water quality data collection. The SRWD is confident that these waters of concern will be improved with the help of local partners and residents.

The following are examples of projects that the SRWD has been involved with since its creation in 1986.

- Horseshoe Chain of Lakes, Big Sauk Lake, Osakis Lake and Big Fish Lake 314 & 319 Phase I Diagnostic Studies
- Big Birch Lake Phase I Diagnostic Study
- Big Birch Lake CWP Phase II A & B Implementation Projects
- Osakis Lake/Judicial Ditch 314 Phase II Implementation Project
- Osakis Lake CWP Phase II A & B Implementation Projects
- Big Sauk Lake 319 Phase II Implementation Project
- Sauk River Chain of Lakes CWP Phase II A & B and 319 Phase II Implementation Projects
- Ashely & Hoboken Creek 319 Phase II
- Grand Lake Preliminary Study
- Sauk Lake Dam, Phase I and II
- Kranz Lake Dam
- Birch Lake Dam
- County Ditch 6, Judicial Ditch 1 and County Ditch 11 Maintenance
- Sauk Lake Weed Harvester

## **Clearwater River Watershed District**

*Submitted by: Merle Anderson, District Administrator*

Formed in 1975, the Clearwater River Watershed District (CRWD) has worked to protect the region's lakes and streams, as well as protect and promote the regions economic mainstays, farming and tourism. The CRWD has worked with State and local officials and residents to reduce or eliminate the sources of point and nonpoint source pollution. The following is a listing of projects the CRWD has been involved with to reduce pollution and improve water quality in the region:

- Pheasant Lake Outlet
- School Section Lake Outlet
- Clear Lake Project
- Eurasian Watermilfoil Control Project
- Rough Fish Control and Removal Structure
- Clear Lake Wetland Outlet Control Structure
- Clear Lake Sedimentation Basin
- Bog Control
- Hidden River Sewer and Wastewater Treatment
- Clearwater River Chain of Lake Restoration Project

To monitor the effectiveness of projects, the CRWD collects surface water samples throughout the watershed. Samples are tested for parameters such as: total phosphorus, coliform bacteria, chlorophyll-a and water clarity. Water clarity within Watershed is monitored with help from area citizens, who monitor and record readings at designated locations.

Despite significant progress towards reducing pollutant sources within the Clearwater River Watershed, phosphorus from private septic systems remains a key issue facing the CRWD. CRWD believes that the installation of a sanitary sewer system will reduce existing nutrient pollution by replacing failing private septic systems. The Clearwater River Chain of Lakes Master Sanitary Sewer Plan explores various options and alternatives for sanitary sewer installation. The report also provides a conceptual framework to provide sanitary sewer service to various lakeshore developments within the CRWD boundaries.

### **Lake Associations**

A lake association is an organized group of people who have come together because of their common interest in a specific lake. Lake associations serve as an organized voice of their members to township and county government and are often a watchdog for enforcement of local ordinances. Associations may also monitor the condition of a lake, develop lake management plans, educate shoreland property owners about individual and collective actions to protect a lake and provide volunteers to assist in lake and watershed projects. They may also work with the Department of

Natural Resources (DNR) to improve fish habitat or fish stocking, get permits for aquatic plant removal, maintain lake accesses or implement lakeshore stabilization projects.

Table 1E details the 15 lake associations that have been formed in Meeker County. A contact has been provided for each lake association for additional information.

**Table 1E:  
Meeker County Lake Associations**

<b>Association</b>	<b>Contact</b>	<b>Association</b>	<b>Contact</b>
<i>Meeker County Association of Lakes</i>	Dan Fitterer (Pres.) 61998 190 <sup>th</sup> Street Litchfield, MN 55335	<i>Koronis Lake Association</i>	Peter Jacobson (Pres.) 16077 Lake Koronis Road Paynesville, MN. 56362
<i>Big Swan Area Lake Association</i>	Jean Lannes (Pres.) 27465 742 <sup>nd</sup> Avenue Dassel, MN 55325	<i>Long Lake Association of Grove City</i>	Bradley Bird (Pres.) 24610 548 <sup>th</sup> Avenue Grove City, MN. 56243
<i>Clear Lake Property Owners, Inc.</i>	Dick Struckman (Pres.) 65242 365 <sup>th</sup> Street Watkins, MN. 55389	<i>Manuella Lake Association</i>	Larry Graf 21107 CSAH 9 Darwin, MN. 55324
<i>Collinwood Lake Improvement Association</i>	Marvin Granath (Pres.) 21871 748 <sup>th</sup> Avenue Dassel, MN. 55325	<i>Lake Minnie Belle Improvement Association</i>	Roger Jergens (Pres.) 20055 624 <sup>th</sup> Avenue Litchfield, MN. 55355
<i>Dassel Area Environmental Association</i>	Robert Pieti (Pres.) 23768 727 <sup>th</sup> Avenue Dassel, MN. 55325	<i>Meeker County Star Lake Association</i>	Jens Peterson (Pres.) 57943 226 <sup>th</sup> Street Litchfield, MN. 55355
<i>Dunns and Richardson Lake Association</i>	Doug Peterson (Pres.) 66558 CSAH 11 Darwin, MN 55324	<i>Lake Stella Association</i>	Kim Keithahn (Pres.) 22117 CSAH 14 Darwin, MN. 55324
<i>Lake Francis Area Recreation and Conservation Club, Inc.</i>	Rod Conrad (Pres.) 32486 742 <sup>nd</sup> Avenue South Haven, MN. 55382	<i>Lake Washington Improvement Association</i>	Kim Winter (Pres.) 22801 705 <sup>th</sup> Avenue Dassel, MN. 55325
<i>Lake Jennie Improvement Corporation</i>	Sheila Steffen (Pres.) 71840 CSAH 18 Dassel, MN. 55325		

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## CHAPTER TWO: MEEKER COUNTY'S PHYSICAL ENVIRONMENT, LAND USE AND DEVELOPMENT

This chapter profiles many of Meeker County's key natural resources, including sections on the County's geology, topography, soils and watersheds. In addition, the County's physical development is outlined by examining current land use, major public investments (i.e., sewer, water, etc.) and water resource easements.

Chapter two includes information on the following data items:

<i>Data Item</i>	<i>Page</i>
1. Precipitation Gauging Stations .....	2
2. Total Annual Precipitation .....	2
3. Seasonal Precipitation .....	2
4. Hydrogeology .....	6
5. Ground and Surface Water Interconnections, Recharge and Discharge Areas .....	8
6. Watersheds.....	9
7. State Public Waters, Drainage Ditches, Dams and Control Structures .....	12
8. Soils .....	16
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10. Original Vegetation .....	24
11. Topographic Description of Watersheds .....	25
12. Land Use.....	26
13. Public Water, Storm and Sanitary Sewer Systems .....	31
14. Community Public Water Supply Wells and Intakes .....	33
15. Land Ownership .....	36
16. Water Resource and Related Easements.....	38
Expected Changes to Physical Environment, Land Use and Development .....	42

**Precipitation Gauging Stations (*Data Item 1*),  
Total Precipitation (*Data Item 2*), and  
Seasonal Precipitation (*Data Item 3*)**

Because of its location near the center of North America, Meeker County is subject to a variety of air masses that affect the amount of precipitation that falls within the County. During the winter months, cold, dry continental polar air dominates the region. Hot, dry continental tropical air masses from the desert southwest, along with warm, moist maritime tropical air masses that originate over the Gulf of Mexico, are common during the summer months. The spring and fall months serve as transition periods between summer and winter, composed of alternate intrusions of air from various sources.

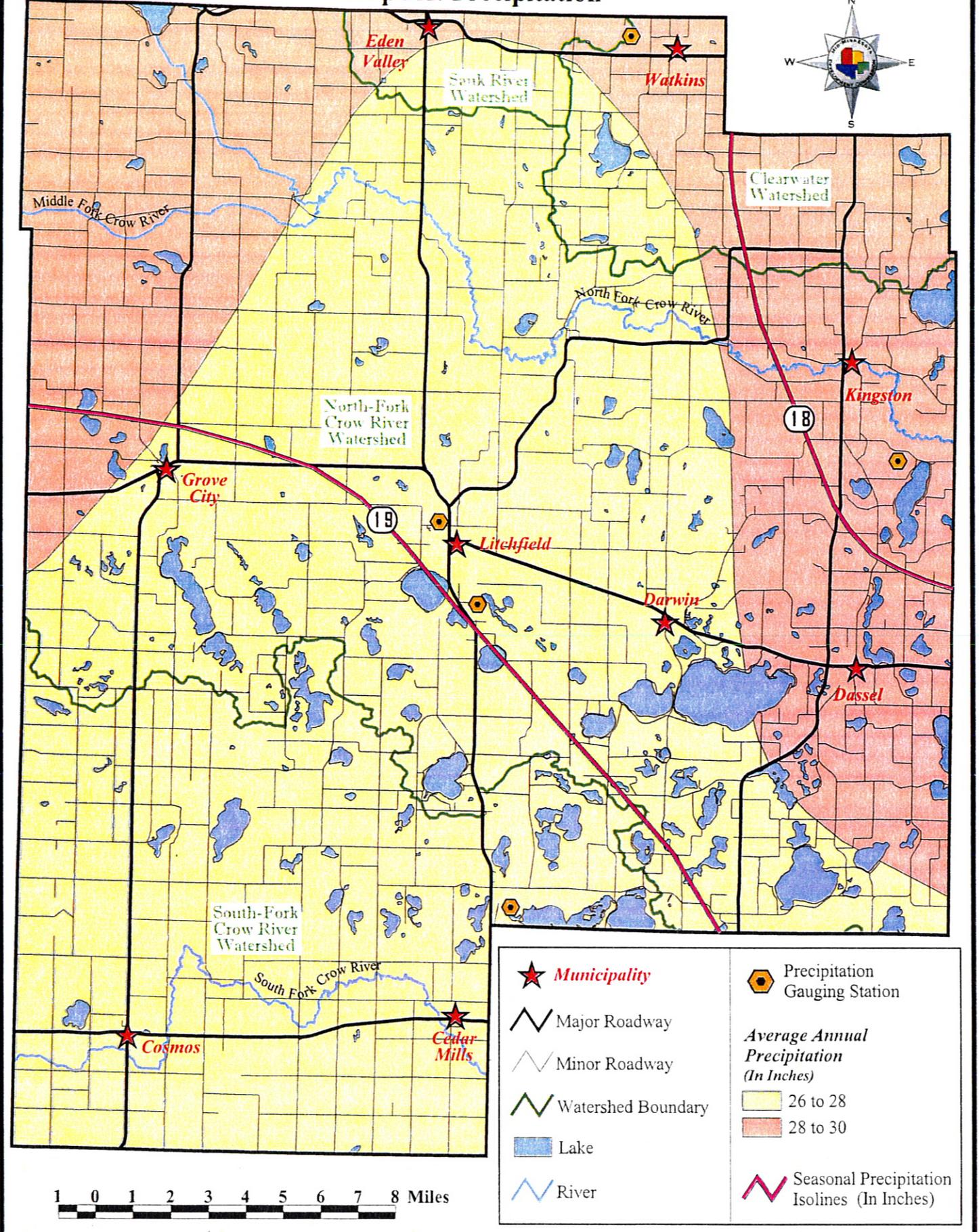
Precipitation within Meeker County is monitored through an interagency cooperative effort between the Minnesota Department of Natural Resources (DNR), the Meeker County Soil and Water Conservation District (SWCD) and the National Weather Service (NWS). The Meeker County SWCD and the NWS are responsible for recording and compiling precipitation data at the local level. Once information is collected, it is then forwarded to the DNR, State Climatology Office, where it is further analyzed and entered into a Statewide database.

According to Table 2A, there were five precipitation gauging stations in operation in Meeker County during the 2001 monitoring year. The Meeker County SWCD had a network of four precipitation gauging stations, while the NWS had one monitoring station. The geographic location of each of these stations can be found in Map 2A.

