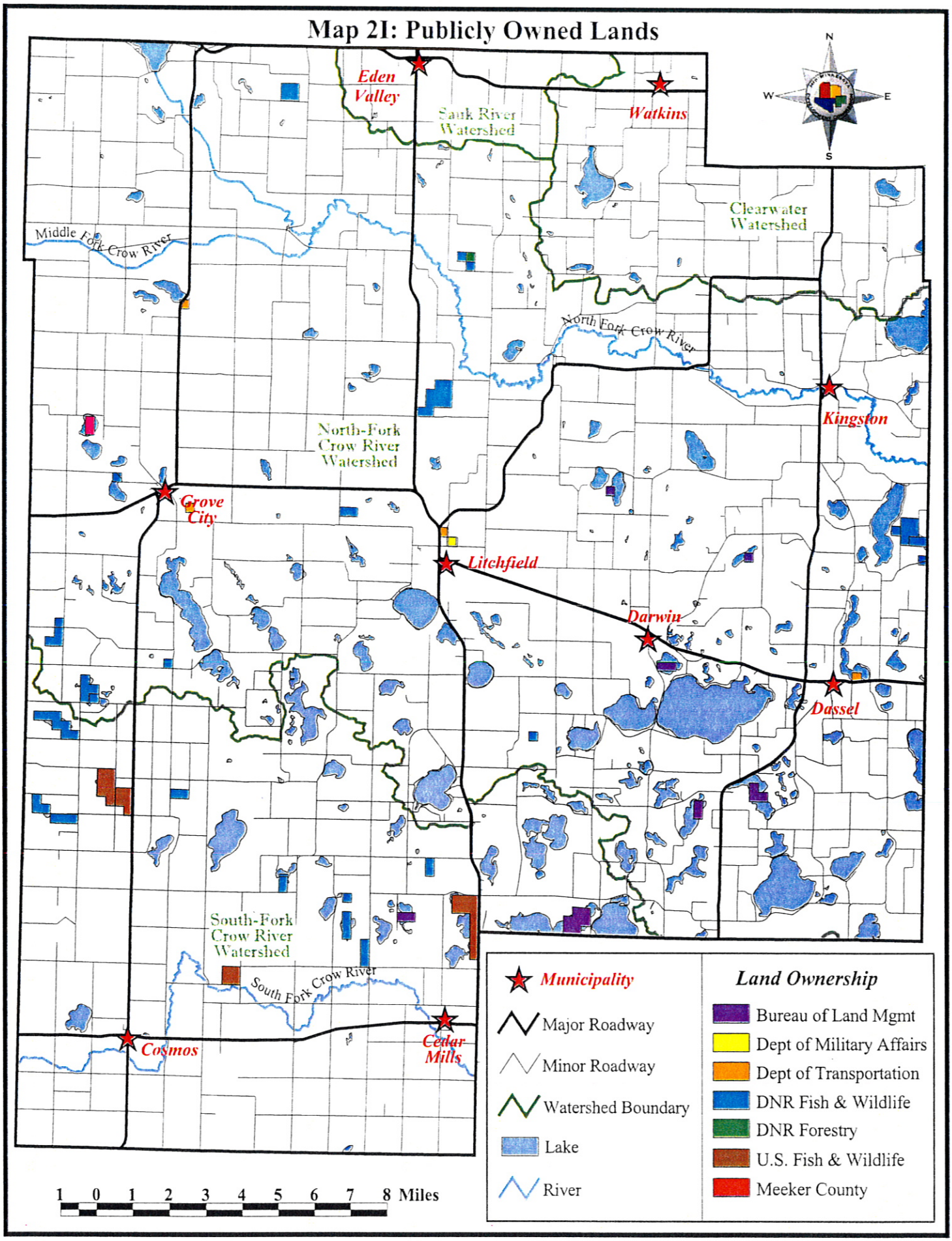
Map 21: Publicly Owned Lands



Water Resource and Related Easements
(Data Item 16)

Easements, whether short-term or perpetual, are commonly used to protect water quality, reduce soil erosion and enhance fish and wildlife habitat. There are a variety of programs offered through local, State and Federal governmental agencies. Among the most common programs offered are the Conservation Reserve Program (CRP), Reinvest in Minnesota (RIM) Reserve Program, Wetland Reserve Program and U.S. Fish and Wildlife Service Easements. In general, the number of conservation easement contracts within the County has increased over the past decade.

Conservation Reserve Program (10-15 Year Contracts)

The Conservation Reserve Program (CRP) offers landowners, operators and tenants the opportunity to voluntarily convert land with high erosion rates and other environmentally sensitive land to permanent vegetative cover. Permanent cover options include grasses and legumes, tree planting and wildlife habitat. The program goals are: to reduce soil erosion, enhance fish and wildlife habitat, improve water quality, protect the soils on the nation's cropland base, demonstrate good land stewardship and improve rural aesthetics.

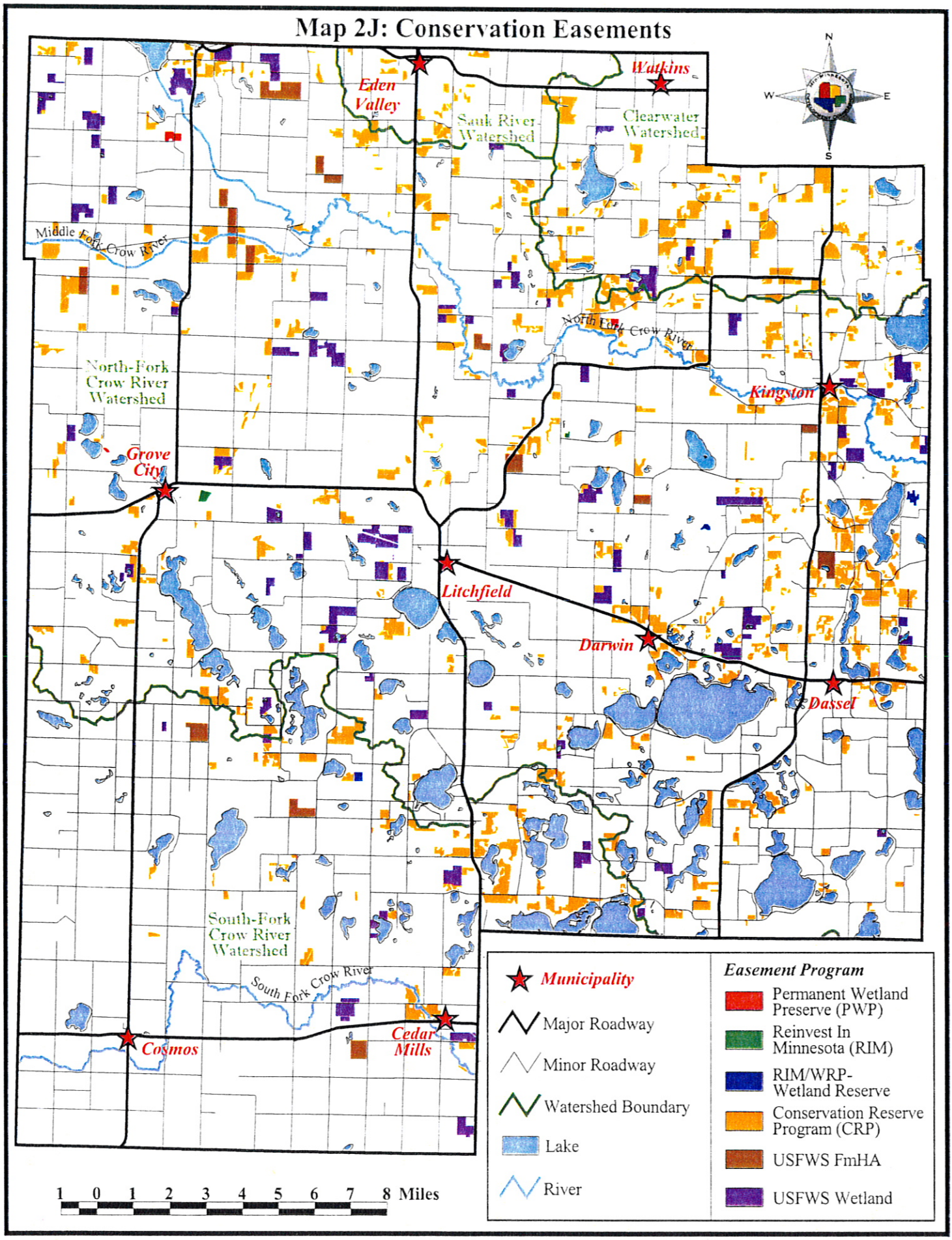
Eligible owners or operators may place highly erodible or environmentally sensitive land into a 10 to 15 year contract. The participant, in return for annual payments, agrees to implement a conservation plan approved by the local conservation district for converting highly erodible cropland or environmentally sensitive land to a less intensive use (i.e., cropland must be planted with a vegetative cover, such as perennial grasses, legumes, forbs, shrubs, or trees). The cropland must be owned or operated for at least 12 months prior to the close of the annual sign-up period, unless the land was acquired by will or succession or the Farm Service Agency (FSA) determines that ownership was not acquired for the purpose of placing the land in the conservation reserve.

Map 2J shows the location of land in Meeker County that has been enrolled in the CRP program through the first 12 signups (1985-1994). However, it should be noted that nearly all of the land enrolled in CRP signups 1-10 is no longer in the program because the contracts have expired. Thus as a result, Map 2J should not be viewed as a current portrayal of CRP lands within the County. Table 2N provides the most current CRP signup totals for Meeker County (signups 04-24). According to the Table, there have been a total of 726 CRP contracts in the County, totaling 15,665 acres.

Table 2N:
Meeker County CRP Signups 04-24

# Contracts	726
# Acres	15,665
Average Rental Rate	$68.61

Map 2J: Conservation Easements



Reinvest in Minnesota Reserve Program (Perpetual)

The Reinvest in Minnesota (RIM) Reserve Program, administered by local SWCDs and BWSR, was one of the first State programs of its kind in the nation. RIM allows landowners to sell perpetual easements for riparian lands, sensitive groundwater areas, wetland restoration areas (drained wetlands), marginal cropland and land for living snowfences. The payment rate for the program is based on 90 percent of the average market value of tillable land in the township. In addition, RIM Reserve provides cost share funds, often times 100 percent, for establishing appropriate conservation and wildlife habitat practices on easement lands.

Since its inception in 1986, funding for the program has been erratic, ranging from a high of $51 million, to a low of $3 million. Since it began, statewide RIM Reserve has enrolled approximately 3,927 easements, covering 126,567 acres, including 43,401 acres of wetland restoration and adjacent upland. The program has historically fostered partnerships with private organizations including Pheasants Forever, Ducks Unlimited and the Minnesota Waterfowl Association, as well as other government agencies, including the U.S. Fish and Wildlife Service (USFWS) and the Minnesota Department of Natural Resources (DNR).

Map 2J displays the RIM wetland restoration easements that have been acquired in Meeker County, as of October 2001. A total of 111.8 acres of wetlands countywide have been enrolled in the RIM program.

Wetland Reserve Program (Perpetual/ Limited)

The Wetland Reserve Program (WRP) is a voluntary program through the USDA to restore and protect wetlands on private property. It provides an opportunity for landowners to receive financial incentives to restore or enhance wetlands on their property. Landowners can enroll in the WRP by one of the following three means:

- Permanent Easement. USDA will pay up to the appraised market value for the land and 100 percent of the cost of restoring wetlands and seeding of upland areas into native grasses and forbs.
- 30-Year Easement. USDA will pay 75 percent of the appraised market value for the land and 75 percent of the cost associated with wetland restorations and upland native grass seeding.
- Restoration Cost-Share Agreement. USDA will pay 75 percent of the cost of restoring a wetland in exchange for a minimum ten-year agreement to maintain the restoration. No land use payment is provided.