**Table 2A:  
Meeker County Precipitation Gauging Stations**

<b>Network Type</b>	<b>Township</b>	<b>Range</b>	<b>Section</b>
Meeker County SWCD	T118N	R30W	31
National Weather Service	T119N	R31W	11
Meeker County SWCD	T119N	R31W	24
Meeker County SWCD	T120N	R29W	35
Meeker County SWCD	T121N	R30W	3

# Map 2A: Precipitation



In addition to detailing the location of precipitation monitoring stations, Map 2A also depicts the total annual and seasonal precipitation averages for Meeker County. The information that was used to create the total precipitation portion of the map is based upon precipitation data from 1961 through 1990 (The Minnesota DNR, State Climatology Office has yet to update their maps to reflect data from 1991 to 2002). Isolines for total precipitation are given in two-inch increments. In general, the northeastern and northwestern portions of Meeker County receive between 28 and 30 inches of precipitation, while the remainder of the County receives between 26 and 28 inches of total precipitation.

Table 2B details the monthly and annual precipitation averages for the only National Weather Service precipitation gauging station in Meeker County. This is the only station within the County that has updated precipitation averages that reflect data through 2000. The average annual precipitation for the Litchfield station (28.56 inches) generally coincides with Map 2A, with the central portion of the County receiving between 26 and 28 inches of total precipitation.

**Table 2B:  
Monthly and Annual Precipitation Averages for the Litchfield  
National Weather Service Precipitation Gauging Station (1971-2000)**

Month	Average Precipitation (inches)
January	0.79"
February	0.67"
March	1.55"
April	2.35"
May	3.37"
June	4.89"
July	4.02"
August	3.67"
September	2.92"
October	2.15"
November	1.50"
December	0.68"
<b>Annual Average</b>	<b>28.56"</b>

*Source: Information was derived from *Climatology of the United States No. 81* – a National Oceanic and Atmospheric Administration publication.*

Seasonal precipitation, the total precipitation of the months of May through September, is shown with isolines on Map 2A. This portion of the map is based upon data collected from 1990 to 2001. The average seasonal precipitation for this time frame was approximately 19.2 inches, or approximately 69 percent of the total precipitation for the County. This is a slight increase from the figures given in the *1990 Meeker County Comprehensive Local Water Management Plan*, in which

it was stated seasonal precipitation within the County was approximately 18 inches, or 67 percent of the total precipitation.

The presence of moist versus dry air masses helps to determine the atmosphere's ability to absorb water vapor evaporating from soil and surface water, as well as transpiring from leaf surfaces. The combination of both of these processes is termed "evapotranspiration". West central Minnesota, which is more frequently under dry air masses, generally has higher evapotranspiration rates than eastern Minnesota.

Figure 2A displays that the majority of Meeker County is located in the transitional zone between the semi-arid climate regime of western Minnesota and the semi-humid climate regime of eastern Minnesota. In this zone average annual precipitation equals average annual evapotranspiration, thus leading to an overall balance of water inputs and outputs.

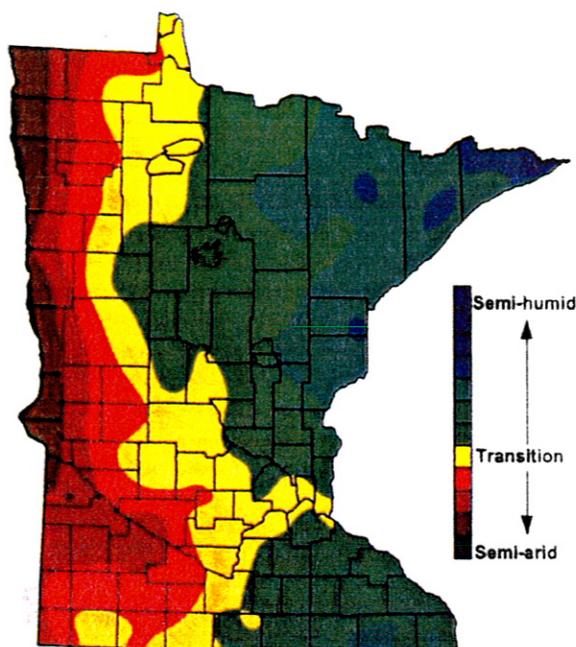


Figure 2A: Precipitation minus Evapotranspiration

According to the Minnesota DNR, total annual snowfall within Meeker County is approximately 44 inches. Snowfall within the County is generally greatest in the northern reaches, where annual snowfall is upwards of 48 inches. Although the average annual snowfall total for Meeker County is nearly four feet, this form of precipitation is only a small portion of the County's total annual precipitation. This is a result of the relatively low moisture content of snow. According to Table 2B, the Litchfield NWS precipitation gauging station received only 12.9 percent of its annual precipitation during the winter months of December through March. Even though only a small portion of the total annual precipitation actually falls during the winter months, flooding can occur in the spring as a result of a number of factors, including: a deep, late winter snow pack, frozen soil prohibiting the infiltration of water, rapid snow melt due to an intrusion of warm air and heavy early spring precipitation.

#### References:

Minnesota Department of Natural Resources, Division of Waters, State Climatology Office  
National Oceanic and Atmospheric Administration

## **Hydrogeology** **(Data Item 4)**

Aquifers are defined as water-bearing porous soil or rock strata that yield significant amounts of water to wells. An aquifer must have the following two properties:

1. The aquifer formation must be porous, such as sand and gravel or cracks and fractures in more solid rock, and
2. Water must be able to flow through and out of the formation in quantities large enough to be significant.

There are two principal aquifers in Meeker County: outwash and bedrock. Map 2B shows the general location of each aquifer type, as well as approximate yield rates. Notice that a majority of the outwash aquifers are located along the North and South Forks of the Crow River.

### **Outwash Aquifers**

Outwash aquifers can be subcategorized into surficial-drift aquifers and buried-drift aquifers. Surficial-drift aquifers are made up of sand or gravel deposits located at or near ground level. These aquifers are generally unconfined and have well depths ranging from 30-240 feet deep, with yields ranging from 25-500 gallons per minute. The water is generally of good quality. These aquifers have high concentrations of iron and manganese in some areas. Nitrate contamination is also present in some areas.

Buried-drift aquifers are composed of sand or gravel deposits located within thick drift and are generally confined. Well depths in these aquifers range from 80-380 feet deep, with yields of approximately 25-500 gallons per minute. Water from these aquifers is generally hard due to the presence of iron. High concentrations of sulfate and chloride are also present in some areas.

### **Bedrock Aquifers**

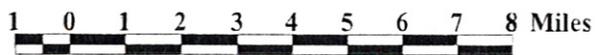
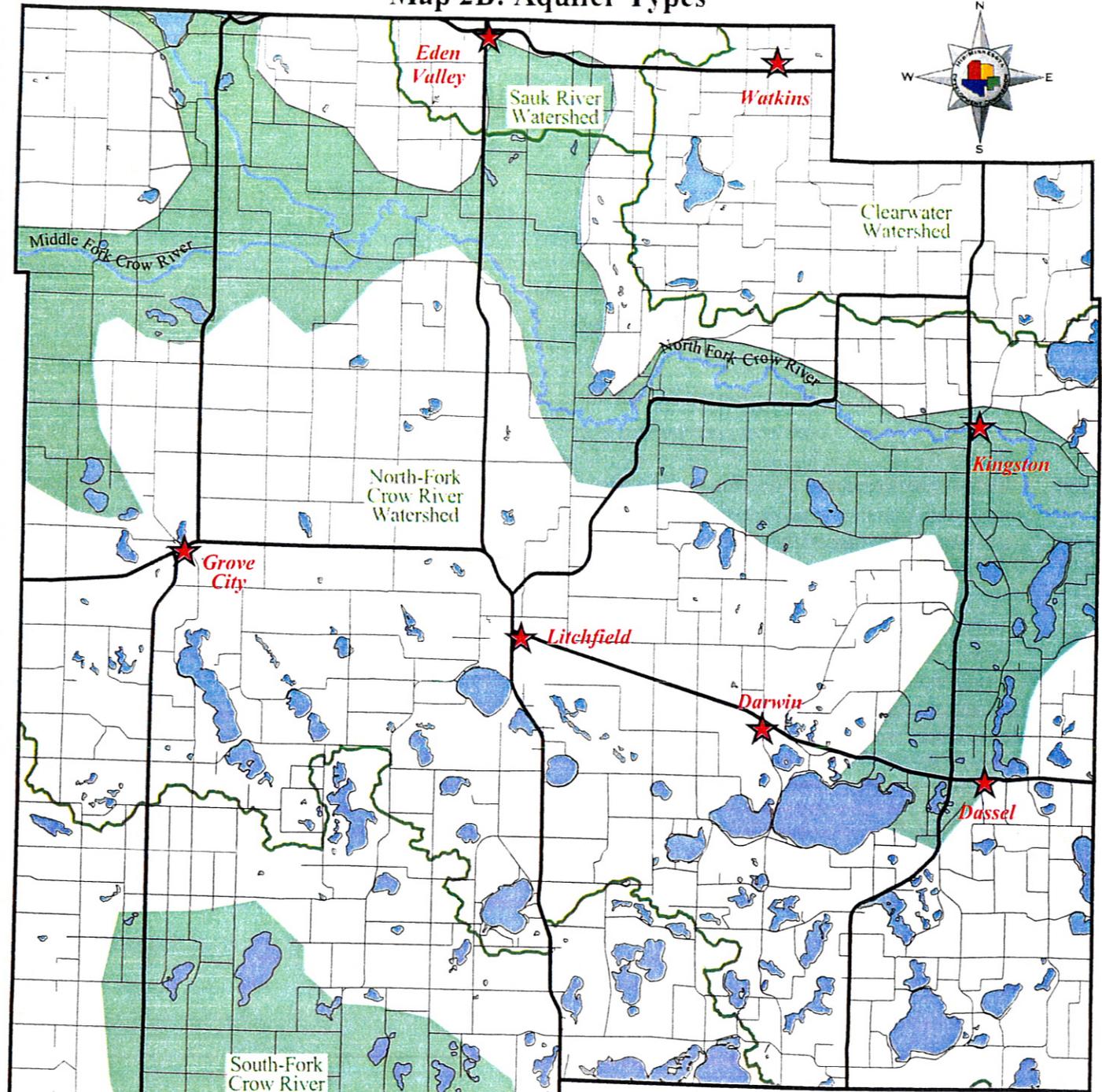
Bedrock aquifers consist of two types in Meeker County: Cretaceous aquifers and Precambrian igneous and metamorphic aquifers. Cretaceous aquifers are made up of sandstone lenses near the base of a predominant shale section. The water associated with these aquifers is commonly hard and is generally confined. Large sulfate, chloride and dissolved solids concentrations exist in many areas.

Precambrian igneous and metamorphic aquifers are undifferentiated and are not typically aquifers, except in faults and fractures. These aquifers can yield water from interflow sediments and from joints and fractures in basalt.

The depth to bedrock in Meeker County is at least 200 feet; as a result, bedrock wells must be at least 200 feet deep. According to the Minnesota Geological Survey (MGS) well records for Meeker County, Cretaceous aquifers typically have well depths that range between 200 to 450 feet and have a yield range of 10 to 250 gallons per minute.

**References:** Minnesota Geological Survey, United States Geological Survey

# Map 2B: Aquifer Types



<b>Municipality</b>	
Major Roadway	
Minor Roadway	
Watershed Boundary	
Lake	
River	
<i>Aquifer Types</i>	
	Bedrock (10-250 gpm)
	Outwash (25-500 gpm)

**Ground and Surface Water Interconnections,  
Recharge and Discharge Areas  
(Data Item 5)**

Many areas in Meeker County are considered to be recharge areas. These are areas where surficial sands and gravel deposits receive and hold relatively large amounts of precipitation, slowly releasing it throughout the year into streams and other water features. Till deposits receive the same amount of precipitation, but have a lower recharge rate because their higher clay content makes them less permeable to infiltration. In areas of till deposits, most of the precipitation runs off overland into streams and lakes.

In areas where the parent material is glacial till, aquifers are confined sand and gravel layers that vary in thickness. Some layers are too thin to provide the desired quantity of water. Generally, the thicker the layer, the higher the water yield. These aquifers occur in a random pattern and can vary within short distances. Some are under pressure and function as artesian wells if tapped. Most are under less pressure, thus water cannot rise or rises only partially up the well casing. Once aquifers are tapped, they generally provide an ample and dependable supply of water, but may be depleted if the withdrawal rate exceeds the recharge rate. This is often the case during periods of drought.

Domestic wells in glacial outwash areas are generally shallow and tap only the surface aquifers. The base of these aquifers generally rests on the top of buried glacial till. They generally do not yield the quantity of water needed for large irrigation systems. Deeper aquifers within the underlying glacial till are often tapped for this purpose. Some wells in the County are more than 400 feet deep and have tapped water within fractured or eroded bedrock.

Shallow groundwater in surficial aquifers flows toward and discharges into streams and rivers. Regionally groundwater flow is usually parallel to the flow direction of major rivers. Watersheds and groundwater movement are interrelated in flow direction.

**References:**

Minnesota Geological Survey  
United States Geological Survey

## **Watersheds** *(Data Item 6)*

Meeker County is located within four major watersheds: the Clearwater River, North Fork of the Crow River, Sauk River and South Fork of the Crow River. All of these watersheds are a part of the larger Mississippi River Drainage Basin. Map 2C shows the location of Meeker County's four major watersheds, along with their corresponding minor watersheds. Table 2C lists the area of each major and minor watershed in square miles. Each of the County's major watersheds is briefly described below, along with information on surface flow patterns.

**The Clearwater River Watershed** covers approximately 47.8 square miles of northeastern Meeker County. Major waterbodies within this watershed include Lake Betsy and Clear Lake. This major watershed is divided into 5 minor watersheds, with a general flow direction to the east. Cultivated agricultural land is the predominant land use. The City of Watkins is located within the Clearwater River Watershed.

**The North Fork of the Crow River Watershed** is the largest watershed in Meeker County, covering approximately 421.4 square miles. The major waterbodies in this watershed are Big Swan, Jennie, Long, Stella, Ripley and Washington Lakes, as well as the North Fork of the Crow River. This major watershed is divided into 27 minor watersheds, with a general flow direction to the south. Cultivated agricultural land is the predominant land use. The cities of Kingston, Grove City, Litchfield, Darwin and Dassel are located within the North Fork Crow River Watershed.

**The Sauk River Watershed** covers approximately 15.8 square miles of northern Meeker County. There are no major waterbodies within the watershed. The watershed is divided into 3 minor watersheds, with a general flow direction to the north. Cultivated agricultural land is the predominant land use. The City of Eden Valley is located within the Sauk River Watershed.

**The South Fork of the Crow River Watershed** covers approximately 159.5 square miles of the south and southwestern portions of Meeker County. Major lakes within the watershed include Belle, Greenleaf, King and Thompson, as well as the South Fork of the Crow River. This major watershed is divided into 21 minor watersheds, with a general flow direction to the southeast. Cultivated agricultural land is the predominant land use. The cities of Cedar Mills, Corvuso and Cosmos are located in the South Fork of the Crow River Watershed.

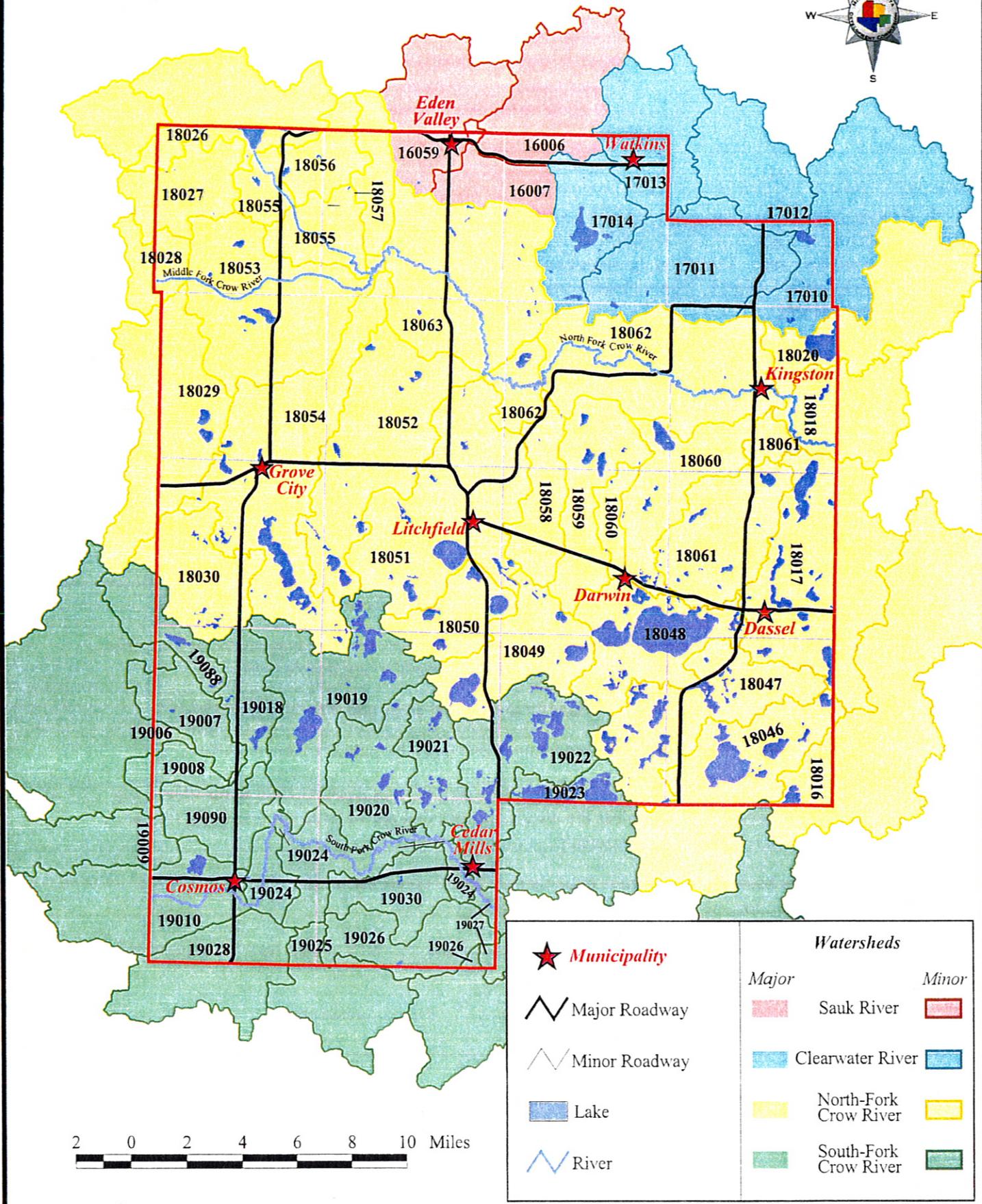
### **Reference:**

Minnesota Department of Natural Resources, Division of Waters

**Table 2C:  
Major and Minor Watersheds by Area**

Major Watershed Name	Area (mi <sup>2</sup> )	Major Watershed Name	Area (mi <sup>2</sup> )
Minor Watershed # (Name)		Minor Watershed # (Name)	
Clearwater River	47.8	18060 (Unnamed)	17.4
17010 (Clearwater River)	7.4	18061 (Unnamed)	19.0
17011 (Clearwater River)	21.5	18062 (North Fk. Crow R.)	34.1
17012 (Willow Creek)	0.8	18063 (North Fk. Crow R.)	31.6
17013 (Co. Ditch #20)	5.1	Sauk River	15.8
17014 (Co. Ditch #44)	13.0	16006 (Vails Lake)	4.2
North Fork of the Crow River	377.6	16007 (Creek to Vails Lake)	7.0
18016 (Sucker Creek Cont.)	3.5	16059 (Long Lake)	4.6
18017 (Clearwater River)	19.8	South Fork of the Crow River	159.5
18018 (North Fk. Crow R.)	5.4	19006 (South Fk. Crow R.)	1.6
18020 (Eagle Creek)	4.4	19007 (Creek to Ditch #18)	6.9
18026 (Lake Koronis)	4.6	19008 (Jud. Ditch #18)	3.3
18027 (Lake Koronis)	7.8	19009 (South Fk. Crow R.)	1.4
18028 (Middle Fk. Crow R.)	2.6	19010 (South Fk. Crow R.)	9.3
18029 (Co. Ditch #47)	13.7	19018 (Belle Creek)	8.3
18030 (Co. Ditch #26)	12.3	19019 (King Creek)	24.7
18046 (From Maple Lake)	14.7	19020 (South Fk. Crow R.)	13.4
18047 (Silver Creek)	20.6	19021 (South Fk. Crow R.)	8.8
18048 (Lake Washington)	17.4	19022 (South Fk. Crow R.)	19.3
18049 (Lake Washington)	15.3	19023 (Cedar Lake)	4.0
18050 (Jewett Creek)	9.2	19024 (South Fk. Crow R.)	16.8
18051 (Jewett Creek)	31.6	19025 (Boon Lake)	2.1
18052 (North Fk. Crow R.)	27.2	19026 (South Fk. Crow R.)	10.4
18053 (Middle Fk. Crow R.)	27.4	19027 (South Fk. Crow R.)	1.4
18054 (Grove Creek)	35.4	19028 (Jud. Ditch #29)	6.5
18055 (North Fk. Crow R.)	12.2	19029 (South Fk. Crow R.)	0.4
18056 (North Fk. Crow R.)	5.7	19030 (Co. Ditch #18)	8.4
18057 (Stag Bk.)	5.0	19032 (Bear Creek)	0.1
18058 (Unnamed)	9.4	19088 (Lake Elizabeth)	3.4
18059 (Unnamed)	13.7	19090 (Jud. Ditch #18)	9.1

# Map 2C: Major and Minor Watersheds



		Watersheds	
		Major	Minor
★ Municipality		Sauk River	Sauk River
≡ Major Roadway		Clearwater River	Clearwater River
≡ Minor Roadway		North-Fork Crow River	North-Fork Crow River
■ Lake		South-Fork Crow River	South-Fork Crow River
≡ River			