Any type of land that can be restored to a wetland at a reasonable cost is eligible for WRP, except for wetlands drained in violation of Swampbuster or land established to trees under the Conservation Reserve Program. Cost-share is available to restore:

- Wetlands cleared and/or drained for farming, pasture, or timber production;
- Upland areas around a restored wetland and;
- Drained wooded wetlands where hydrology will be restored

Through the WRP the landowner continues to control access to the land and may lease the land for hunting, fishing and other compatible recreational activities.

Map 2J displays the location of the WRP/RIM easements that have been acquired in Meeker County, as of October 2001. A total of 107.5 wetland acres are enrolled in the WRP program in the County.

U.S. Fish and Wildlife Service Easements (Perpetual)

The U.S. Fish and Wildlife Service (USFWS) manages land enrolled in two types of conservation easement programs in Meeker County: the Farmer's Home Administration Program and the Wetland Easement Program. Land enrolled in each of these USFWS programs is displayed in Map 2J.

Under the Farmer's Home Administration (FmHA) program, when a landowner defaults on an FmHA loan, and that property contains wetlands, those wetlands receive protection. Protection may come in the form of a perpetual conservation easement or fee title transfer to a Federal or State fish and wildlife agency for management. As of May 2002, there were 2,386.3 acres enrolled in the FmHA Program in Meeker County.

The Wetland Easement Program provides landowners an opportunity to permanently protect existing wetlands through a perpetual easement. Wetlands that are enrolled in this program cannot be drained, filled, leveled or burned. Landowners retain both hunting and mineral rights and can graze or hay wetland when they naturally dry up. As of May 2002, there were a total of 7,776.6 acres enrolled in the Wetland Easement Program in Meeker County.

References:

Meeker County Soil and Water Conservation District
Minnesota Board of Soil and Water Resources
Minnesota Department of Agriculture
United States Department of Agriculture
United States Fish and Wildlife Service

Expected changes to physical environment, land use and development

Changes to Meeker County's physical environment, land use and development can have a significant impact on water resources. The following provides insight to projected changes in the County's population, economic mainstays, land use, wastewater treatment systems, groundwater protection and conservation easements.

Population

According to population projections provided in Tables 1B and 1C, 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 within the County, the fast projection rate 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.

Future population and household growth will have 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 of 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 quality and carrying capacity of the County's water resources could be diminished to the point that it no longer suits the needs of the residents of the area.

Economic Mainstays

According to the Minnesota Department of Economic Security (MDES), there was an available workforce of 9,413 people in Meeker County in 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 the workforce was unemployed. The MDES also reported that four industries 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. Due to poor commodity prices, the overall trend of fewer farms, farming larger acreages and employing fewer employees, is likely to continue over the next ten years.

Land Use

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. According to the inventory, cultivated agricultural land is the single largest land use in Meeker County (70.9%). The implications of cultivated agriculture land being the largest land use has far reaching impacts on the quality and quantity of the County's surface and groundwater resources. 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) protected the soil from both water and wind erosion. 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 and sugar beets) and do not adequately protect the soil from erosion. As a result, water quality and quantity is adversely affected. Over the next ten years, it is expected that the current crop selection within the County will remain the same.

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 in rapidly growing areas, such as surrounding the City of Litchfield. To meet the aggregate demand of this growth, gravel mining within the County has also risen. The increased mining has led to the removal of additional acres of farmland from production and an increased need for erosion and stormwater management. The overall the trend of increasing development and mining activity within the County is expected to remain constant over the next ten years.

Wastewater Treatment Systems

According to the Minnesota Pollution Control Agency (MPCA), the City of Litchfield is in need of wastewater treatment facility upgrades 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.

Groundwater 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. Over the next ten years, it is expected that 12 public water suppliers in Meeker County will enroll in the MDH Wellhead Protection Program. Each of these water suppliers will be developing a management plan for their 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.

Conservation Easements

Common conservation easement programs in Meeker County include the Conservation Reserve Program (CRP), Reinvest in Minnesota (RIM) Reserve Program, Wetland Reserve Program (WRP) and U.S. Fish and Wildlife Service easements. These programs offer short term and/or perpetual easements to protect water quality, reduce soil erosion and enhance fish and wildlife habitat. It is expected that the number of conservation easements within the County will remain at least at current levels over the next ten years, depending on Federal and State funding.

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CHAPTER THREE:
HYDROLOGIC INVENTORY OF MEEKER COUNTY

This chapter provides a hydrologic inventory of Meeker County, with sections on the quality and quantity of streams, lakes and groundwater. In addition, information on groundwater appropriations and water use conflicts is included.

Chapter three includes information on the following data items:

High, Mean and Low Flows of Streams
(Data Item 17)

The Minnesota Department of Natural Resources (DNR) evaluates average annual stream flow by using Exceedence Value Ranges (EVRs). An exceedence value is a statistical measurement of stream flow based on historical discharge records. The value is the probability of the stream flow exceeding a certain value. For instance, a 50 percent exceedence value (sometimes written as Q50) indicates that the level of stream flow currently being reported at a gauging station has been equaled or exceeded 50 percent of the time during the period of record being used (which could be monthly or yearly). A 75 percent exceedence value (Q75) would be the level of stream flow at a particular gauging station that was equaled or exceeded 75 percent of the time during the period of record. A description of each EVR is given below.

- **Critical Flow (Q90-Q100):** A watershed is classified as having critical flow when its stream flow falls below the annual 90 percent exceedence value (Q90). If a watershed is classified as having critical flow, the DNR may, if necessary, restrict the appropriation of water from that watershed to conserve water for instream flow or other higher priority uses.
- **Low Flow (Q75-Q90):** A watershed is classified as having low flow when its stream flow is below the monthly 75 percent exceedence value (Q75), but still above critical flow.
- **Normal Flow (Q25-Q75)**: A watershed is classified as having normal flow when its stream flow is between the monthly 25 percent (Q25) and 75 percent (Q75) exceedence values.
- **High Flow (Q10-Q25):** A watershed is classified as having high flow when its stream flow is above the monthly 25 percent exceedence level (Q25).
- **Flood Flow (Q1-Q10):** A watershed is classified as having flood flow when its stream flow is at or above the flood stage set for that watershed by the National Weather Service (NWS).

Table 3A displays the mean annual EVRs for streams in Meeker County's four major watersheds. (1996-2000). From 1996 to 1998, High Flow (Q10-Q25) levels were observed in all four watersheds, with the exception of the Clearwater River Watershed, which recorded mean stream EVRs in the Normal Flow (Q25-Q75) range in 1996 and 1998. Since 1998, a majority of the watersheds have experienced flow levels in the Normal Flow (Q25-Q75) range. For specific information relating to stream hydrographs or gauging stations, please contact the DNR or USGS.

Table 3A:
Mean Stream Exceedence Value Ranges by Watershed

Watershed	1996 EVR	1997 EVR	1998 EVR	1999 EVR	2000 EVR
Clearwater River	Q25-Q75	Q10-Q25	Q25-Q75	Q10-Q25	Q25-Q75
North Fork Crow River	Q10-Q25	Q10-Q25	Q10-Q25	Q25-Q75	Q25-Q75
Sauk River	Q10-Q25	Q10-Q25	Q10-Q25	Q25-Q75	Q25-Q75
South Fork Crow River	Q10-Q25	Q10-Q25	Q10-Q25	Q25-Q75	Q25-Q75

Reference: Minnesota Department of Natural Resources, Division of Waters

Ordinary High Water Levels for Lakes
(Data Item 18)

The boundary of protected waters and wetlands, for regulatory purposes, is defined by the Ordinary High Water Level (OHWL). The OHWL is the elevation delineating the highest water level which has been maintained for a sufficient period of time to leave evidence on the landscape. Generally, it is the point where the natural vegetation changes from predominately aquatic to predominately terrestrial. Any work done below the OHWL is within the beds of public waters and is therefore subject to the permit authority of the Minnesota Department of Natural Resources (DNR). Table 3B lists the 52 lakes within Meeker County that have DNR established OHWLs.

Table 3B:
Ordinary High Water Levels for Lakes

Lake Name	OHWL	Lake Name	OHWL
Arvilla (47-0023)	1011.8	Mud (47-0059)	1089.7
Belle (47-0049)	1077.2	Pipe (47-0110)	1071.1
Benton (47-0054)	1106.4	Popple (47-0173)	1189.7
Big Swan (47-0038)	1002.0	Porter (47-0057)	1085.5
Birch (47-0055)	1087.9	Powers (47-0048)	1064.1
Butternut (47-0005)	1085.5	Richardson (47-0088)	1063.8
Clear (47-0095)	1130.8	Ripley (47-0134)	1125.3
Dunns (47-0082)	1062.8	Sioux (47-0060)	1083.6
Erie (47-0064)	1099.0	Smiley (47-0070)	1051.8
Fallon (47-0045)	1076.1	Spring (47-0032)	1030.5
Francis (47-0002)	1049.3	Star (47-0129)	1164.9
Greenleaf (47-0062)	1083.6	Stella (47-0068)	1069.0
Harden (47-0112)	1078.0	Stone (47-0131)	1097.4
Hoff (47-0106)	1078.0	Thompson (47-0159)	1107.2
Hoosier (47-0116)	1162.5	Towers (47-0142)	1125.0
Hurley (47-0053)	98.1*	Turtle (47-0074)	1094.9
Jennie (47-0015)	1061.0	Unnamed (47-0043)	1108.1
Jewitt (47-0044)	1074.1	Unnamed (47-0132)	1163.3
Little Mud (47-0096)	1131.3	Unnamed (47-0148)	1145.1
Long (47-0017	97.2*	Unnamed (47-0191)	1172.8
Long (47-0026)	1032.6	Unnamed (47-0164)	1168.7
Long (47-0177)	1166.4	Washington (47-0046)	1069.0
Manuella (47-0050)	1070.3	Whitney (47-0205)	1161.0
Mary (47-0143)	1103.4	Wilcox (47-0193)	1133.6
Minnesota (47-0140)	1150.0	Willie (47-0061)	1081.1
Mud (47-0031)	1022.8	Wolf (47-0016)	1047.8

** Assumed Datum*

Reference: Minnesota Department of Natural Resources, Division of Waters

Permitted Surface Water Appropriations
(Data Item 19)

A list of Minnesota Department of Natural Resources (DNR) issued water appropriation permits for Meeker County's lakes and streams is provided in Appendix A (identified with resource codes of 2 or 3). A total of 6 permits have been issued within the County for lake and stream water withdrawal. Water appropriation permits are required by the DNR for withdrawals greater than 10,000 gallons per day or one million gallons per year. There are several exemptions from the permit requirement, including domestic uses serving less than 25 persons for general residential purposes, test pumping, reuse of water already authorized by a permit and certain agricultural drainage systems. All active water appropriation permit holders are required to measure monthly water use with an approved measuring device to an accuracy of 10 percent and report water use yearly.

Reference:

Minnesota Department of Natural Resources, Division of Waters

State Protected Lake Levels and Stream Flows
(Data Item 20)

The Minnesota Department of Natural Resources (DNR) is the regulatory agency in charge of establishing protected flows and lake levels within the State. The DNR has defined protected flow as "the amount of water required in the watercourse to accommodate instream needs such as water-based recreation, navigation, aesthetics, fish and wildlife habitat, water quality and needs by downstream higher priority users located in reasonable proximity to the site of appropriation." Protection flow for "instream needs" has been identified as a significant social and environmental issue. Instream flow protection is addressed in Minnesota Statutes, and permits issued for appropriation of water from streams or lakes may be limited in order to maintain and protect instream uses.