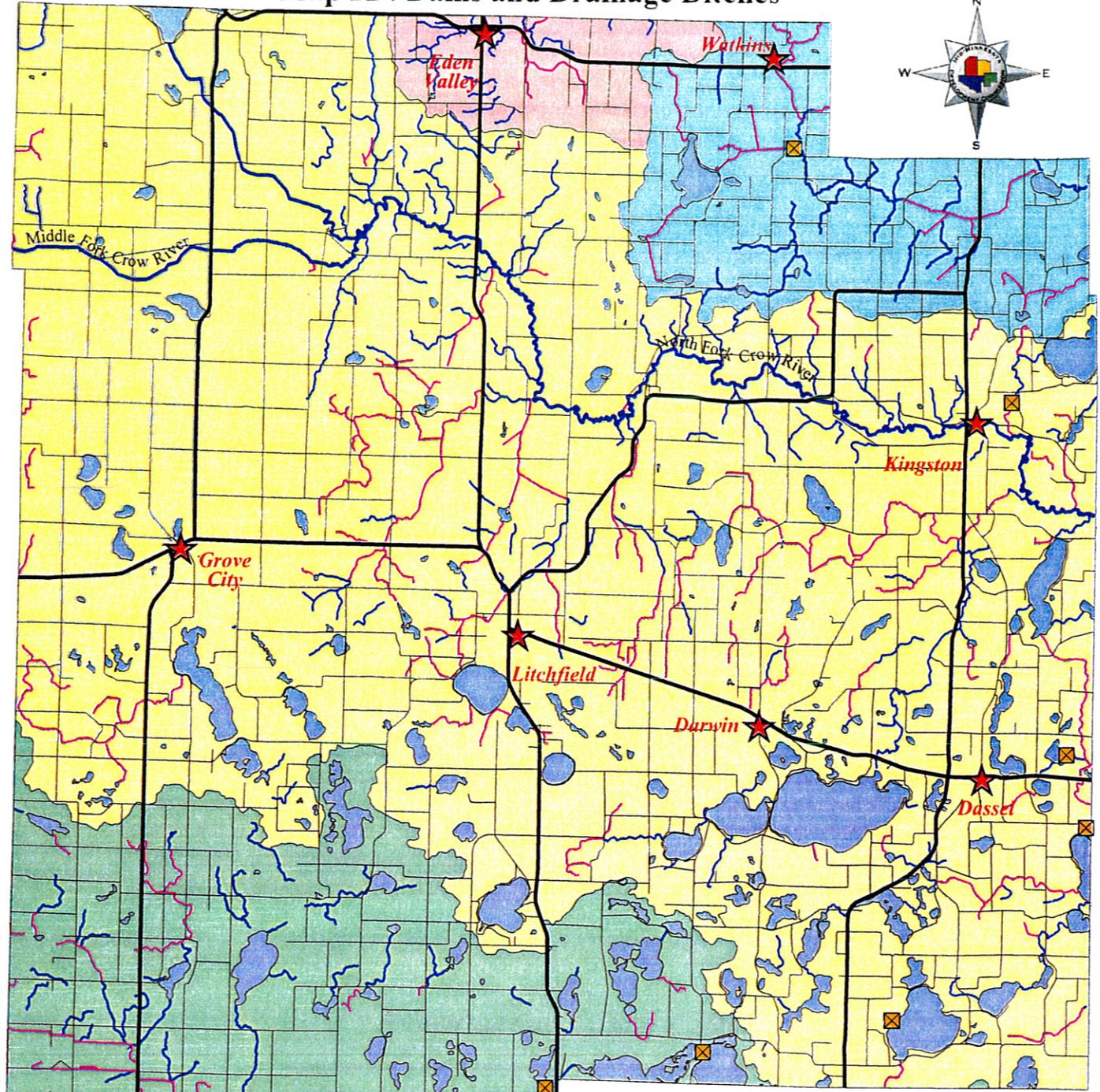
**State Public Waters, Drainage Ditches,  
Dams and Control Structures**  
*(Data Item 7)*

**Public Waters**

Public Waters are designated as such to indicate which lakes, wetlands and watercourses the Minnesota Department of Natural Resources (DNR), Division of Waters has regulatory jurisdiction over. The statutory definition of Public Waters can be found in Minnesota Statute 103G, Subdivision 15. The following waterbodies and watercourses are given such a classification:

- All types 3, 4 and 5 wetlands (as defined in U.S. Fish and Wildlife Service Circular No. 39, 1971 ed.) that are 10 acres or more in size in unincorporated areas or 2 ½ acres or more in size in incorporated areas;
- Water basins assigned a shoreline management classification by the Commissioner of the DNR, under sections 103F.201 to 103F.221, except wetlands less than 80 acres in size that are classified as natural environment lakes;
- Waters of the State which have been determined to be public waters or navigable waters by a court of competent jurisdiction;
- Meandered lakes, excluding lakes that have been legally drained;
- Water basins previously designated by the Commissioner for management for a specific purpose, such as trout lakes and game lakes pursuant to applicable laws;
- Water basins designated as scientific and natural areas under Section 84.033;
- Water basins located within and totally surrounded by publicly owned lands;
- Water basins where the State of Minnesota or the Federal government holds title to any of the beds or shores, unless the owner declares that the water is not necessary for the purposes of the public ownership;
- Water basins where there is publicly owned and controlled access that is intended to provide for public access to the water basin;
- Natural and altered watercourses with a total drainage area greater than two square miles in area;
- Natural and altered watercourses designated by the Commissioner as trout streams; and
- Public Waters wetlands, unless the statute expressly states otherwise.

# Map 2D: Dams and Drainage Ditches



<b>Municipality</b>	Dam
Major Roadway	Drainage Ditch
Minor Roadway	Stream/River
Lake	<b>Watersheds</b>
	Sauk River
	Clearwater River
	North-Fork Crow River
	South-Fork Crow River



The regulatory boundary for State Public Waters is the Ordinary High Water Level (OHWL), which is determined by DNR field technicians. Under Minnesota Statute 103G.245, Subdivision 1 (except as provided in Subdivisions 2, 11 and 2), the State, a political subdivision of the State, a public or private corporation, or a person must obtain a public waters work permit to do the following:

1. Construct, reconstruct, remove, abandon, transfer ownership of, or make any change in a reservoir, dam, or waterway obstruction on public waters; or
2. Change or diminish the course, current, or cross section of public waters, entirely or partially within the State, by any means, including filling, excavating, or placing of materials in or on the beds of public waters.

Detailed Public Waters maps are available for viewing at applicable county auditors offices, DNR Waters regional and area offices, DNR area fisheries offices, county Soil and Water Conservation District offices and planning and zoning offices. A listing of Public Waters in Meeker County with a DNR approved shoreland classifications can be found under data item 46.

### **Drainage Ditches**

Map 2D details Meeker County’s drainage ditch system. A breakdown of the miles of drainage ditch per Meeker County watershed is given in Table 2D. The two largest watersheds within Meeker County, the North Fork of the Crow River (132.5 mi.) and South Fork of the Crow River (55.2 mi.) watersheds, have moderate to extensive drainage ditch systems. Fine textured soils, with low to moderate infiltration rates, are found throughout the area, making drainage critical to agricultural production. The remaining two watersheds, the Clearwater River (22.1 mi.) and Sauk River (4.2 mi.), have slightly less extensive drainage systems. Soils in the northern portion of Meeker County are generally coarser in texture, resulting in higher infiltration rates and a reduced need for drainage for agricultural production. For detailed ditch maps and related information, please contact the Meeker County Soil and Water Conservation District or the Meeker County Highway Department.

**Table 2D:  
Miles of Drainage Ditch per Watershed**

Watershed	Miles of Drainage Ditches
Clearwater River	22.1
North Fork of the Crow River	132.5
Sauk River	4.2
South Fork of the Crow River	55.2
<b>Total</b>	<b>214.0</b>

## Dams and Control Structures

Map 2D also displays the 7 water level control structures in Meeker County that have been classified as dams and have been assigned a hazard potential by the DNR. A dam's hazard potential is rated 1 to 3 (1 being the highest risk). The lower the rating a dam receives, the higher the risk for structural, economic and human life loss if it were to fail. Table 2E lists the County's dams and their associated DNR hazard potential rating. All seven of the structures in Meeker County have been classified as having a hazard potential rating of 3 (the safest rating).

**Table 2E:  
Meeker County Dams**

DNR ID	Name	Section	Township	Range	Hazard Potential
MN00059	Collinwood Lake	1	118N	29W	3
MN01182	Belle Lake	34	118N	30W	3
MN01183	Clear Lake	13	121N	30W	3
MN01184	Francis Lake	14	120N	29W	3
MN01185	Hoff Lake	1	117N	31W	3
MN01186	Washington Lake	29	118N	29W	3
MN00988	Mud Lake Restoration	25	119N	29W	3

### Reference:

Minnesota Department of Natural Resources, Division of Waters

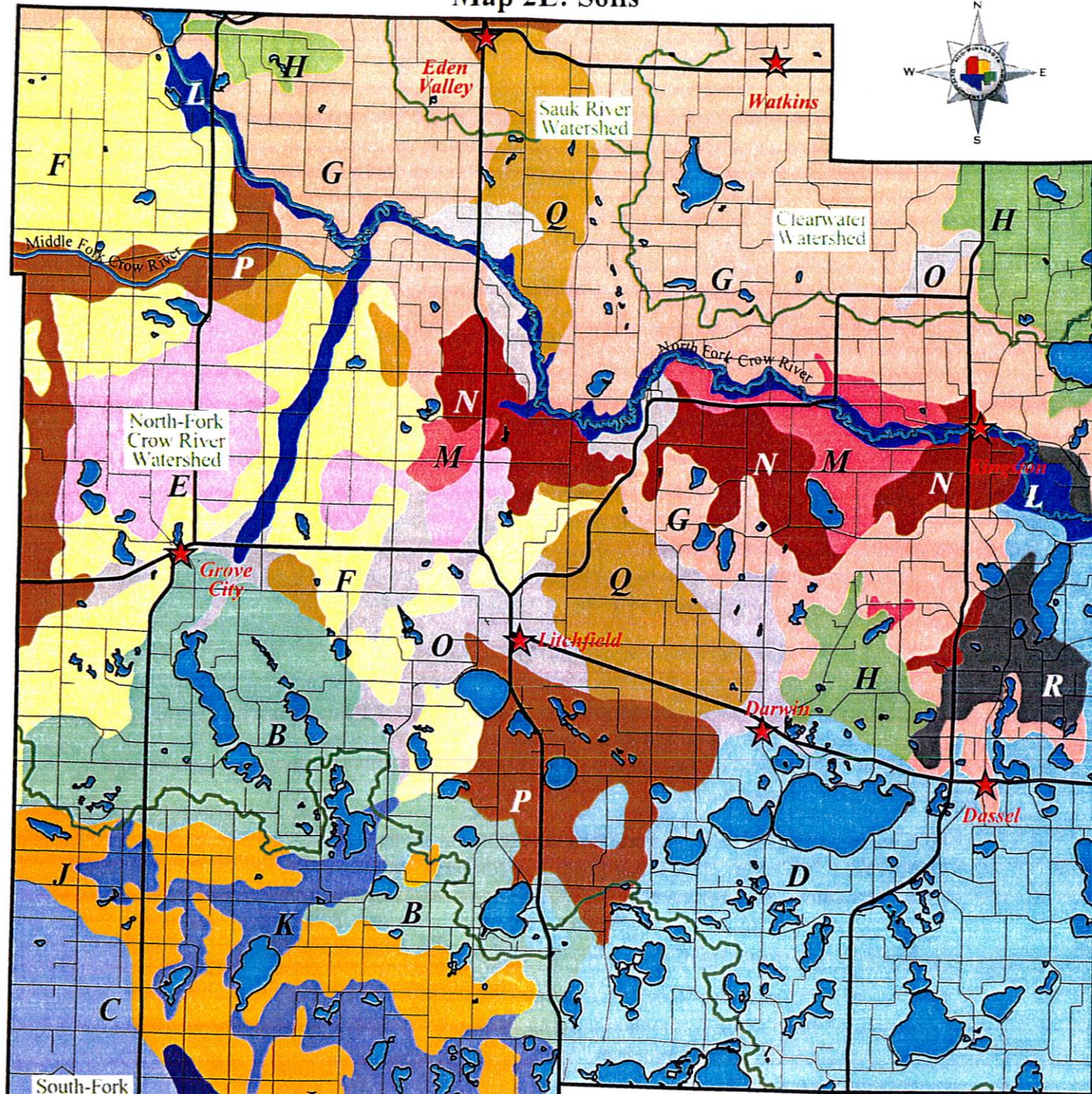
## Soils (Data Item 8)

As an agricultural county, soils are one of Meeker County's most valuable resources. Soils develop from the breakdown of rock minerals, intermixed with plant and animal remains. The formation of a soil is an extremely long process, taking place over hundreds to thousands of years. Meeker County's soils were formed from deposits originally left by glaciers more than 10,000 years ago. The County has a wide variety of soil types due to the wide variety of parent material from which they were formed. Also important in the formation of the County's soils are factors such as climate, vegetation and topography.

Meeker County's 18 major soil associations are displayed in Map 2E. A brief description of each association is provided below:

1. **Canisteo-Okoboji-Nicollet Association.** Soil texture for the association ranges from a silty clay loam to clay loam. Infiltration is generally poor. The common landform setting for soils classified in the Canisteo-Okoboji-Nicollet Association is moraines. Slopes generally range from 0 to 3 percent. The Canisteo-Okoboji-Nicollet Association comprises 3 percent of the area in Meeker County and is primarily found in the south-central portion of the County.
2. **Clarion-Hamel-Storden Association.** Soil texture for the association is a loam. Infiltration ranges from good to poor. The common landform setting for soils classified in the Clarion-Hamel-Storden Association is moraines. Slopes generally range from 0 to 12 percent. The Clarion-Hamel-Storden Association comprises 7 percent of the area in Meeker County and is primarily found in the west-central portion of the County.
3. **Harps-Nicollet-Webster Association.** Soil textures for the association ranges from a silty clay loam to clay loam. Infiltration is generally poor. The common landform setting for soils classified in the Harps-Nicollet-Webster Association is moraines. Slopes generally range from 0 to 3 percent. The Harps-Nicollet-Webster Association comprises 6 percent of the area in Meeker County and is found in the extreme southwestern portion of the County.
4. **Cokato-Storden-Muskego Association.** Soil texture for the association is a loam. Infiltration ranges from good to poor. The common landform setting for soils classified in the Cokato-Storden-Muskego Association is moraines. Slopes generally range from 0 to 12 percent. The Cokato-Storden-Muskego Association comprises 13 percent of the area in Meeker County and is found in the southeastern portion of the County.
5. **Swedegrove-Grovecity-Lundlake Association.** Soil textures for the association include loam and silty clay loam. Infiltration ranges from fair to poor. The common landform setting for soils classified in the Swedegrove-Grovecity-Lundlake Association is moraines. Slopes generally range from 0 to 3 percent. The Swedegrove-Grovecity-Lundlake Association comprises 3 percent of the area in Meeker County and is primarily found in the northwestern portion of the County.

# Map 2E: Soils



Nearly Level to Steep Loamy and Clayey Soils Formed in Glacial Till on Uplands	Nearly Level to Gently Sloping, Clayey and Silty Soils in Lake Basins
<ul style="list-style-type: none"> <li><span style="color: red;">A</span> Association 1</li> <li><span style="color: green;">B</span> Association 2</li> <li><span style="color: blue;">C</span> Association 3</li> <li><span style="color: lightblue;">D</span> Association 4</li> <li><span style="color: pink;">E</span> Association 5</li> <li><span style="color: yellow;">F</span> Association 6</li> <li><span style="color: orange;">G</span> Association 7</li> <li><span style="color: lightgreen;">H</span> Association 8</li> <li><span style="color: darkblue;">I</span> Association 9</li> <li><span style="color: gold;">J</span> Association 10</li> <li><span style="color: lightblue;">K</span> Association 11</li> </ul>	<ul style="list-style-type: none"> <li><span style="color: red;">M</span> Association 12</li> <li><span style="color: darkred;">N</span> Association 13</li> </ul>
Nearly Level to Rolling Loamy and Sandy and Organic Soils on Outwash Plains, Stream Terraces.	
<ul style="list-style-type: none"> <li><span style="color: lightblue;">O</span> Association 14</li> <li><span style="color: orange;">P</span> Association 15</li> <li><span style="color: yellow;">Q</span> Association 16</li> <li><span style="color: darkgrey;">R</span> Association 17</li> </ul>	
Soils On Floodplains and Stream Terraces.	
<ul style="list-style-type: none"> <li><span style="color: blue;">L</span> Association 18</li> </ul>	
<ul style="list-style-type: none"> <li> Lakes</li> <li> Rivers</li> <li> Cities</li> </ul>	<ul style="list-style-type: none"> <li> Major Roads</li> <li> Minor Roads</li> <li> Watershed</li> </ul>

6. **Wadenill-Swedegrove-Muskego Association.** Soil textures for the association include loam and muck. Infiltration ranges from good to poor. The common landform setting for soils classified in the Wadenill-Swedegrove-Muskego Association is moraines. Slopes generally range from 0 to 12 percent. The Wadenill-Swedegrove-Muskego Association comprises 10 percent of the area in Meeker County and is primarily found in the northwestern portion of the County.
7. **Koronis-Forestcity-Houghton Association.** Soil textures for the association include sandy loam, loam and muck. Infiltration is good to poor. The common landform setting for soils classified in the Koronis-Forestcity-Houghton Association is moraines. Slopes generally range from 0 to 12 percent. The Koronis-Forestcity-Houghton Association comprises 19 percent of the area in Meeker County and is found primarily in the northeastern portion of the County.
8. **Koronis-Houghton-Forestcity Association.** Soil textures for the association include sandy loam and muck. Infiltration is generally good to poor. The common landform setting for soils classified in the Koronis-Houghton-Forestcity Association is moraines. Slopes generally range from 0 to 18 percent. The Koronis-Houghton-Forestcity Association comprises 4 percent of the area in Meeker County and is found primarily in the northeastern portion of the County.
9. **Cosmos-Meeker-Corvuso Association.** Soil textures for the association include clay loam, silty clay and clay. Infiltration is generally poor. The common landform setting for soils classified in the Cosmos-Meeker-Corvuso Association is moraines. Slopes generally range from 0 to 5 percent. The Cosmos-Meeker-Corvuso Association comprises 3 percent of the area in Meeker County and is primarily found in southwestern portion of the County.
10. **Cosmos-Strout-Meeker Association.** Soil textures for the association include silty clay and clay. Infiltration is generally poor. The common landform setting for soils classified in the Cosmos-Strout-Meeker Association is moraines. Slopes generally range from 0 to 6 percent. The Cosmos-Strout-Meeker Association comprises 6 percent of the area in Meeker County and is primarily found in southwestern portion of the County.
11. **Danielson-Newlondon-Strout Association.** Soil textures for the association include clay loam and clay. Infiltration ranges from fair to poor. The common landform setting for soils classified in the Danielson-Newlondon-Strout Association is moraines. Slopes generally range from 1 to 18 percent. The Danielson-Newlondon-Strout Association comprises 3 percent of the area in Meeker County and is primarily found in southwestern portion of the County.
12. **Collinwood-Waldorf-Shorewood Association.** Soil texture for the association is a silty clay loam. Infiltration is generally fair to poor. The common landform setting for soils classified in the Collinwood-Waldorf-Shorewood Association is lake plains. Slopes generally range from 0 to 6 percent. The Collinwood-Waldorf-Shorewood Association comprises 2 percent of the area in Meeker County and is found scattered throughout the northern half of the County.

13. **Madelia-Truman-Kingston Association.** Soil textures for the association include silt loam and silty clay loam. Infiltration ranges from good to poor. The common landform setting for soils classified in the Madelia-Truman-Kingston Association is lake plains. Slopes generally range from 0 to 12 percent. The Madelia-Truman-Kingston Association comprises 3 percent of the area in Meeker County and found scattered throughout the northern half of the County.
14. **Sparta-Darfur-Litchfield Association.** Soil textures for the association include loamy sand and loam. Infiltration ranges from good to poor. The common landform setting for soils classified in the Sparta-Darfur-Litchfield Association is outwash plains, terraces and deltas. Slopes generally range from 0 to 6 percent. The Sparta-Darfur-Litchfield Association comprises 4 percent of the area in Meeker County and is found scattered throughout the northern half of the County.
15. **Kanaranzi-Estherville-Biscay Association.** Soil textures for the association include silt loam, loam and clay loam. Infiltration is generally fair to poor. The common landform setting for soils classified in the Kanaranzi-Estherville-Biscay Association is floodplains and terraces. Slopes generally range from 0 to 40 percent. The Kanaranzi-Estherville-Biscay Association comprises 2 percent of the area in Meeker County and is found in the central and extreme northwestern portions of the County.
16. **Fieldon-Litchfield-Dassel Association.** Soil textures for the association include sandy loam and loam. Infiltration is generally good to poor. The common landform setting for soils classified in the Fieldon-Litchfield-Dassel Association is outwash plains and terraces. Slopes generally range from 0 to 6 percent. The Fieldon-Litchfield-Dassel Association comprises 5 percent of the area in Meeker County and is found scattered throughout the northern half of the County
17. **Hawick-Estherville Association.** Soil texture for the association is a sandy loam. Infiltration is generally good. The common landform setting for soils classified in the Hawick-Estherville Association is outwash plains and terraces. Slopes generally range from 0 to 18 percent. The Hawick-Estherville Association comprises 1 percent of the area in Meeker County and is primarily found southwest of Big Swan Lake.
18. **Cohoctah-Muskego-Estherville Association.** Soil textures for the association include sandy loam, loam and muck. Infiltration is generally good to poor. The common landform setting for soils classified in the Cohoctah-Muskego-Estherville Association is floodplains and terraces. Slopes generally range from 0 to 6 percent. The Cohoctah-Muskego-Estherville Association comprises 3 percent of the area in Meeker County and is found along Grove Creek and the Fork Crow River.

**Reference:**

United States Department of Agriculture, Soil Survey of Meeker County, Minnesota

## Erosion-Prone Soils (Data Item 9)

The previous section provided a generalized description of the 18 soil associations found in Meeker County. The following section analyzes the erosion potential of those soil associations. Meeker County is adversely affected by both wind and water erosion.

### Water Erosion

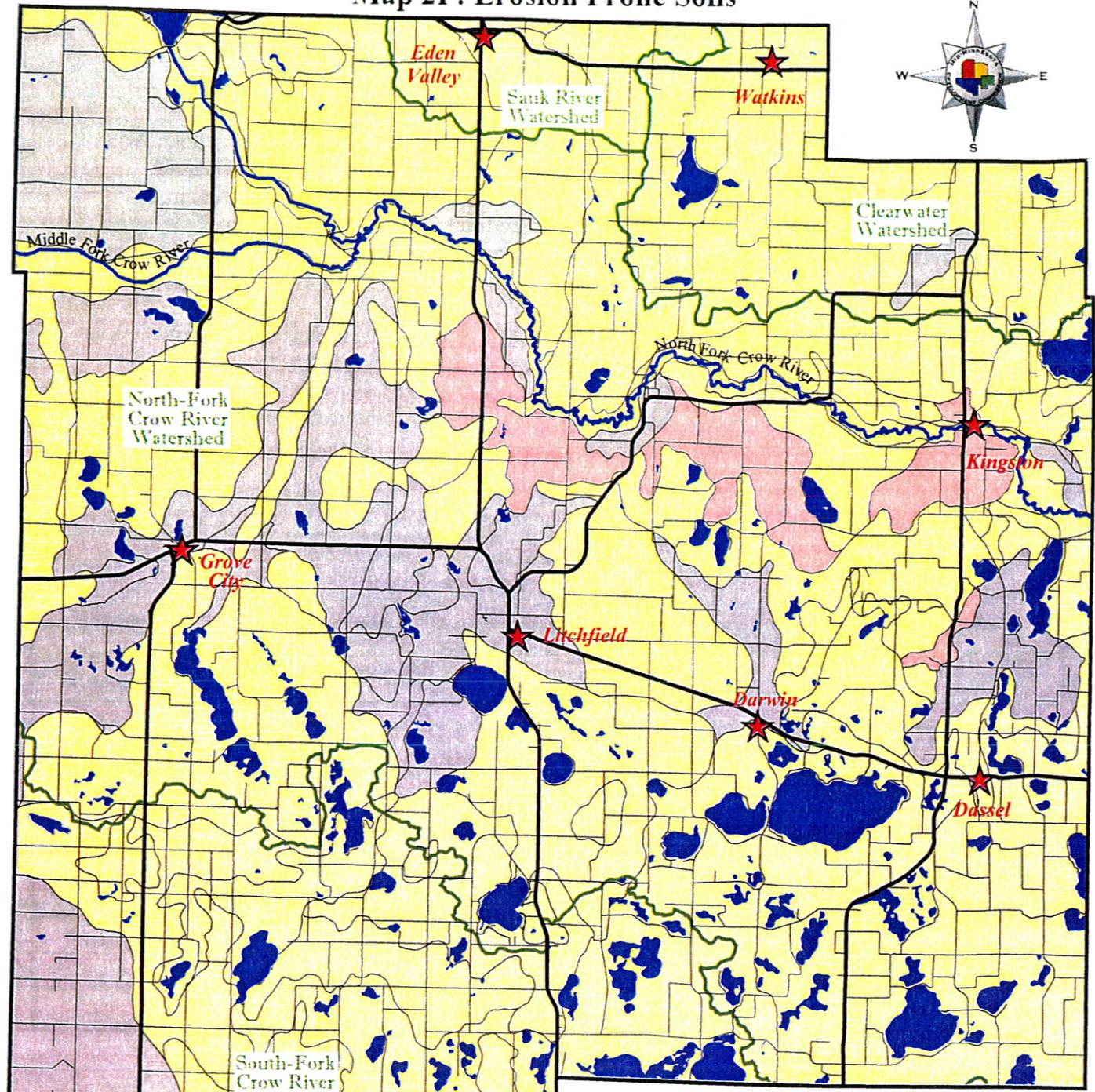
Water erosion results from soil being moved from its original location by the force of water to the convex lower slopes and flats. Average tolerable soil loss for the County is three to five tons per acre per year. Erosion types are classified as sheet, rill, ephemeral and gully. Soil erosion affects cropland, urban areas, roadsides, lakeshores, streambanks and drainage systems. Water erosion impacts the water quality of the County's waterbodies, as well as develops detrimental conditions in the uplands and steeper slopes of the soil associations with erosion-prone characteristics. Water erosion in Meeker County generally occurs most often between the months of April and June, when fields have been tilled and planted, but a crop canopy has not developed to protect the soil surface.