Although Minnesota is widely perceived as a water-rich State, local and statewide shortfalls are common. For instance, in 1988 Minnesota, as well as much of the Upper Midwest, experienced a severe to extreme drought, rivaling the drought conditions of 1933-1934. Wells went dry, streams had low or no flow, and the lack of adequate water supplies affected all users, out-of-stream and instream. Surface-water appropriators who had never before experienced water availability shortages, had their surface water appropriation permits suspended as early in the season as June. As recently as the summer of 2000, serious thought was given to suspending appropriations due to low flows because the growing season was abnormally dry over significant areas of Minnesota. The DNR notified water appropriators to plan ahead in case of permit suspensions. However, heavy rainfall in early November helped to replenish dehydrated topsoil, as well as streams and lakes.

According to the DNR, there are no known protected lake levels in Meeker County. To regulate surface water appropriators, the DNR uses the following protection elevations:

1. For basins with a functioning outlet below their ordinary high water level (OHWL), the basin's runout elevation will be used as the protection elevation for permit suspension.
2. For basins without a functioning outlet below the OHWL (landlocked basins), the protection elevation for permit suspension will be 1.5 feet below the OHWL.
3. Exceptions to A or B: A protection elevation other than listed in A or B must be based on an analysis of important aquatic vegetation characteristics related to fish and wildlife habitat, existing uses by public and riparian landowners, the total volume of the basin and the slope to the littoral zone, as provided in Minnesota Statutes, Section 103.285, Subdivision 3.

Table 3C details the protected flows that have been established on select Meeker County rivers and streams. On rivers or streams that do not have an established protected flow, the DNR issues new water appropriation permits based on a watercourse's annual 90 percent exceedence flow.

Well Interferences/Groundwater Use Conflict
(Data Item 23)

When a high capacity well is pumping, a portion of the aquifer around it is dewatered in a pattern known as a cone of depression. Wells located within the cone of depression may experience lower water levels and have problems getting water if water levels are lower than well pump. This condition, displayed in Figure 3A, is referred to as "well interference". Most well interference problems tend to be localized and short in duration; however, being without water is a major inconvenience and can cause damage to well pumps. Lowering the pump in the well or installing a new well pump can resolve many well interference problems. In some situations it may become necessary to construct a new water supply well.

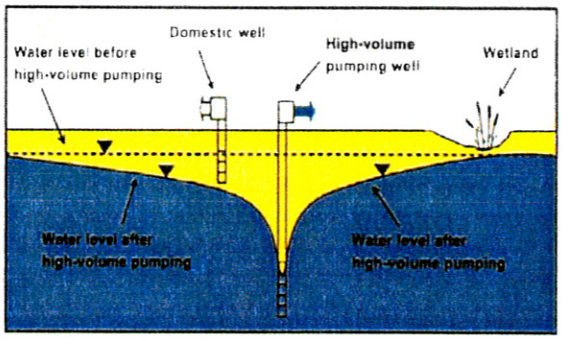


Figure 3A: Well Interference

Minnesota Statutes 103G.261 establishes domestic water use as the highest priority of the State's water when supplies are limited. Procedures for resolving well interferences are defined by Minnesota Rules 6115.0730. Domestic well owners and municipal water suppliers that have problems obtaining water and believe the situation is due to the operation of a high capacity well that pumps in excess 10,000 gallons per day or one million gallons per year, can submit a well interference complaint to the DNR for investigation. However, before the DNR will investigate a well interference complaint, the well owner must have the well inspected by a licensed well driller to determine if the water supply problems are related to the condition of the domestic well.

According to Table 4D, four well interference complaints involving groundwater usage have been entered into the Minnesota DNR Well Interference Complaint Tracking Database for Meeker County. Upon investigation, two of the conflicts were resolved with the complainants, one conflict was resolved by issuing the appropriation permit and another was resolved by the applicant withdrawing the appropriation permit.

Reference:

Minnesota Department of Natural Resources, Division of Waters

Observation Wells
(Data Item 24)

The Minnesota Department of Natural Resources (DNR) monitors the use of the State's water and allocates resources to assure there is sufficient quality and quantity to supply the needs for future generations. Under the observation well network program, groundwater levels are routinely measured in 700 wells statewide. The primary objectives of the observation well network are to:

- Place wells in areas of future or present high groundwater use while considering variations in geologic and other environmental conditions;
- Identify long-term trends in groundwater levels;
- Detect significant changes in groundwater levels;
- Provide data for evaluation for local groundwater complaints and to resolve allocation problems; and
- Identify target areas that need further hydrogeologic investigation, water conservation measures, or remedial action.

There are two types of aquifer systems that are sampled by observation wells in Meeker County: water table and buried artesian. Water table aquifers are the saturated portions of the upper soil profile located above a confining layer. The saturated soil must be of such composition (e.g., sand and/or gravel) that the water can be easily withdrawn. A saturated, clayey soil does not meet the definition of a water table aquifer. Buried artesian aquifers are composed of glacially deposited sands and gravels, over which a confining layer of clay or clay till was deposited. Their hydraulic connections beneath the ground surface are often unknown.

Map 3A identifies the locations of the eight DNR observation wells within Meeker County. Table 3E provides specific details for each of the observation wells, including information on the location of the well, depth of the well, aquifer type, years of record and average reading. Readings for each of the observation wells is graphed in Appendix E.

Table 3E:
DNR Observation Wells

Well #	Unique #	Township	Range	Section	PLSQ	Depth	Aquifer Type	Years of Record	Average Reading
47000	243993	119N	30W	19	NWNENE	26'	Water Table	1977-Present	-4.73'
47001	243994	121N	31W	26	SWSENW	16'	Water Table	1977-Present	-5.13'
47002	132274	119N	31W	20	NWSWSE	260'	Buried Artesian	1982-Present	-62.65'
47003	105565	119N	31W	21	NENENE	224'	Buried Artesian	1982-Present	-27.06'
47004	211684	121N	32W	33	NESESE	41	Water Table	1983-Present	-10.33'
47005	243995	119N	30W	27	NESWSW	0'	Other	1983-Present	-32.44'
47006	150545	119N	30W	19	NWSWNW	180'	Buried Artesian	1984-Present	-25.45'
47007	152111	121N	32W	34	NWNWSW	120'	Buried Artesian	1984-Present	-14.65'

Reference:

Minnesota Department of Natural Resources, Division of Waters

Implications and Assessment

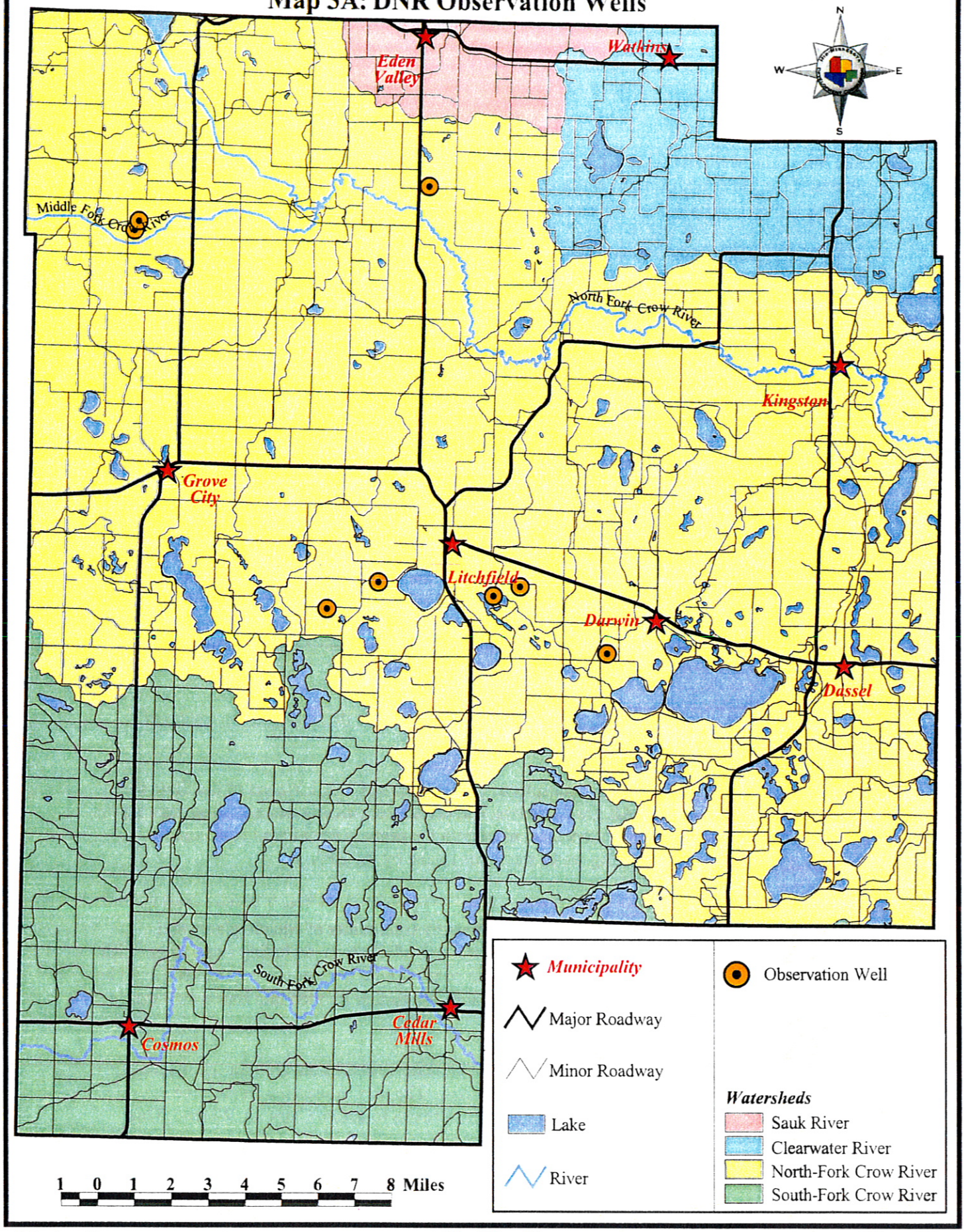
Relative to the amount of information known about surface water in the County, very little is known about groundwater resources. Available information indicates that groundwater resources are plentiful within the County. Outwash and bedrock aquifers are the two predominant aquifer systems that are found in the County. Outwash aquifers are generally found along the North Fork and South Fork of the Crow River and provide a high quality water source for use in domestic and municipal water supplies, irrigation and commercial uses. These aquifers typically yield 25-500 gallons per minute. Aquifers within the bedrock system are typically found throughout Meeker County, at depths of 200 feet or greater. Yields from bedrock aquifers generally range from 10 to 250 gallons per minute. The quality of aquifers within this system is typically very hard, with high concentrations of sulfate, chloride and dissolved solids in many areas.

In an effort to further the understanding of groundwater resources in the area, the County should work in conjunction with the Minnesota Department of Natural Resources (DNR) and Kandiyohi, McLeod and Renville Counties to conduct a Regional Hydrogeologic Atlas. Current groundwater quality monitoring efforts by the Minnesota Department of Agriculture (MDA), Minnesota Department of Health (MDH) and the Minnesota Pollution Control Agency (MPCA) should be continued and expanded within the County. The County should also work with the DNR to continue the observation well program in the County.

To date, the DNR has issued a total of 95 water appropriation permits in Meeker County for groundwater withdrawal, a majority of which have been issued for irrigation purposes. Groundwater irrigation is primarily focused in the northern portion of the County. Townships with greater than 1,000 acres of irrigated land include: Darwin, Swede Grove and Union Grove. This area is characterized by outwash aquifers that can be quite susceptible to contaminants, such as nitrates. The water table in this region is typically found within five feet of the soil surface, with surficial material consisting of coarse sands and gravels. These water-bearing deposits are generally noncontiguous, thus if contamination were to occur, it would be localized. Landowners in this region should be targeted for educational assistance on the proper application and disposal of chemicals and fertilizers. In addition, homeowners should be encouraged to annually test their wells for contaminants.