The USDA developed the Universal Soil Loss Equation (USLE) to effectively predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. One of the six factors used in the equation, erosion factor K, indicates the susceptibility of a soil to sheet and rill erosion. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion. Map 2F identifies the water erosion prone Meeker County soil associations that have K factors equal to or greater than 0.28. Table 2F details the Meeker County soil associations that are classified as erosion prone. Notice that water erosion prone soils cover 79 percent of Meeker County.

**Table 2F:  
Water Erosion Prone Soil Associations**

Soil Association	Percent of County	Soil Association	Percent of County
01-Canisteo-Okoboji-Nicollet	3	10-Cosmos-Strout-Kandiyohi	6
02-Clarion-Hamel-Storden	7	11-Danielson-Newlondon-Strout	3
04-Cokato-Storden-Muskego	13	12-Collinwood-Waldorf-Shorewood	2
05-Swedegrove-Grovecity-Lundlake	3	13-Madelia-Truman-Kingston	3
07-Koronis-Forestcity-Houghton	19	15-Kanaranzi-Estherville-Biscay	2
08-Koronis-Houghton-Forestcity	4	16-Fieldon-Litchfield-Dassel	5
09-Cosmos-Kandiyohi-Corvuso	3	18-Cohoctah-Muskego-Estherville	3
<b>Total</b>			<b>79</b>

# Map 2F: Erosion Prone Soils



Municipality	Wind Erosion Prone
Major Roadway	Water Erosion Prone
Minor Roadway	Both Wind and Water Erosion Prone
Watershed Boundary	
Lake	
River	



## Wind Erosion

The potential for wind erosion occurs when wind velocities increase above 12 miles per hour. Wind speeds above this mark overcome the force of gravity and dislodge soil particles. Soil is most vulnerable when unprotected by vegetative cover. Soils with fine granulated structure are most susceptible to erosion, including sandy loam, loamy sand and sand. November through June, when field surfaces may be dry and strong northwest winds are prevalent, is the worst time period for wind erosion.

The USDA has classified soils into Wind Erodibility Groups, according to their susceptibility to wind erosion in cultivated areas. Wind Erodibility Groups range from 1-8. The lower the group number, the higher the vulnerability to wind erosion. Groups 4L or less are classified as highly susceptible to wind erosion. Map 2F displays the Meeker County soil associations that are classified as wind erosion-prone. Table 2G indicates that 94 percent of Meeker County has wind erosion prone soils.

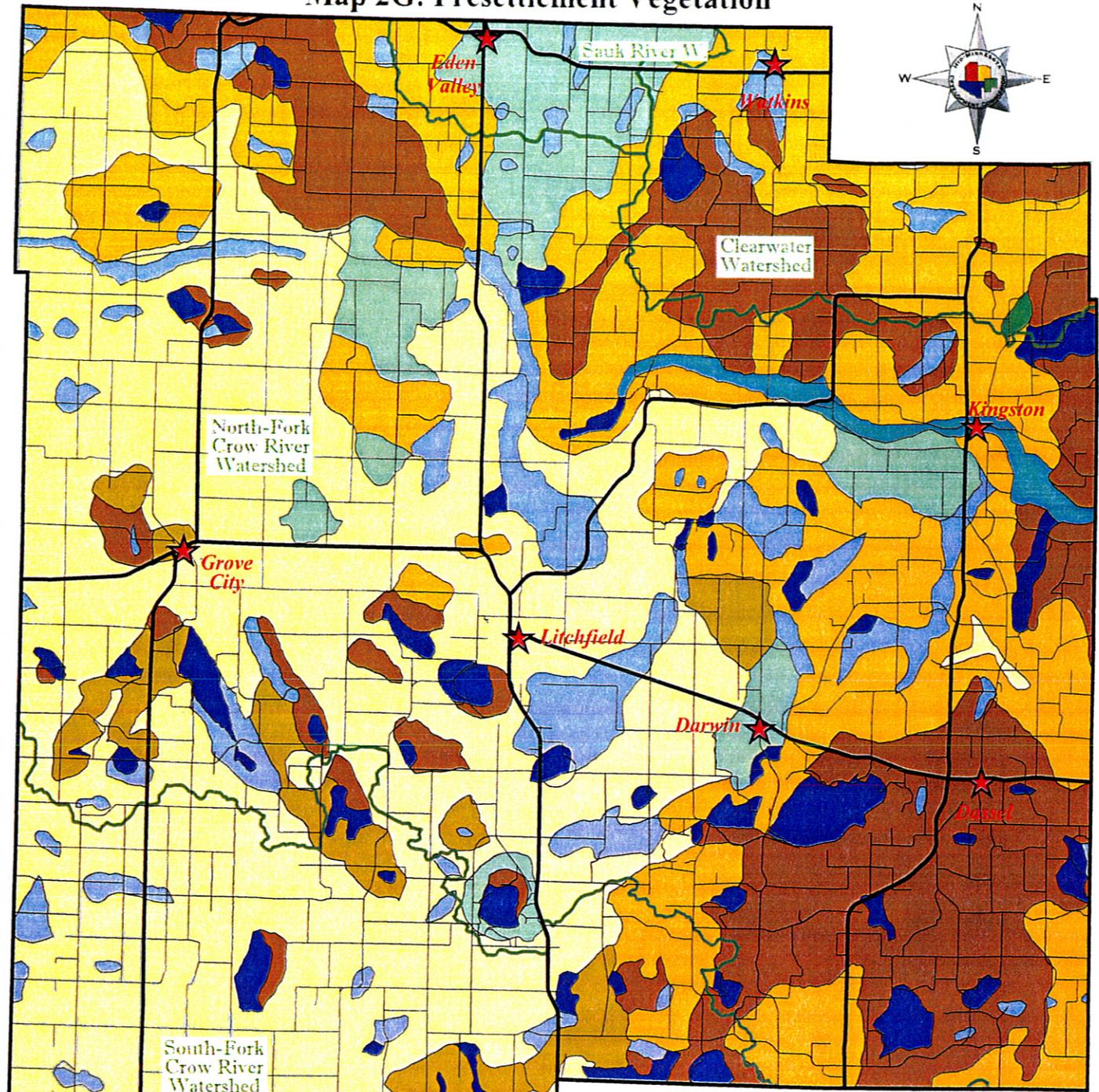
**Table 2G:  
Wind Erosion Prone Soil Associations**

Soil Association	Percent of County	Soil Association	Percent of County
01-Canisteo-Okoboji-Nicollet	3	10-Cosmos-Strout-Kandiyohi	6
02-Clarion-Hamel-Storden	7	11-Danielson-Newlondon-Strout	3
03-Harps-Nicollet-Webster	6	12-Collinwood-Waldorf-Shorewood	2
04-Cokato-Storden-Muskego	13	14-Sparta-Darfur-Litchfield	4
05-Swedegrove-Grovecity-Lundlake	3	15-Kanaranzi-Estherville-Biscay	2
06-Wadenill-Swedegrove-Muskego	10	16-Fieldon-Litchfield-Dassel	5
07-Koronis-Forestcity-Houghton	19	17Hawick-Estherville	1
08-Koronis-Houghton-Forestcity	4	18-Cohoctah-Muskego-Estherville	3
09-Cosmos-Kandiyohi-Corvuso	3	<b>Total</b>	<b>94</b>

### Reference:

United States Department of Agriculture, Soil Survey of Meeker County, Minnesota

Map 2G: Presettlement Vegetation



Municipality	Prairie
Major Roadway	Wet Prairie
Minor Roadway	Brush Prairie
Watershed Boundary	Aspen-Oak Land
Lake	Oak Openings and Barrens
River	Big Woods (hardwoods)
	River Bottom Forest
	Conifer Bogs and Swamps
	Open Water

## **Original Vegetation** *(Data Item 10)*

The Minnesota Department of Natural Resources (DNR) has inventoried the original vegetation of Meeker County through its Presettlement Vegetation Database. Presettlement vegetation was determined by analyzing the detailed maps and records of early surveyors (circa 1895). The purpose of the database is to “analyze presettlement vegetation patterns for the purpose of determining natural community potential, productivity indexes and patterns of natural disturbance”. Map 2G presents the presettlement vegetation of Meeker County.

Before settlement, Meeker County was predominately covered with upland prairie and prairie wetland vegetation; however, large stands of hardwood trees were commonly found throughout the northern and eastern parts of the County. The upland prairie occupied a wide variety of landforms, including beach ridges and swales, glacial lakebeds, morainic hills, steep bluffs and rolling till plains. Big bluestem and Indian grass occupied the deep soils of the moist uplands, while little bluestem and side oats grama covered the thin soils of the dry uplands. In general, bluejoint, prairie cordgrass, rushes and sedges dominated the lowland areas and wetlands. Many of these wetlands are known today as “prairie potholes”.

The oak woodland and brushland was a common ecotonal type between the prairie and deciduous forest. Fire, more than topography or climate, was the primary factor influencing the location and extent of this type of vegetation. The oak woodland and brushland ranged from small groves of trees intermixed with open prairie, to communities of scrub forest and dense scrub thicket. The dominant tree species were bur and pin oak. Maple-basswood forests were dominated by elm, basswood, sugar maple and red oak. These forests were highly sensitive to fire. As a result, their boundaries were in large part controlled by the frequency of fire. The forests were restricted to areas where natural firebreaks (such as rivers, lakes and rough topography) prevented the spread of fire from the adjacent prairie lands.

### **Reference:**

Minnesota Department of Natural Resources, Division of Forestry

## **Topographic Description of Watersheds** *(Data Item 11)*

For watershed locations, please refer to Map 2C.

**Clearwater River Watershed** – The topography of the Clearwater River Watershed is typified by rolling moraines, characterized by knolls and hills of irregular size and shape, intermingled with swales and numerous closed depressions. Relief in morainic areas of the watershed ranges from 5 feet to less than 50 feet. The highest elevation within Meeker County is found within this watershed, at 1,250 feet above sea level.

**North Fork of the Crow River Watershed** – The topography of this watershed is characterized by rolling moraines and glacial outwash and lake plains. Moraines are found in northern and eastern portions of the watershed. The central portion of the North Fork of the Crow River Watershed consists of glacial outwash plains and glacial lake plains of mostly silty and clayey sediment. Relief within the watershed ranges from less than 5 feet, to approximately 100 feet in the eastern and northwestern portions of the County. The lowest elevation (1,000 feet above sea level) within Meeker County is found at the point where the North Fork of the Crow River exits the County.

**Sauk River Watershed** – The Sauk River Watershed is dominated by a rolling moraine topography. Topographic relief generally ranges from 5 feet, to less than 50 feet.

**South Fork of the Crow River Watershed** – Rolling moraines and glacial outwash and lake plains dominate the topography of the South Fork of the Crow River. Moraines are found in the southern portion of the watershed, while glacial outwash and lake plains are found in the northern portion. Relief within the South Fork of the Crow River Watershed ranges from 5 feet, to less than 50 feet.

Detailed topographic maps for Meeker County can be viewed at the Meeker County Soil and Water Conservation District office.

### **References:**

United States Department of Agriculture, Soil Survey of Meeker County, Minnesota  
United States Geological Survey

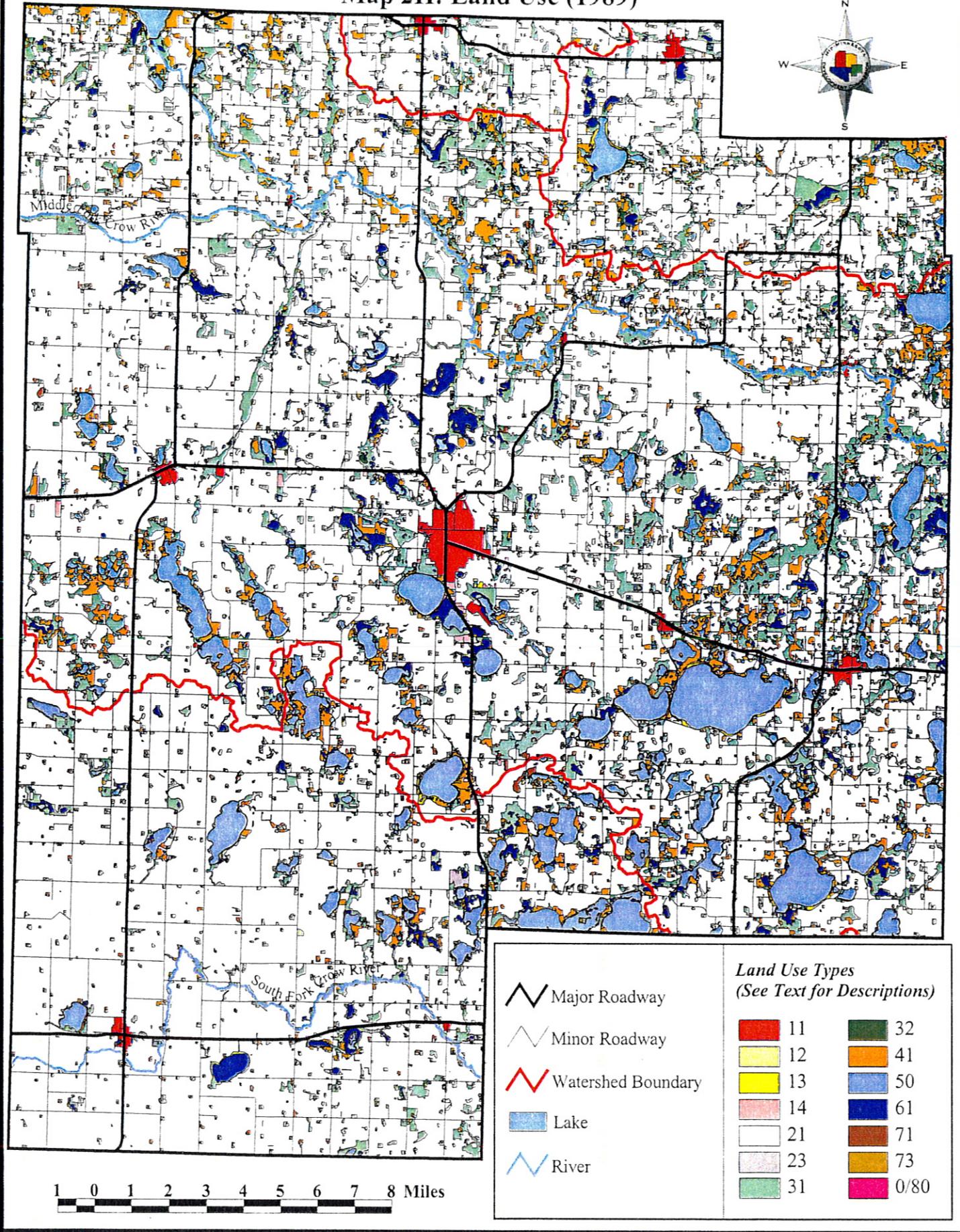
## Land Use (Data Item 12)

As an update to the 1969 Land Use Inventory, the Minnesota Land Management Information Center conducted the Minnesota Land Use-Agricultural and Transition Areas Inventory in 1989. Land uses were interpreted using National Wetland Inventory Maps from the United States Fish and Wildlife Service, USDA-Agricultural Stabilization and Conservation Service (ASCS) low altitude 35-mm aerial photography and Landsat satellite imagery. The results of the Inventory are reproduced in Map 2H (the numbers correspond with the text below).

The land cover classifications used in this project were derived from *A Classification Manual for Land Cover and Land Use in Minnesota*, which was developed in 1978 by the Minnesota State Planning Agency. The objective of the current classification scheme was to provide as much consistency as possible with the 1969 land use categories, while at the same time recognizing current user needs and better data sources. The following definitions describe the types of land use found in each classification scheme:

- **Urban and Industrial (Area 11)** - This category includes cities, towns and villages with place names. Small residential areas without USGS topographic map place names are classified as rural residential developments. The urban and industrial category also includes commercial, industrial or urban developments that are included within, or are directly associated with, an urban area. Examples include manufacturing and processing plants, power plants, urban airports and waste treatment plants.
- **Farmsteads and Rural Residences (Area 12)** - Farmsteads include the farmhouse and adjoining farmyard areas. Farmsteads also include buildings such as machinery storage areas, grain storage facilities, corrals, livestock holding and feeding areas directly associated with the farmyard area. Rural residences are non-urban residences other than farmsteads. Rural residences include the residence, associated structures (such as garages and sheds) and the associated landscaped area. This category includes from one to four residences within close proximity, with no distinguishable, intervening, non-residential features.
- **Rural Residential Development Complexes (Area 13)** - This category includes rural residences, as defined above, in a complex that includes five or more residences within close enough proximity to be mapped as a single unit.
- **Other Rural Developments (Area 14)** - This category includes commercial, industrial, cultural, recreational and agricultural developments not directly associated with urban areas.
  - **Commercial and Industrial** - Developments include substations, communications facilities, power plants, small private airstrips, junkyards, landfills, storage maintenance yards, businesses, factories, lumber mills, commercial livestock and grain operations.

# Map 2H: Land Use (1989)



Major Roadway	<b>Land Use Types</b> (See Text for Descriptions)			
Minor Roadway	11	32	41	50
Watershed Boundary	12	61	71	0/80
Lake	13	73		
River	14			
	21	31		
	23			



- **Cultural and Recreational** - Developments include built-up factories and service areas associated with parks and rest areas, camp grounds and golf courses.
- **Agriculture** - Developments include those agricultural facilities not directly associated with farmsteads. It includes machine storage areas, grain storage areas, barns and corrals and isolated buildings. It also includes isolated farmsteads that no longer have apparent road access.
- **Cultivated Land (Area 21)** - Cultivated land includes those areas under intensive cropping or rotation, including periods when a parcel may be fallow. It represents land planted to forage or cover crop. The units exhibit linear or other patterns associated with current or relatively recent tillage.
- **Transitional Agricultural Land (Area 23)** - This category includes areas that show evidence of past tillage but do not now appear to be continuously cropped or in a crop rotation. Parcels in this unit include fields that are idle or abandoned and may or may not have been planted to a cover crop. In addition to displaying some evidence of past tillage, they usually are relatively uniform in vegetation.
- **Grassland (Area 31)** - This unit includes grasslands and herbaceous plants. It may contain up to one-third shrubs and/or tree cover. Areas may be small to extensive, and range from regular to very irregular in shape. They are often found between agricultural land and more heavily wooded areas, and along right-of-ways and drainages. These areas may be mowed or grazed, and range in appearance from very smooth to quite mottled.
- **Grassland-Shrub-Tree Complex (Area 32)** - This classification includes a combination of grass, shrubs and trees, in which the *deciduous tree cover* comprises from one-third to two-thirds of the area, and/or the shrub cover comprises more than one-third of the area. This complex is often found adjacent to grassland or forested areas, but may be found alone. These areas are often irregular in shape and vary greatly in extent.
- **Grassland-Shrub-Tree Complex (Area 33)** - This classification includes a combination of grass, shrubs and trees, in which the *coniferous tree cover* comprises from one-third to two-thirds of the area, and/or the shrub cover comprises more than one-third of the area. This complex is often found adjacent to grassland or forested areas, but can be found alone. These areas are often irregular in shape and vary greatly in extent.
- **Deciduous Forest (Area 41)** - This classification includes areas with at least two-thirds of the total canopy cover composed of predominantly woody deciduous species. It may contain coniferous species but it is dominated by deciduous species. It includes woodlots, shelterbelts and other planted areas.
- **Coniferous Forest (Area 42)** - This classification includes areas with at least two-thirds of the total canopy cover composed of predominantly woody coniferous species. It may contain deciduous species but it is dominated by coniferous species. It includes woodlots, shelterbelts and other planted areas.

- **Water (Area 50)** - This category includes permanent waterbodies, including lakes (U.S. Fish and Wildlife Service Lacustrine System 'L'), rivers, reservoirs, stock ponds and permanent palustrine open water. Intermittently exposed palustrine open water areas are included in this open water category when the photo evidence indicates that the area is covered by water the majority of the time.
- **Wetlands (Area 61)** - This category includes wetlands visible through photography, with an area of at least two acres. Wetlands boundaries are delineated from U.S. Fish and Wildlife Service National Wetland Inventory data. In cases where these boundaries have changed (such as for drained wetlands), the boundaries are determined from the current photography. U.S. Fish and Wildlife Service National Wetland Inventory types included in this category are semi-permanent palustrine emergent wetlands and areas of semi-permanent palustrine open water. These categories represent basins with deep-water emergents (primarily cattail, bulrush and whitetop) and open water inclusions. Where U.S. Fish and Wildlife Service data is not available, wetland classification will be based on the distribution of visible deep-water emergents and open water inclusions. Temporary, saturated, seasonal and intermittently exposed palustrine wetlands will, in most cases, be mapped according to dominant cover type visible on the photography (e.g., open grassland, cultivated, grass-shrub-tree complex, etc.) rather than as wetlands.
- **Gravel Pits and Open Mines (Area 71)** - This category includes areas stripped of topsoil with exposed substrate. Gravel pit areas that have been reclaimed either naturally or artificially are classified as the current cover type.
- **Bare Rock (Area 72)** - This category includes areas of rock outcrops that lack appreciable soil development or vegetative cover.
- **Exposed Soil, Sandbars and Sand Dunes (Area 73)** - This category includes areas lacking appreciable plant cover that are not gravel pits or bare rock.
- **Unclassified (Area 80)** - This category includes areas that could not be classified into any of the other categories.
- **Unlabeled (Area 0)** - These areas were not labeled on the original mylar.

Table 2H provides a breakdown of each land use category by acreage and percentage of the County. The single largest land use is cultivated agricultural land, which comprises 377,212 acres or 68.4 percent of the County. Other major land uses within Meeker County include Grasslands (11.0%), Water (7.1%), Deciduous Forest (6.8%) and Wetlands (3.3%).