In addition to those DNR water appropriation permits issued for groundwater irrigation, 19 have been issued for municipal water usage. In an effort to protect public water supplies from contamination, the MDH is in the process of requiring public water suppliers to develop wellhead protection plans. Meeker County should support the MDH in their efforts by participating in wellhead protection technical committees and assisting in data collection efforts. Septic system upgrades, abandoned well sealing and BMPs should be targeted in wellhead protection areas. In addition, the County should work with the MDH to modify or develop land use regulations receptive to wellhead protection areas.

Map 3A: DNR Observation Wells



State Water Quality Management Classifications
(Data Item 25)

The Minnesota Pollution Control Agency (MPCA) establishes water quality standards for all waters of the State, both surface and groundwater. These standards are contained in Minnesota Rules Chapter 7050 and have statewide applicability. The MPCA's statutory authority to adopt water quality standards and to classify waters of the State is found in Minnesota Statutes Chapter 115. Water quality standards consist of beneficial uses and the numerical standards needed to protect those uses. The beneficial uses of water include drinking, protection of aquatic life, fishing and recreation, industrial, agriculture and wildlife use. Chapter 7050 is usually revised every three years. The current version became effective on February 14, 2000.

Chapter 7050 classifies all waters for multiple uses. For example, all trout waters are classified as Class 1B, 2A, 3B, 3C, 4A, 4B, 5 and 6 Waters (see definition of Classes below). All wetlands are classified as Class 2D, 3D, 4C, 5 and 6 Waters. All surface waters of the State, that are not specifically listed in Chapter 7050 and are not wetlands, which includes most lakes and streams in Minnesota, are classified as Class 2B, 3B, 4A, 4B, 5 and 6 Waters. Since all waters carry multiple use classes, all the water quality standards for each of the classes apply. If more than one use class has standards for the same pollutant, the most stringent standard is used.

Numerical water quality standards are assigned to each use class to protect that beneficial use. For surface waters not protected for drinking, most of the applicable standards are associated with Class 2, fisheries and recreation. In general, if the Class 2 standards are met, other uses such as industrial and agricultural uses are also protected. Chapter 7050 includes a method to develop site-specific criteria to address pollutants for which numerical standards have not been adopted.

Refer to the current version of the rule for the specific standards that apply to the waters of interest. The use classifications are defined below.

- **Class 1 Waters: Domestic Consumption**. The quality of Class 1 Waters of the State shall be suitable for drinking. All groundwaters, and certain specifically designated surface waters are Class 1 Waters. These waters must meet both the primary (maximum contaminant levels) and secondary drinking water standards issued by the EPA.

- **Class 2 Waters: Aquatic Life and Recreation**. The quality of Class 2 Waters shall be suitable for the growth and propagation of a healthy community of aquatic plants and animals and their habitats, and for aquatic recreation of all kinds, including swimming. Fish from Class 2 Waters should be safe for human consumption and aquatic organisms should be safe for consumption by wildlife. Class 2 Waters are further divided into four subclasses listed below.

    - **Class 2A Waters: Trout Waters**. These waters shall be suitable for the maintenance of a healthy community of cold-water fish. The MPCA uses the Department of Natural Resources list of trout lakes and streams to define Class 2A Waters. This class of surface waters is also protected as a source of drinking water.

- **Class 2B Waters**. These waters shall be suitable for maintenance of a healthy community of cool or warm water sport fish, associated aquatic life and their habitats. Most lakes, streams and rivers in the State are Class 2B Waters.

- **Class 2Bd Waters**. These waters are the subgroup of Class 2B Waters that are protected for drinking.

- **Class 2C Waters**. Class 2C Waters are usually small streams that provide a more limited habitat for game fish populations. However, with very few exceptions, the same standards that apply to Class 2B Water also apply to Class 2C Waters.

- **Class 2D Waters**. These waters are wetlands and they are protected for the propagation and maintenance of a healthy community of aquatic and terrestrial species indigenous to wetlands, and their habitats. Wetlands shall be suitable for boating and other forms of aquatic recreation for which the wetland may be usable. Most Class 2B standards apply to wetlands.

- **Class 3 Waters: Industrial Consumption**. The quality of Class 3 Waters shall be such as to permit their use with or without chemical treatment for most industrial purposes, except food processing.

- **Class 4 Waters: Agricultural and Wildlife**. Class 4 Waters of the State shall be such as to permit their use for irrigation without significant damage or adverse effects upon any crops or vegetation, including truck garden crops; and for use by livestock and wildlife for watering without inhibition or injurious effects. Class 4 wetlands (4C) are also protected for erosion control, groundwater recharge, low flow augmentation and stormwater retention.

- **Class 5 Waters: Aesthetic Enjoyment and Navigation**. The quality of Class 5 Waters of the State shall be such as to be suitable for aesthetic enjoyment of scenery, to avoid any interference with navigation or damaging effects on property.

- **Class 6 Waters: Other Uses**. The uses to be protected in Class 6 Waters may be under other jurisdictions and in other areas to which the waters of the State are tributary and may include any or all of the above uses, plus any other possible beneficial uses. No numerical standards are associated with the Class 6 use. (This classification does not refer to stormwater detention ponds).

- **Class 7 Waters: Limited Resource Value Waters**. The quality of Class 7 Waters of the State shall be such as to protect aesthetic qualities, secondary body contact use and groundwater for use as a potable water supply. Class 7 Waters do not provide enough water or suitable habitat for aquatic life and aquatic recreation and are not protected for this use.

Table 3F lists the waters of Meeker County that have an MPCA Water Quality Management Classification. Location of each of the waters is given by township(s), range(s) and section(s).

Table 3F:
MPCA Water Quality Management Classifications

Name	Classification	Township(s)	Range(s)	Sections (s)
Battle Creek	2C	120N	30W	NA
	2C	120N	31W	NA
Belle Creek	2C	117N	32W	NA
	2C	118N	32W	NA
Belle Lake	2B	118N	30W	34,35
Big Swan Lake	2B	119N	29W	1,2,11,12
	2B	120N	29W	35,36
Clear Lake	2B	121N	30W	16,21,22,28
Crow River, North Fork	2B,3B	From Lake Koronis outlet to Wright County line		
Dunns Lake	2B	120N	30W	34
	2B	119N	30W	3
Eagle Creek	2C	120N	R29W	NA
Greenleaf Lake	2B	118N	30W	20,29
Jewett Creek	2C	119N	30W	NA
	2C	120N	31W	NA
Lake Betsy	2B	120N	29W	23,24
Lake Erie	2B	118N	30W	22,23,26,27
Lake Francis	2B	120N	29W	1,11,12
Lake Jennie	2B	118N	29W	20,28,29,32,22
Lake Minnie Belle	2B	118N	31W	11,12,13,14
Lake Ripley	2B	119N	31W	14,15,22,23
Lake Washington	2B	119N	30W	25,35,36
	2B	119N	29W	31,32
	2B	118N	29W	5,6
	2B	118N	30W	1,2
Lake Willie	2B	118N	30W	19,30
Long	2B	119N	29W	14,15,22,23
Long	2B	119N	32W	14,15,22,23,26
Manuella Lake	2B	118N	30W	3,4
Round Lake	2B	119N	31W	25,36
	2B	119N	30W	30,31
Sioux Lake	2B	118N	30W	16,17,20,21
Spring Lake	2B	119N	29W	26,27
Stag Brook	2C	121N	30W	NA
	2C	122N	31W	NA
Stella Lake	2B	118N	30W	2,3
	2B	119N	30W	34,35
Unnamed Creek, Grove City	7	120N	32W	34,35,36

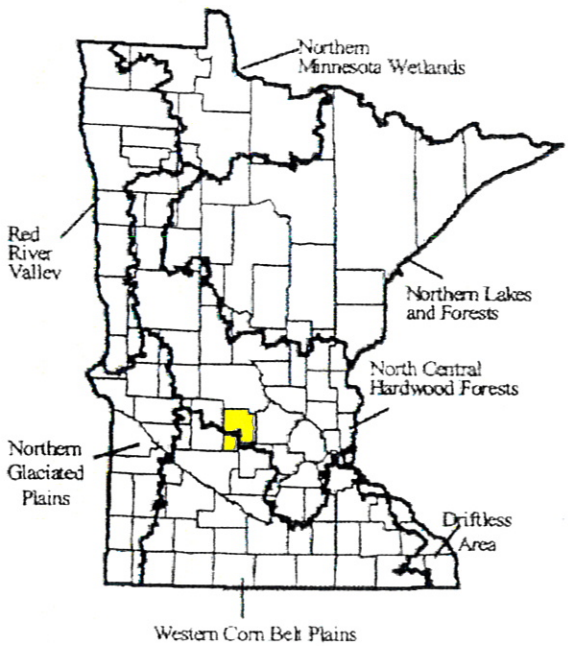
Reference: Minnesota Pollution Control Agency

Lake and Stream Water Quality
(Data Items 26 & 27)

Ecoregional Classification of Minnesota Lakes

Minnesota has over 12,000 lakes spread across a diverse array of environmental conditions. Studies have shown distinct regional patterns in lake productivity associated with regional differences in geology, vegetation, hydrology and land use conditions. Based on this concept, the Minnesota Pollution Control Agency (MPCA) established a classification system of Minnesota lakes based upon seven ecoregions. Figure 3B details the ecoregions of Minnesota. Notice Meeker County is divided into two ecoregions: the North Central Hardwood Forests and the Western Corn Belt Plains.

Figure 3B:
Minnesota's Seven Ecoregions



Ecoregions were delineated based on water quality data that was collected on 90 reference lakes statewide between 1985 and 1987. Lakes were tested for such water quality parameters as total phosphorus, chlorophyll *a* and water clarity. Reference lakes were chosen to represent minimally impacted sites within the region. Criteria used in selecting reference lakes included maximum depth, surface area, fishery classification and general recommendations from the Minnesota Department of Natural Resources (DNR). In addition to reference lake data, the MPCA examined a statewide database containing water quality data collected on approximately 1,400 lakes from 1977 to 1987. Table 3G displays the summer average water quality characteristics for the two ecoregions found in Meeker County. For additional water quality standards, please contact the MPCA.

Table 3G:
Summer Average Water Quality
Characteristics for Meeker County's Ecoregions

Parameter	Ecoregion	
	North Central Hardwood Forest	Western Corn Belt Plains
Total Phosphorus (ug/l)	23-50	65-150
Chlorophyll a (ug/l)	5-22	30-80
Secchi Disk (ft.)	4.9-10.5	1.6-3.3
Total Kjeldahl Nitrogen (mg/l)	<0.6-1.2	1.3-2.7

The combination of total phosphorus levels, chlorophyll *a* levels and Secchi disk readings is often used to define the degree of eutrophication, or trophic status of a lake. The concept of trophic status is based on the fact that changes in nutrient levels (measured by total phosphorus) causes changes in lake clarity (measured by Secchi disk transparency). A trophic state index is one convenient means of quantifying this relationship. One popular index was developed by Dr. Robert Carlson of Kent State University, called the Carlson's Trophic State Index (CTSI). The CTSI uses a log transformation of Secchi disk values as a measure of algal biomass on a scale from 0-110. Each increase of ten units on the scale represents a doubling of algal biomass. Because chlorophyll *a* and total phosphorus are usually closely correlated to Secchi disk measurements, these parameters can also be assigned trophic state index values. Formulas for calculating CTSI values for Secchi disk readings, chlorophyll *a* levels and total phosphorus levels are listed below.

CTSI (for Secchi disk readings) = 60 – 14.41 In Secchi disk (meters)
CTSI (for chlorophyll *a* levels) = 9.81 In chlorophyll *a* (ug/L) + 30.6
CTSI (for total phosphorus) = 14.42 In total phosphorus (ug/L) + 4.15

where:

CTSI = Carlson's Trophic State Index
In = natural logarithm

Table 3H details mean values for Secchi disk readings, chlorophyll *a* levels, total phosphorus levels and CTSI for MPCA monitored lakes in Meeker County. Figure 3C displays the values that are associated with various trophic levels.

Figure 3C:
Trophic Levels

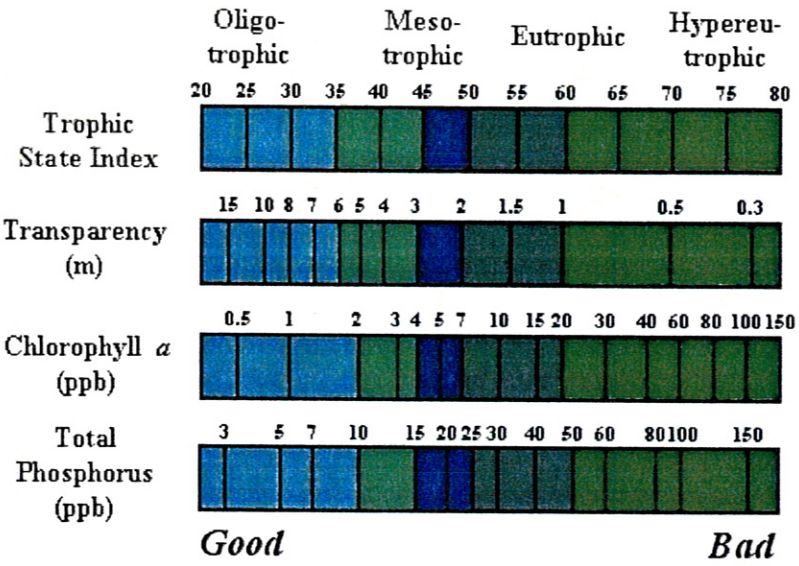


Table 3H:
MPCA Water Quality Data

Lake Name	DNR ID	Mean Secchi Disk (m)	Mean Chlorophyll *a* (ppb)	Mean Total Phosphorus (ppb)	Mean CTSI value
Belle	47-0049	1.6	NA	NA	53
Betty	47-0042	1.0	21.3	237	68
Big Swan	47-0038	0.9	NA	NA	62
Clear	47-0082	0.7	100.0	197	74
Dunns	47-0082	0.8	61.7	128	69
Francis	47-0002	2.0	NA	NA	50
Jennie	47-0015	1.4	42.4	80	63
Little Mud	47-0096	1.7	45.0	67	62
Long	47-0026	1.8	39.6	46	59
Long	47-0177	0.4	NA	NA	73
Manuella	47-0050	2.3	14.2	23	51
Minne-Belle	47-0119	3.8	NA	NA	41
Richardson	47-0088	1.4	34.7	85	63
Ripley	47-0134	1.0	NA	78	64
Spring	47-0032	0.6	126.9	207	75
Star	47-0129	0.9	NA	NA	62
Stella	47-0068	2.0	8.4	20	49
Washington	47-0046	1.1	22.3	45	60

Lake Water Quality Assessment Reports

The Lake Assessment Program (LAP) was developed in 1985 in response to requests from lake associations that were interested in cooperatively assessing the condition of their lakes. Since 1985, the MPCA has conducted over 160 LAP studies. In addition to complete studies, the MPCA conducts a variety of other lake monitoring (regional and trend studies) efforts that result in briefer reports. These include the following:

- **Trend Reports** are often follow-up studies to previously conducted LAP or other studies. Their primary focus is to assess trends in lake condition over time.
- **Note Reports**, as they are referred to, are brief LAP-like reports often prepared in response to lakeshore residents' concerns or as a part of oral presentations. These are brief reports that focus primarily on the current trophic status of the lake.
- **Status Reports** are brief reports that serve to characterize the trophic status and trends of several lakes in a county.

Table 3I provides a listing of all available LAP and related reports for Meeker County. A total of eight LAP reports and one Lake Status report have been conducted in the County

Table 3I:
MPCA Lake Water Quality Reports

Lake and Description	DNR ID	Year
Collinwood Lake Status report	86-0293	1996
Dunns and Richardson Lake LAP report	47-0082	1996
Jennie Lake LAP report	47-0015	1996
Lake Ripley LAP report	47-0134	1985
Lake Ripley LAP report	47-0134	1985
Manuella and Stella Lakes LAP report	47-0050, 47-0068	1998
Minnie Belle Lake LAP report	47-0119	1987
Spring and Long Lakes LAP report	47-0032	1991
Washington Lake LAP report	47-0046	1992

Citizen Lake Monitoring Program

The Citizen Lake Monitoring Program (CLMP) is a cooperative program combining the technical resources of the Minnesota Pollution Control Agency (MPCA) and volunteer efforts of citizens statewide, who collect water quality data on their lakes. CLMP volunteers collect water transparency data using an eight-inch, circular, all-white metal plate attached to a calibrated rope. This tool is called a Secchi disk. About once a week during the summer, volunteers boat

to a designated spot on their lakes to collect transparency readings. The volunteer lowers the disk into the water until it is no longer visible and notes the depth from the markings on the rope. The disk is then lowered a little further and then raised back up until it is just visible. The second depth reading is averaged with the first, and a final number is recorded on a data sheet. At the end of summer, volunteers send their data sheets to the MPCA to be compiled with other water quality data. Water transparency readings derived through the CLMP provides MPCA with highly useful information concerning the lake's water quality. First, it indicates the amount of light penetration into a lake. Second, Secchi transparency provides an indirect measure of the amount of suspended materials in the water, which in many cases is an indication of the amount of algae in the water. Long-term transparency monitoring helps scientists detect signs of degradation to a lake. Generally, the sooner water quality problems are detected, the easier and less expensive it is to restore the lake to its previous state. Since 1979, 17 lakes in Meeker County have been monitored through the Citizens Lake Monitoring Program. Table 3J lists the average annual Secchi disk readings for lakes monitored through the program.

Table 3J:
CLMP Lake Transparency

Lake Name	Year	Average Secchi Reading (ft.)	Lake Name	Year	Average Secchi Reading (ft.)
Belle (47-0049)	1992	5.3	Dunns (47-0082)	1997	3.5
	1994	4.6		1998	2.4
	1995	5.7		1999	1.7
	2001	5.7		2000	2.5
Betty (47-0042)	1979	3.6		2001	2.3
	1980	4.1	Francis (47-0002)	1975	5.5
	2001	2.9		1986	8.2
Big Swan (47-0038)	1996	3.0		1987	9.8
	1997	3.7		1988	6.6
	1998	2.6		1991	6.5
	1999	3.3		1992	8.7
	2000	3.4		1993	6.9
	2001	7.2		1994	7.5
Clear (47-0082)	1989	0.6		1995	6.6
	1990	1.7		1996	5.5
	1992	4.0		1997	6.1
	1998	1.2		1998	6.2
	1999	2.0		1999	5.2
	2000	1.3		2000	6.1
	2001	2.3		2001	5.5
Dunns (47-0082)	1995	2.5	Jennie (47-0015)	1992	3.8
	1996	2.4		1993	6.7

Table 3J:
CLMP Lake Transparency *(continued…)*

Lake Name	Year	Average Secchi Reading (ft.)	Lake Name	Year	Average Secchi Reading (ft.)
Jennie (47-0015)	1994	6.0	Minne-Belle (47-0119)	1986	9.9
	1995	5.3		1987	12.5
	1996	4.1		1988	12.0
	1997	5.6		1989	13.1
	1998	4.2		1990	12.3
	1999	4.8		1991	11.6
	2000	8.5		1992	10.6
	2001	6.2		1993	12.0
Little Mud (47-0096)	1999	9.1		1994	12.5
	2000	9.5		1995	15.3
	2001	9.2		1996	11.9
Long (47-0026)	1990	2.8		1997	16.4
	1991	5.8		1998	10.0
	1992	5.5		1999	12.7
	1993	6.9		2000	11.4
	1994	6.1		2001	14.6
	1995	6.4	Richardson (47-0088)	1995	2.4
	1996	8.5		1996	7.2
	1997	6.2		1997	4.2
	1998	6.9		1998	3.2
	1999	6.8		1999	3.4
	2001	7.4		2000	3.8
Long (47-0177)	1996	0.6		2001	3.8
	1997	2.6	Ripley (47-0134)	1985	2.9
	1998	0.7		1987	3.1
	1999	0.6		1988	4.7
	2000	0.5	Spring (47-0032)	1989	1.5
	2001	3.8		1990	0.9
Manuella (47-0050)	1996	9.1		1991	1.0
	1997	8.1		1992	1.0
	1998	6.0		1993	4.0
	1999	7.2		1994	1.5
	2000	10.0		1995	2.6
	2001	10.1		1996	2.9
	1998	6.0		1997	2.44
	1999	7.2		1998	2.0
	2000	10.0		1999	5.7
	2001	10.1		2000	10.2

Table 3J:
CLMP Lake Transparency *(continued...)*

Lake Name	Year	Average Secchi Reading (ft.)	Lake Name	Year	Average Secchi Reading (ft.)
Star (47-0129)	1996	5.0	Stella (47-0068)	2000	10.2
	1997	2.8		2001	7.8
	1998	0.9	Washington (47-0046)	1985	3.2
	1999	1.8		1986	4.2
	2000	2.7		1987	5.0
Stella (47-0068)	1987	5.3		1988	3.4
	1988	6.3		1989	2.5
	1989	5.6		1990	3.1
	1990	6.0		1992	3.2
	1991	5.8		1993	4.2
	1992	4.8		1994	4.7
	1993	7.2		1995	4.9
	1994	6.8		1996	3.8
	1995	7.1		1997	4.8
	1996	7.5		1998	3.7
	1997	6.9		1999	2.1
	1998	6.2		2000	2.7
	1999	5.7		2001	5.5

Citizen Stream Monitoring Program

The Citizen Stream Monitoring Program (CSMP) combines the knowledge and commitment of interested citizens with the technical expertise and resources of the Minnesota Pollution Control Agency (MPCA), to develop a more comprehensive statewide network for monitoring Minnesota's 92,000 miles of streams. Any person or group willing to devote a small amount of time and energy to conduct simple stream checks on a regular basis can become a volunteer monitor with the MPCA. Approximately once a week during the summer months, monitors measure transparency, appearance, recreational suitability and stream stage on an established spot of a nearby stream. Monitors measure precipitation on a daily basis.

The CSMP increases our overall understanding of how human activities, such as land use, affect water quality. Increased stream monitoring will help identify problems, develop strategies and prioritize activities for improving water quality, and track progress toward improvement.

Goals of the CSMP are to:

1. Help determine the condition of Minnesota streams by expanding our water quality monitoring network.

2. Provide the opportunity for anyone interested to participate in a basic, centrally administered and interpreted stream monitoring program.
3. Support existing volunteer monitoring programs.
4. Facilitate awareness and understanding of water quality issues.

Changes over time in transparency, appearance and recreational suitability can serve as yardsticks to measure improvements or declines in water quality. Individuals and organizations can use CSMP data to detect trends in water quality and help decide if additional assessments or actions are needed to protect and improve water quality. Some potential projects for CSMP monitoring include:

- **Before and after a change in upstream land use -** If a land management change is planned near a stream or river, select a monitoring site just downstream of where the change will take place. Monitor before and after the change occurs to detect any potential effects on the stream.
- **Seasonal storm monitoring -** Compare CSMP data for rainfall events during spring, summer and fall to background or baseflow (low flow) conditions. Keep track of upstream land management practices or crop status during this period.
- **Upstream and downstream of a water quality improvement project -** Monitor a site upstream and a site downstream of a stormwater retention pond or stream vegetative buffer to evaluate its effectiveness at reducing sediment inputs.