**Table 2H:  
Land Use Analysis**

Land Use	Acreage	Percent of County
Cultivated Land (Area 21)	292,391	70.9
Grassland (Area 31)	48,712	11.8
Deciduous Forest (Area 41)	28,132	6.8
Water (Area 50)	18,833	4.6
Wetlands (Area 61)	11,529	2.8
Farmstead and Rural Residential (Area 12)	6,854	1.7
Urban and Industrial (Area 11)	2,845	0.7
Rural Residential Development Complexes (Area 13)	920	0.2
Other Rural Developments (Area 14)	881	0.2
Grassland-Shrub-Tree Complex (Area 32)	951	0.2
Transitional Agricultural Land (Area 23)	109	<0.1
Gravel Pits and Open Mines (Area 71)	294	0.1
Exposed Soil, Sandbars, and Sand Dunes (Area 73)	15	<0.1

The implications of cultivated agriculture being the single largest land use in the County has far reaching impacts on the quantity and quality of surface water. Over the past few decades, land use practices in agriculture have changed significantly. Not long ago, agriculture was diversified with livestock and dairy operations. Most of the crops that were produced were considered to be high residue and were grown to feed livestock. High residue crops (i.e., corn, alfalfa, small grain) protect the soil from erosion and protected water quality. Today, crop selection in agriculture has shifted to primarily cash grain operations with corn, soybeans, small grain and sugar beets being produced. Some of these cash grain crops are considered low residue (i.e. soybeans, sugar beets) and only marginally protect the soil from water and wind erosion. As a result, water quality and quantity is often adversely affected.

Even though cultivated agricultural land is the largest land use within the County, the number of acres of farmland is slowly decreasing as a result of urban sprawl around growing municipalities. This is especially true in area surrounding the City of Litchfield. Many of the lakes in the County are also experiencing lakeshore development.

**References:**

Meeker County Soil and Water Conservation District  
Minnesota Land Management Information Center

**Public Water, Storm Sewer and  
Sanitary Sewer Systems  
(Data Item 13)**

According to Table 21, 7 of Meeker County's communities are served by public water, 8 are served by a storm sewer system and 7 are served by a sanitary sewer system (Please refer to Map 1A for community location). The MPCA has identified the City of Litchfield as in need of upgrading its sanitary sewer facility to remain in compliance with State and Federal discharge requirements. In addition, the unsewered communities of Cedar Mills, Forest City, Green Leaf, Kingston and Manannah have been identified by MPCA as in need of installing a centralized sanitary sewer system. Over the next ten years, Meeker County should assist each of these communities in seeking options to install or upgrade their existing systems, thus avoiding further degradation of water resources.

**Table 21:  
Communities Served by Public Water,  
Storm Sewer and Sanitary Sewer Systems**

Community	Public Water	Storm Sewer	Sanitary Sewer
Cedar Mills	No	Yes	No
Cosmos	Yes	Yes	Yes
Darwin	Yes	Yes	Yes
Dassel	Yes	Yes	Yes
Eden Valley	Yes	Yes	Yes
Forest City	No	No	No
Green Leaf	No	No	No
Grove City	Yes	Yes	Yes
Kingston	No	No	No
Litchfield	Yes	Yes	Yes*
Manannah	No	No	No
Watkins	Yes	Yes	Yes

*\* Identified by the MPCA as in need of system upgrades*

**Water Pollution Control Revolving Fund**

The Federal Clean Water Act authorizes a Clean Water State Revolving Fund program to provide funds to finance water pollution control projects. Under the Act, the U.S. Environmental Protection Agency (EPA) awards annual capitalization grants to each state to capitalize a state revolving fund (SRF), which the State can then use to provide loans for both point source (wastewater) and

nonpoint source water pollution-control projects. As part of its capitalization grant application, each State must annually prepare an Intended Use Plan (IUP) that describes the intended use of the available funds.

The Minnesota Legislature has established the Water Pollution Control Revolving Fund under Minn. Statutes Section 446A.07 to receive the Federal capitalization grants and State matching funds. The Minnesota Public Facilities Authority is responsible for managing the funds and its assets. The Authority is also responsible for the financial administration of the point source (wastewater) loan program, including reviewing applicants and setting the rates, terms and conditions of the loans.

The Minnesota Pollution Control Agency (MPCA) is responsible for preparing the annual IUP, and for setting wastewater project priorities and reviewing wastewater projects to ensure they meet technical and environmental requirements. Nonpoint source loan programs are administered by the MPCA, the Minnesota Department of Agriculture and the Minnesota Department of Trade and Economic Development.

The 2002 IUP identifies projects and activities that are expected to be funded through the Water Pollution Control Revolving Fund in 2002. Table 2J reveals that two Meeker County communities, Dassel and Litchfield, were included in MPCA's Final 2002 IUP. Cedar Mills' wastewater collection and treatment facility project was not included on the list due to the fact the city applied to Rural Development for funding.

**Table 2J:  
Meeker County Communities on the  
MPCA Final 2002 Project Priority List**

<b>Community</b>	<b>Project Ranking</b>	<b>Project</b>	<b>Estimated Start Date</b>	<b>Estimated Project Cost</b>
Dassel	97	Rehab/ expand existing system	April 2001	\$1,400,000
Litchfield	65	Rehab/ expand existing system	November 2001	\$9,300,000

**References:**

Mid-Minnesota Development Commission  
 Minnesota Department of Natural Resources, Division of Waters  
 Minnesota Pollution Control Agency

**Community Public Water Supply Wells and Intakes**  
(Data Item 14)

Data available from the Minnesota Department of Natural Resources (DNR) Water Appropriate Permit Index lists permitted community public water or municipal wells in Meeker County. A DNR water appropriation permit is required for withdrawals greater than 10,000 gallons per day or one million gallons per year. Table 2K lists those public water supplies within Meeker County that have a DNR issued water appropriation permit.

**Table 2K:**  
**Public Water Supplies**

Municipality	DNR Permit #	Permitted Withdrawal*	Township	Range	Section
Cosmos, City of	864033-1	30.0	117N	32W	15
Cosmos, City of	864033-2	30.0	117N	32W	15
Cosmos, City of	864033-3	30.0	117N	32W	16
Dassel, City of	754251-1	60.0	119N	29W	27
Dassel, City of	754251-2	60.0	119N	29W	27
Dassel, City of	754251-3	60.0	119N	29W	34
Darwin, City of	854175-1	13.8	119N	30W	23
Darwin, City of	854175-2	13.8	119N	30W	23
Litchfield, City of	690169-8	425.0	119N	31W	11
Litchfield, City of	690169-10	425.0	119N	31W	1
Litchfield, City of	690169-12	425.0	119N	31W	12
Litchfield, City of	690169-14	425.0	119N	31W	11
Litchfield, City of	690169-15	425.0	119N	31W	1
Grove City, City of	754321-1	35.0	119N	32W	3
Grove City, City of	754321-3	35.0	120N	32W	34
Eden Valley, City of	590555-2	28.1	121N	31W	1
Eden Valley, City of	590555-3	28.1	121N	30W	5
Watkins, City of	570300-3	45.0	121N	31W	1
Watkins, City of	570300-4	45.0	121N	31W	1

\* Million Gallons per Year (MG/Y)

## **Wellhead Protection**

Wellhead protection, which is administered by the Minnesota Department of Health (MDH), is a means of safeguarding public water supply wells by preventing contaminants from entering the area that contributes water to the well or wellfield over a period of time. A public water supply is defined as a system that provides piped drinking water for human use to 15 or more service connections or to 25 or more persons for at least 60 days a year. The wellhead protection area is determined by using geologic criteria, such as the physical characteristics of the aquifer and the effects which pumping has on the rate and direction of groundwater movement. A management plan is developed for the wellhead protection area that includes inventorying potential sources of groundwater contamination, monitoring for the presence of specific contaminants and managing existing and proposed land and water uses that pose a threat to groundwater quality.

The long-term goal of the MDH is to implement wellhead protection measures for all public water supply wells. However, due to the large number of public water supply wells (13,000), the diversity of geologic conditions in Minnesota and current resource constraints, wellhead protection will be implemented in phases. The MDH began implementing wellhead protection measures in 1996, beginning with new community wells. Existing community wells and other types of public water supply wells will be phased in between June 1998 and June 2003. All public water suppliers will be required to:

1. Maintain the isolation distances from potential contamination sources defined in the State Well Code;
2. Monitor noncomplying sources located on their property; and
3. Report to MDH other violations to the isolation distance, or ask a local governmental unit to regulate these sources.

In addition to maintaining the isolation distances, owners of community and nontransient noncommunity wells, when either notified by MDH or when a new well is added to a municipal water supply system, must develop a wellhead protection plan which includes:

1. A map of the wellhead protection area,
2. A vulnerability assessment of the well and the wellhead protection area,
3. An inventory of potential sources of contamination within the wellhead protection area,
4. A plan to manage and monitor existing or proposed potential source(s) of contamination, and
5. A water supply contingency strategy.

Table 2L displays the status of wellhead protection in Meeker County. To date, the City of Litchfield, as well as the First District Association and Towmaster Trailers, participate in the MDH Wellhead Protection Program. The City of Eden Valley is expected to be conducting a wellhead protection plan in the near future. The remaining water suppliers within the County will be phased in based on priority, which is identified by their MDH assigned State ranking. Through the State ranking system, the lower the ranking assigned to a community, the higher the priority for the community to participate in the Wellhead Protection Program.

**Table 2L:  
Status of Wellhead Protection**

<b>Water Supplier</b>	<b>Rank</b>	<b>Status</b>
City of Litchfield	NA	Currently in the MDH Wellhead Protection Program
First District Association	NA	Currently in the MDH Wellhead Protection Program
Towmaster Trailers	NA	Currently in the MDH Wellhead Protection Program
City of Eden Valley	NA	*Expected to conduct wellhead protection plan
City of Dassel	489	Expected to be phased in based on ranking
City of Watkins	500	Expected to be phased in based on ranking
City of Cosmos	515	Expected to be phased in based on ranking
City of Darwin	541	Expected to be phased in based on ranking
Johnson Brothers, Inc.	628	Expected to be phased in based on ranking
Grove City	1022	Expected to be phased in based on ranking
St. John's Lutheran School	1226	Expected to be phased in based on ranking
Sparboe Summit Farms	1343	Expected to be phased in based on ranking

*\* Due to new well construction*

**References:**

Minnesota Department of Health  
Minnesota Department of Natural Resources

**Land Ownership**  
*(Data Item 15)*

In 1995, the Minnesota Land Management Information Center (LMIC), in conjunction with the Minnesota Department of Natural Resources (DNR), developed a computerized database of publicly owned lands in the State, called the Gap Analysis Project (GAP) Stewardship. Much of the data used to create the GAP Stewardship database was from the mid 1970s to the late 1980s, thus the accuracy of the database is limited. Another factor that limits the accuracy of this database is that tracts are only broken down by 40 acre blocks, thus land interest is only expressed when an agency owns more than 50 percent of a 40 acre tract.

According to the GAP Stewardship, the vast majority of land in Meeker County (99 percent) is privately owned. Approximately 3,803 acres, or 1 percent of the County is publicly owned (the national average is over 30%). The Minnesota Department of Natural Resources (DNR) is the single largest public land entity within Meeker County. Other public agencies and organizations that own or operate land within Meeker County include the Bureau of Land Management, Department of Military Affairs, Department of Transportation, Meeker County and U.S. Fish and Wildlife Service.

Table 2M provides a breakdown of public land ownership within Meeker County. Map 2I displays the location of the publicly owned lands within the County.

**Table 2M:**  
**Public Land Ownership**

Agency/ Organization	No. of Tracts	Area (acres)
Bureau of Land Management	7	720
Department of Military Affairs	1	41
Department of Transportation	4	159
DNR, Division of Fish and Wildlife	24	2,606
DNR, Division of Forestry	1	40
Meeker County	1	79
U.S. Fish and Wildlife Service	3	158
<b>Total</b>	<b>41</b>	<b>3,803</b>

**References:**

Minnesota Department of Natural Resources  
Minnesota Land Management Information Center