Table 3K lists the Meeker County volunteer monitors who have registered with the MPCA's Citizen Stream Monitoring Program, as derived from MPCA's *2000 Report on the Water Quality of Minnesota Streams*. Additionally, a summary of the 2000 water quality data collected for each site is also included. As of August 2002, a summary of the results from the 2001 monitoring year remained unavailable. However, those volunteers that were registered with the MPCA for 2001 are indicated with an asterisk beside their name.

Table 3K:
CSMP Volunteers and Water Quality Data

Volunteer	Site ID	Stream Name	Mean Transparency	Minimum Transparency	Maximum Transparency
Thomas Burr*	188	North Fork Crow River	51 cm	42 cm	60 cm
Litchfield WWTP*	191	Jewitts Creek	58 cm	49 cm	60 cm
Litchfield WWTP*	192	North Fork Crow River	42 cm	23 cm	60 cm
Bob Schwingler*	254	Tributary to Manuella Lake	56 cm	18 cm	60 cm
No name provided*		Clearwater River			
Greg Hallberg*		Collinwood Creek			

Table 3K:
CSMP Volunteers and Water Quality Data *(continued...)*

Volunteer	Site ID	Stream Name	Mean Transparency	Minimum Transparency	Maximum Transparency
Lee Miska*		Collinwood Lake South Inlet			
Lee Sundmark*		Jewitts Creek			
Chuck Rick*		North Fork Crow River			
Howard Turck*		North Fork Crow River			
Steve Dille*		North Fork Crow River			
Richard Gehlen*		Silver Creek			

Total Maximum Daily Loads (TMDLs)

The Federal Clean Water Act requires states to adopt water quality standards to protect the nation's waters. These standards are to define how much of a pollutant can be in surface and/or groundwater, while still allowing it to meet its designated uses, such as drinking water, fishing, swimming, irrigation or industrial purposes. Minnesota's statewide water quality standards and other provisions that protect water quality are found in Minn. Rules Chapter 7050. Standards are broken down based upon water use classifications.

Hypoxia Zone of the Gulf of Mexico

Over the past two decades, scientists have studied the hypoxia zone of the Gulf of Mexico. The hypoxia zone is an oxygen depleted area of the Gulf, caused by excessive nitrogen and phosphorus loading from the Mississippi River. High levels of these nutrients cause excessive plankton growth, which in turn die and aerobically decompose. The result is an overall reduction in the level of dissolved oxygen in the Gulf, which can lead to fish kills and overall ecological instability.

In studying the hypoxia zone of the Gulf of Mexico, scientists have concluded that this area has increased dramatically over the last several years. Studies conducted by the Environmental Protection Agency (EPA) have identified agricultural production in the Upper Mississippi River Basin (Illinois, Iowa, Minnesota and Wisconsin) as the primary source of nitrates in the hypoxia zone.

Many of Minnesota's water resources cannot currently meet their designated uses because of pollution problems from a combination of point and nonpoint sources. For each pollutant that causes a waterbody to fail to meet State water quality standards, the Clean Water Act requires the states to conduct a Total Maximum Daily Load (TMDL) study. A TMDL study identifies all point and nonpoint sources of each pollutant in a waterbody, which fails to meet water quality standards. Water quality sampling and computer modeling determine how much each pollutant source must reduce its contributions to assure the standard is met in that waterbody. Rivers and streams may have several TMDLs, each one determining the limit for a different pollutant.

Section 303(d) of the Clean Water Act requires states to publish, every two years, an updated list of streams and lakes that are not meeting their designated uses because of excess pollutants. The list, known as the Section 303(d) List of Impaired Waters, is based on violations of water quality standards. A draft of the 2002 Section 303(d) List of Impaired Waters for Meeker County is found in Table 3L. According to the table, a total of seven river reaches and seven lakes are due to be included on the list. A number of these reaches and lakes are listed multiple times for different pollutants. The absence of a waterbody or watercourse from the 303(d) List does not necessarily mean it is meeting its designated uses. It may be that the reach or lake has either not been sampled or there is not enough data to make an impairment determination.

Table 3L:
Draft 2002 Section 303 (d) List of Impaired Waters (Meeker County)

Reach/Lake	ID	Affect Use	Pollutant	Target start/ Completion
Clearwater River; Clear Lake to Lk Betsy	07010203-502	Swimming	Fecal Coliform	2007/2010
Clearwater River; Clear Lake to Lk Betsy	07010203-502	Aquatic Life	Low Oxygen	2006/2010
Crow River, North Fk; Middle Fk Crow R to Jewitts Cr	07010204-507	Aquatic Life	Mercury FCA	2002/2015
Crow River, South Fk; Headwaters to Hutchinson Dam	07010205-503	Aquatic Life	Impaired Biota	2005/2012
Crow River, South Fk; Headwaters to Hutchinson Dam	07010205-503	Aquatic Life	Mercury FCA	2002/2012
Grove Creek; Unnamed Cr To Middle Fk Crow R	07010204-514	Aquatic Life	Impaired Biota	2007/2014
JD 29; Headwaters to South Fk Crow R	07010205-506	Aquatic Life	Impaired Biota	2007/2014
Jewitts Creek; Headwaters to N Fk Crow R	07010204-501	Aquatic Life	Ammonia	2006/2011
Jewitts Creek; Headwaters to N Fk Crow R	07010204-501	Aquatic Life	Impaired Biota	2006/2013
Jewitts Creek; Headwaters to N Fk Crow R	07010204-501	Aquatic Life	Low Oxygen	2011/2015
Unnamed Creek; Headwaters to North Fk Crow R	07010204-513	Aquatic Life	Impaired Biota	2007/2014
Unnamed Creek; Headwaters to South Fk Crow R	07010205-507	Aquatic Life	Impaired Biota	2008/2015
Dunns Lake	47-0082	Swimming	Excess Nutrients	2008/2013
Dunns Lake	47-0082	Aquatic Life	Mercury FCA	2002/2015
Lake Francis	47-0002	Aquatic Life	Mercury FCA	2002/2015
Lake Jennie	47-0015	Aquatic Life	Mercury FCA	2002/2015
Lake Washington	47-0046	Aquatic Life	Mercury FCA	2002/2015
Long Lake	47-0026	Aquatic Life	Mercury FCA	2002/2015
Richardson Lake	47-0088	Swimming	Excess Nutrients	2008/2013
Richardson Lake	47-0088	Aquatic Life	Mercury FCA	2002/2015
Spring Lake	47-0032	Aquatic Life	Mercury FCA	2002/2015

A number of lawsuits dealing with TMDL development have been filed nationally, primarily by environmental advocates, who charge the studies are not being completed as required. The Environmental Protection Agency (EPA) is under court order to establish TMDLs in at least 20 states if these states do not do so themselves. There is currently no such lawsuit in Minnesota. However, if Minnesota does not comply with Federal requirements to establish TMDLs, a lawsuit and subsequent requirements to complete the studies are likely.

Beyond the Federal requirements, there are a number of reasons why the State needs to move forward with the development of TMDLs. Foremost is the need to clean up rivers and lakes to maximize their contributions to the State's economy and quality of life and protect them as a resource for future generations.

STORET

STORET is a water quality data clearinghouse that is maintained by the Environmental Protection Agency (EPA), with help from the Minnesota Pollution Control Agency (MPCA). The EPA maintains two STORET data management system: the Legacy Data Center and STORET. The Legacy Data Center (LDC) contains historic water quality data dating back to the early part of the 20th century and collected up to the end of 1998. STORET contains data collected beginning in 1999, along with older data that has been properly documented and migrated from the LDC. Currently, the new STORET system contains very little information for Meeker County. Table 3M identifies the location of STORET stations within the County.

Table 3M:
STORET Stations

Lake/Stream	ID	Station Location	Agency
Francis	47-0002	5 miles SW of South Haven	MPCA
Jennie	47-0015	5 miles SW of Dassel	MPCA
Long	47-0026	At Dassel	MPCA
Spring	47-0032	At Dassel	MPCA
Big Swan	47-0038	3 miles north of Dassel	MPCA
Betty	47-0042	5 miles NE of Kingston	MPCA
Washington	47-0046	1 mile SE of Darwin	MPCA
Belle	47-0049	5 miles south of Darwin	MPCA
Manuella	47-0050	2 miles SW of Darwin	MPCA
Sioux	47-0060	5 miles SW of Darwin	MPCA
Willie	47-0061	6 miles SW of Darwin	MPCA
Greenleaf	47-0062	6 miles SW of Darwin	MPCA
Erie	47-0064	5 miles south of Darwin	MPCA
Stella	47-0068	1 mile south of Darwin	MPCA
Darwin	47-0076	1 mile SE of Darwin	MPCA

Table 3M:
STORET Stations *(continued…)*

Lake/ Stream	ID	Station Location	Agency
Dunns	47-0082	3 miles north of Darwin	MPCA
Richardson	47-0088	4 miles north of Darwin	MPCA
Clear	47-0095	3 miles SW of Watkins	MPCA
Little Mud	47-0096	3 miles SW of Watkins	MPCA
Round	47-0102	2 miles south of Litchfield	MPCA
Minnie-Belle	47-0119	4 miles south of Litchfield	MPCA
Star	47-0129	2 miles north of Strout	MPCA
Ripley	47-0134	At Litchfield	MPCA
Long	47-0177	7 miles west of Litchfield	MPCA
Jewetts Creek	S000-294	4 miles north of Litchfield	MPCA
South Fork Crow River	S000-575	3 miles NE of Cosmos	MPCA
South Fork Crow River	S000-576	2 miles NE of Cosmos	MPCA
South Fork Crow River	S000-577	1.5 miles NE of Cosmos	MPCA
South Fork Crow River	S000-578	Above Cosmos Pond Outfall	MPCA
Grove Creek	S000-847	7.5 miles NE of Grove City	MPCA
Grove Creek	S000-848	5 miles NE of Grove City	MPCA
Grove Creek	S000-849	4 miles NE of Grove City	MPCA
Grove Creek	S000-850	3 miles NE of Grove City	MPCA
Grove Creek	S000-851	1.5 miles NE of Grove City	MPCA
Town Slough Out	S000-852	At Grove City	MPCA
Town Slough Outlet	S000-853	0.5 miles north of Grove City	MPCA
Grove Creek	S000-854	1 mile east of Grove City	MPCA
Grove Creek	S000-897	7 miles NE of Grove City	MPCA
Jewitts Creek	S000-919	3 miles north of Litchfield	MPCA
Jewitts Creek	S000-920	2.5 miles north of Litchfield	MPCA
Jewitts Creek	S000-921	North of Litchfield	MPCA
Jewitts Creek	S000-922	0.5 miles north of Litchfield	MPCA
Jewitts Creek	S000-923	CSAH 42/ Armstrong Ave., Litchfield	MPCA
Tributary to Spring Lake	S000-951	Near Dassel	MPCA
Spring Lake Outlet	S000-952	0.5 miles east of Dassel	MPCA
DT to Lake Minnie Belle	S001-100	SW ¼, NW ¼, Section 14, T118N, R31W	MPCA
Outlet of Lake Minnie Belle	S001-117	At Road, NE ¼, SE ¼, Section 11	MPCA
DT to Lake Minnie Belle	S001-118	East of bay, on SW end of lake	MPCA
Tile to Lake Minnie Belle	S001-119	NW ¼, NW ¼, Section 13, T118N, R31W	MPCA
Inlet to Lake Minnie Belle	S001-133	At end of road, NW side of lake	MPCA
Tile to Lake Minnie Belle	S001-134	NW ¼, NW ¼, Section 14, T118N, R31W	MPCA

Table 3M:
STORET Stations *(continued...)*

Lake/ Stream	ID	Station Location	Agency
DT to Lake Minnie Belle	S001-135	At road to culvert SE side of lake	MPCA
Tile to Lake Minnie Belle	S001-136	Lot #66, SE end of lake	MPCA
Tile to Lake Minnie Belle	S001-137	Lot #65, SE end of lake	MPCA
Tributary to Jewitts Creek	S001-165	At MN-24, NE of Litchfield	MPCA
Jewitts Creek	S001-166	0.1 mile down of CSAH 24 in Litchfield	MPCA
Jewitts Creek	S001-208	At Sibley Ave./MN-22 at Litchfield	MPCA
Jewitts Creek	S001-209	At Lake Ripley Outlet, 1 mile SW Litchfield	MPCA

Watershed Management-like Organization Data

Many of Meeker County's watershed management-like organizations (i.e. watershed projects, watershed districts, clean water partnerships) routinely monitor the quality of the County's surface water. Samples are analyzed for a number of physical, chemical and biological parameters, such as total suspended solids, total phosphorus, nitrate nitrogen and fecal coliform bacteria. Appendix F contains recent data collected from each of the organizations. Contact each organization for additional baseline data.

Fish Kills

Winterkill of fish in Meeker County lakes is limited, but does occur occasionally. Winterkill results when the dissolved oxygen concentration in a lake or stream falls beneath lethal limits for fish. Lethal limits are different for each fish species. Lethal limits can change for individual fish species and even different age classes of a species of fish, when they are under added stress from reproduction, competition for food and habitat, lack of forage and fish pathogens, among other things. Dissolved oxygen declines as snow depth and ice thickness increase and fish and other aquatic organisms respire, aquatic plants die, in which case they consume more dissolved oxygen than they produce, and plants and other organic matter decompose. The rate at which dissolved oxygen declines can differ as well. Fish adjust better if dissolved oxygen declines slowly than they do if it declines rapidly (increasing stress). The Area Fisheries Supervisor can open a lake for unlimited fishing if the potential for winterkill is imminent (i.e. dissolved oxygen is perilously low and some fish will likely winterkill) and the public has lawful access. Since the mid 1970s, Meeker County lakes have been intermittently checked and opened for unlimited fishing due to low oxygen levels. Table 3N provides a complete listing of the lakes in Meeker County that have been opened for unlimited fishing.

Table 3N:
Meeker County Lakes Opened For Unlimited Fishing Due To Low Dissolved Oxygen Levels

Lake Name (ID)	Date Opened
Arville (47-0023)	2/75, 2/76, 2/77, 2/79, 2/82, 2/84, 2/86, 1/88, 2/89, 2/91, 1/92, 2/93, 2/97, 1/01
Big Wolf (47-0016)	3/75, 2/76, 1/77, 1/88, 1/89, 1/97
Byron (47-0004)	1/84
Butternut (47-0005)	1/75, 1/83
Casey (47-0080)	1/88, 1/92
Clear (47-0095)	1/94, 1/01
Dunns (47-0082)	1/77
Erickson (47-0033)	2/84
Fallon (47-0045)	1/84
Goose (47-0127)	1/75, 1/77, 2/78, 2/82, 2/86, 1/88, 2/89, 12/91
Greenleaf (47-0062)	1/79, 2/86, 2/92, 1/01
Hoff (47-0106)	2/74, 1/75, 1/76, 3/79, 2/82, 1/84, 12/85, 2/88, 1/89, 1/91, 1/93, 12/93, 1/97, 1/01
Hope (47-0183)	3/74, 2/75, 2/76, 1/77, 2/80, 1/84, 2/85, 12/85, 1/88, 2/89, 1/91, 1/93, 2/96, 1/97, 2/01
Jewitt (47-0044)	12/81, 2/82, 1/84, 12/85, 1/88
King (47-0153)	1/76, 2/77, 12/78, 2/79, 1/84
Little Mud (47-0096)	2/92, 1975 (winterkill-not opened)
Little Wolf (47-0019)	1/75, 1/83, 2/84, 2/85, 1/86, 1/88, 1/96, 2/97
Long-Dassel (47-0026)	2/92
Long-Grove City (47-0066)	1/75, 1/77, 1/78, 2/80, 2/84, 2/86, 1/88, 1/89, 2/92, 1/93, 12/93, 2/96
Maple (47-001)	1/75, 2/76, 12/78, 2/79, 2/80, 1/83, 1/84, 1/85, 1/88, 2/89, 12/91, 1/93, 1/01
Minnesota (47-0140)	2/75
Peterson (47-0198)	2/86, 2/89, 2/92
Pigeon (47-0008)	2/74, 3/75, 2/77, 12/81, 2/82, 1/84, 1/85, 12/85, 1/88
Rohrbeck (47-0100)	1/88
Round (47-0102)	2/75, 2/79, 2/89, 1/91, 2/97
Schoolhouse (47-0056)	12/85
Sellards (47-0035)	1/88
Sioux (47-0060)	1/76, 2/82, 1/84, 1/86, 1/88
Spencer (47-0014)	1/75, 1/84, 1/86, 1/88
Spring (47-0032)	2/74, 3/75, 2/89, 1/93
Star (47-0129)	3/75, 2/79, 2/86, 2/89
Thompson (47-0159)	1/84, 1/86, 1/77, 2/83, 1/86
Turtle (47-0074)	1/86, 1/88
Youngstrom (47-0138)	2/75, 1/77, 1/78, 1/82, 1/84, 12/85, 1/88, 1/97, 1/01

Informal Sources of Surface Water Quality Information

Currently, there are no Federal, State or local agencies that formally compile information relating to informal sources of water quality information.

References:

Environmental Protection Agency, Minnesota Department of Natural Resources, Division of Fisheries, Minnesota Department of Natural Resources, Division of Waters, Minnesota Pollution Control Agency, Watershed Management-like Organizations

Implications and Assessment

Improving the quality of surface water is a major issue in Meeker County. In many areas of the County water quality is in fair to poor condition. Surface water is being adversely affected by sediment and nutrients, as well as by biological pollutants, such as bacteria. Sources of these pollutants are generally tied to land usage and associated management. According to the Minnesota Land Use-Agricultural and Transition Areas Inventory conducted in 1989, agricultural land comprises 70.9 percent of Meeker County, much of which is classified as erosion prone. The County should work with landowners to implement BMPs, such as grass buffer strips, crop residue management, field windbreaks and alternative drainage systems, to reduce soil erosion.

Another major source of surface water pollution is urban and rural developments. Although not as large in composition as agricultural land, urban and rural developments present pollution potential in the form of contaminated stormwater, soil erosion, failing ISTSs and sewage bypasses. To address these issues, the County should consider developing an erosion and stormwater management ordinance, as well as enforce its existing ISTS ordinance. The County should also assist those communities in need of wastewater treatment facility upgrades in seeking options to do so.

Trouble spots for surface water quality are found throughout the County. Table 3L lists the 14 watercourses and waterbodies that have been included in the 2002 Section 303(d) List of Impaired Waters. Watercourses and waterbodies that were included on the list are not meeting their designated uses because of excess pollutants, many of which were included because of high levels of mercury (toxic to humans). For each pollutant that causes a watercourse or waterbody to fail to meet its designated use, the Clean Water Act requires a Total Maximum Daily Load (TMDL) study be conducted. A TMDL study identifies all point and nonpoint sources of each pollutant in an impaired watershed. The County should work with the Minnesota Pollution Control Agency (MPCA) and other Federal, State and local agencies and groups in developing TMDLs for the County's impaired waters.

Additional efforts to diagnose trouble spots within the County are occurring through Clean Water Partnerships and Watershed Projects. Through water quality testing and modeling, these organizations are able to pinpoint areas where pollution is occurring and provide, in many cases, cost share money to resolve pollution issues. Continued financial support of the efforts of these organizations will be critical in the effort to improve the quality of water resources in Meeker County.

Groundwater Quality
(Data Item 28)

Minnesota Department of Health

The Minnesota Department of Health (MDH) monitors public water supplies under the Federal Safe Drinking Water Act. Public water supplies generally fall into three categories: 1) Community Public Water Supplies, 2) Nontransient Noncommunity Public Water Supplies and 3) Noncommunity Public Water Supplies. The first two categories of public water supplies are tested regularly for 25 chemical and biological parameters. The third category is usually routinely tested for nitrate levels and bacteria only.

Under the 1989 Minnesota Groundwater Protection Act, the MDH developed Health Risk Limits (HRLs) for substances found to degrade groundwater through groundwater quality monitoring. A health risk limit is the concentration of a groundwater contaminant, or a mixture of contaminants, that can be safely consumed daily for a lifetime. HRLs are expressed as a concentration in micrograms per liter, or calculated as a "hazard index." The limits are calculated using the same methodology as for the "recommended allowable limits" (RALs), which were advisory levels the MDH used before the HRL rules were promulgated.

HRLs reflect health effects data alone. They do not incorporate economic or technological factors such as treatment cost and treatment feasibility, as do Federal drinking water standards, the Maximum Contaminant Levels (MCLs). Economic and technological factors, the protection of the environment and the health of non-human species are considered in other groundwater protection regulations. The health risk limit rules are unique in that they do not specify how health risk limits are to be applied. The following are some of the public health protection purposes the Minnesota Department of Health uses Health Risk Limits:

1. **Advice for Private Wells**. Because private well drinking water supplies are not regulated for contamination, HRLs are used to evaluate contaminated wells and provide advice to consumers and well owners about the suitability of their water supply for consumption and other uses.

2. **Unregulated Contaminants in Public Water Supplies**. In instances where no Federal drinking water standard exists for a contaminant in public water supplies, HRLs are used as criteria to evaluate options for reducing the community's exposure to the contaminant.

3. **Environmental Review**. The MDH uses health risk limits as criteria in environmental review projects. For example, monitoring data may be compared to HRLs to evaluate potential impacts of a project on public health.

4. **Site Assessment Criteria**. The MDH's Site Assessment and Consultation Program uses HRLs as criteria to evaluate potential site impacts on public health and to make recommendations on monitoring and mitigation.

Minnesota Pollution Control Agency

In 1989, the Minnesota Pollution Control Agency (MPCA) received a grant from the Legislative Commission on Minnesota Resources (LCMR) to redesign Minnesota's ambient groundwater monitoring program. The resulting program was called the Groundwater Monitoring and Assessment Program (GWMAP). GWMAP's primary objective was to meet statewide and local groundwater quality information needs. For over a decade the program endeavored to answer five basic questions about Minnesota's groundwater quality:

1. What are background concentrations of chemicals in Minnesota's groundwater?
2. Where is the groundwater impacted by human activities?
3. What is the nature and severity of the impact?
4. Why is the groundwater impacted?
5. What can be done to minimize groundwater impacts?

Three components were created to facilitate answering these questions. The first component was a statewide baseline assessment of water quality in Minnesota's principal aquifers, conducted from 1990-1996. The second component involved conducting groundwater trend studies. The staff of GWMAP conducted a series of discussions and determined that changes in land use could be linked to trends in water quality. Consequently, GWMAP designed and conducted a variety of land use studies between 1996 and 2001. Groundwater studies were conducted throughout the State to evaluate impacts from different land use management strategies. The third and final component of GWMAP was the development of regional cooperatives. Between 1992 and 2001, GWMAP staff provided groundwater data and information to a variety of people and groups, as well as technical support to local groups conducting groundwater monitoring.

The GWMAP program was discontinued in the summer of 2001. Table 3M details the groundwater quality data that was collected in Meeker County. The following provides a brief summary of some of the key water quality parameters that were used in the GWMAP study.

- **Arsenic** - Although arsenic has many human sources, including industrial applications, such as pesticides, most arsenic found in wells sampled for the baseline study comes from natural sources. Arsenic is one of the few proven human carcinogens. The current drinking standard is 10 ug/L (parts per billion).

  The greatest concentrations of arsenic occur in wells located along a line extending from northern Minnesota through the southern Twin Cities Metropolitan Area. This is an area consisting primarily of stagnation moraines, but the geologic source of the arsenic is still unknown. Arsenic concentrations are greatest in wells completed in buried Quaternary deposits. Table 3O reiterates this point for Meeker County, as three of the four wells classified in the Buried Quaternary Aquifer Group had arsenic concentrations above 10 ppb.

- **Boron -** Most boron found in groundwater is from natural sources, although there may be small contributions resulting from human activity. At high concentrations boron can affect the human reproductive system. The current drinking water criteria for boron is 600 ppb.

  The greatest concentrations of boron are found in southwest and northeast Minnesota. Concentrations are usually lower in central and southeast Minnesota. The highest concentrations of boron are generally correlated with Buried Quaternary aquifers above Cretaceous bedrock aquifers. This is because water flows upward from the Cretaceous aquifers into the Quaternary aquifers. Drilling shallow wells in these locations may reduce the risk of encountering high boron concentrations.

  According to Table 3O, there were no wells tested in Meeker County that exceeded the 600 ppb drinking water standard for boron.

- **Nitrate -** Nitrate occurs naturally at concentrations less than 1 ppm. Concentrations are much lower deep in aquifers where oxygen is absent. Nitrate is the most important anthropogenic (related to human activity) chemical in groundwater. Infants less than six months in age may be affected by drinking water with high nitrate concentrations. The drinking criteria for nitrate is 10 ppm.

  Elevated nitrate concentrations are found throughout the State, but clusters of high concentrations are found in southwest, southeast and central Minnesota. These are areas where shallow groundwater is sensitive to contamination from human activity at the land surface. Mean concentrations of nitrate are generally low in groundwater. Concentrations are lowest in buried Quaternary and Cretaceous aquifers because they are well protected, and in Precambrian aquifers because there are low inputs of nitrogen.

  Nitrate concentrations greater than 1 ppm are often considered to represent aquifers impacted by human activity. Despite the low average nitrate concentrations in groundwater, over 10 percent of all wells sampled statewide had a nitrate concentration greater than 1 ppm. However, there were no wells tested through the GWMAP program in Meeker County that exceeded the 1 ppm concentration level for nitrate.

  The concentration of nitrate in groundwater is dependent on a source for the nitrate (e.g., fertilizer, animal waste) and on aquifer geochemical conditions. In the presence of oxygen, oxidation-reduction potential (Eh) is high, iron and manganese concentrations are low, and nitrate is stable in groundwater. When oxygen becomes depleted, nitrate is denitrified and concentrations decrease rapidly. Consequently, in areas where there are large potential inputs of nitrogen to groundwater (e.g. agricultural areas, unsewered residential developments), sensitivity of an aquifer to nitrate contamination can be determined by measuring Eh and concentrations of dissolved oxygen, iron and manganese.

- **Manganese** - Manganese is a naturally occurring chemical in groundwater. Although there are many uses of manganese in industrial processes, it is unlikely that human activity has much impact on manganese concentrations in groundwater. Manganese may impact the central nervous system when present in high concentrations. The current drinking water criteria for manganese is 100 ppb, but the Minnesota Department of Health has issued a memorandum supporting use of 1,000 ppb as the drinking water criteria.

  Elevated concentrations of manganese are distributed throughout the State. Low concentrations are generally found in northeast and southeast Minnesota. Manganese concentrations are greatest in Quaternary aquifers and lowest in Precambrian and Paleozoic bedrock aquifers. The source of manganese in Quaternary deposits is most likely shale incorporated into till during glaciation. Table 3O shows that all five of the Quaternary aquifer wells in Meeker County had manganese concentrations in excess of 100 ppb.

  Although manganese concentrations differ between aquifers, geochemical conditions within groundwater exert a large influence on concentrations of manganese. Manganese concentrations are generally lowest in the presence of oxygen (Eh > 250). When oxygen and nitrate concentrations in groundwater are low, dissolved manganese concentrations increase.

- **Volatile Organic Compounds** - Volatile Organic Compounds (VOCs) are primarily synthetic compounds. VOCs are commonly found in fuel oils, gasoline, paints, dyes and a wide variety of industrial solvents. For drinking water purposes, VOCs should not be detected in a water source.

  The occurrence of VOCs in groundwater is generally associated with a point source, rather than the geology or the geochemical conditions within the aquifer. Although most common in Cretaceous aquifers, VOCs have been detected in a variety of geological settings.

  In conducting testing for the GWMAP program, Chloroform was the most frequently detected VOC and was found in 5.8 percent of sampled wells statewide. Chloroform is generally associated with well disinfection, but may also occur naturally in low concentrations. Chemicals associated with fuel oils and industrial solvents were found in 3.5 and 2.4 percent of sampled wells statewide. According to Table 3O, no Meeker County wells tested positive for VOCs.

- **Chloride** - Chloride is a highly mobile chemical found naturally in groundwater. There are also many human sources of chloride, such as road salt, fertilizer and animal waste. This makes chloride an excellent indicator of chemical and transport processes occurring in an aquifer. Although there is no established health-based drinking water criteria for chloride, a Secondary Maximum Contaminant Level of 250 ppm does exist. Chloride concentrations can be elevated in different areas of the State, but concentrations increase from east to west. This is related to reduced recharge to groundwater, increased residence times in groundwater and differences in geology from east to west.

Concentrations of chloride are greatest in Cretaceous bedrock. Cretaceous bedrock is enriched in minerals associated with seawater, including chloride. Concentrations are also commonly high in surficial Quaternary aquifers. Since these aquifers should be readily recharged and have low concentrations of chloride in the geologic material comprising the aquifer, the chloride is due to human activity. Fertilizer, road salt and human waste are the most likely sources of chloride in these aquifers.

Concentrations of chloride in Meeker County wells are generally low. According to Table 3O, there were no wells tested with in the County that had chloride levels above the 250 ppm Secondary Maximum Contaminant Level.

MDA Nitrate Water Testing Program

In 1993, the Minnesota Department of Agriculture developed a "walk-in" style of water testing clinic with the goal of increasing public awareness of nitrates in rural drinking and livestock water supplies. Results from the testing not only educate the participants, but may also provide some broad information on the occurrence of nitrate 'hotspots' across the State; this could eventually aid in justifying nitrate monitoring networks/programs. The clinic concept revolves around a number of simple principles: local participation is critical; testing is free to the public with immediate results; the overall program needs to be inexpensive; a non-regulatory atmosphere is important and wellowners may remain anonymous; and the staff's most important goal is to provide the required technical assistance across a diverse audience of wellowners.

Since the beginning of the program six years ago, the Nitrate Water Testing Program has provided testing services and educational outreach to over 16,000 well owners. The concept has proven adaptable for county fairs, field day events, public school programs and 'stand alone' events. Past sponsors have been the Soil and Water Conservation Districts, U of M Extension Service, county health or environmental health services, county planning and zoning, public schools, lake associations and farm organizations. Well inspectors and hydrologists from the Minnesota Department of Health are often present at the clinics to help answer well construction and health concern type problems.

Currently, there are no results of nitrate sampling through the MDA's Nitrate Water Testing Program for Meeker County.

References:

Minnesota Department of Health
Minnesota Pollution Control Agency

Table 3O:
GWMAP Water Quality Data

ID Number	Well Use	UTM Easting	UTM Northing	Aquifer Group	Well Depth (ft)	Sampling Date	Arsenic (ppb)	Boron (ppb)	Nitrate-N (ppm)	Manganese (ppb)	VOC Detected	Chloride (ppm)
GWMAP00513	Domestic	365758	5001400	Buried Quaternary	98.0	9/7/1994	37.44	83.7	<0.50	123.0	No	2.3100
GWMAP00526	Domestic	380082	5004225	Buried Quaternary	69.0	9/13/1994	10.36	104.1	<0.50	223.9	No	0.5300
GWMAP00542	Domestic	399562	4983123	Surface Quaternary	92.0	9/27/1994	21.10	59.9	<0.50	135.2	No	4.3200
GWMAP00572	Domestic	366119	4980294	Buried Quaternary	110.0	9/7/1994	29.93	425.6	<0.50	278.2	No	0.6600
GWMAP00621	Domestic	378730	4987609	Buried Quaternary	115.0	9/27/1994	1.32	49.6	<0.50	282.5	No	1.4900

Implications and Assessment

As stated earlier, relative to surface water, very little information is known about groundwater resources in the County. Overall, the quality of groundwater in the County is believed to be good. However, testing through programs, such as the Minnesota Pollution Control Agency's GWMAP program and the Minnesota Department of Agriculture's Nitrate Water Testing Program, has revealed that some wells within the County are being adversely impacted by contaminants. Common contaminants in Meeker County wells include arsenic, manganese and nitrate. At high levels, many of these contaminants can pose a potential health risk. Additional testing and analyzation of existing data is needed to establish an accurate baseline of groundwater quality in the County.

Both geology and current land use are factors that have the potential to impact the County's groundwater quality. While it is nearly impossible to negate the impact of existing geology, land use is a factor that the County and its residents can dictate. Certain land uses and practices have a higher associated risk for groundwater pollution than others. For example, over application of nitrogen fertilizers on coarse textured soils can result in nitrate contamination of underlying aquifers. Similarly, failing ISTSs have the potential to contaminate groundwater with pollutants such as nitrate and fecal coliform bacteria.

Because very little information is known on the quality of groundwater within the County, the location of trouble spots is generally unknown. Future efforts need to be made to delineate such problem areas within the County. To protect existing groundwater quality, the County needs to continue to implement existing land use controls, such as its zoning and ISTS ordinances. Additional opportunities for groundwater protection are possible through the Minnesota Department of Health's (MDH) Wellhead Protection Program. The County should assist the MDH and public water suppliers as they develop wellhead protection plans.

CHAPTER FOUR:
MEEKER COUNTY'S SPECIAL LAND USES AND CONDITIONS

This chapter highlights specific land use and conditions that exist within Meeker County. Sections on irrigation, pollutant sources, wetlands, flooding and wildlife management, among others, are provided in this chapter.

Chapter four includes information on the following data items:

Eroding Lands and Nonpoint Source Pollution
(Data Item 29)

Eroding land is a major source of nonpoint source pollution in Meeker County (see Data Items 8 and 9). Erosion prone soils are found throughout Meeker County. In agricultural areas, the major nonpoint source pollutants are sediment, nutrients, pesticides, bacteria and oxygen demanding substances. Each of these is discussed below.

Sediment

Sedimentation, resulting from eroding land, is a major source of water pollution in Meeker County. Sedimentation affects most surface water types: lakes, wetlands and streams. Sediment clogs drainageways, fills basins, increases lake water turbidity and adversely affects spawning areas for fish. In addition, nutrients and chemicals attached to sediment can have adverse effects on water quality. Phosphate, attached to fine textured sediments, accelerates algae and plant growth in many lakes.

In Meeker County, high priority sedimentation areas are primarily located in the northern portion of the County, particularly in the North Fork of the Crow River Watershed. Soil associations that are prone to sedimentation, as a result of erosion, include Clarion-Hamel-Storden, Cokato-Storden-Muskego, Koronis-Forestcity-Houghton, Cosmos-Strout-Kandiyohi and Fieldon-Litchfield-Dassel.

Nutrients

Nutrients such as phosphorus, nitrogen and potassium are the essential part of plant growth in agriculture. They are normally added to the soil in the form of fertilizers, manure, or decaying vegetation. These nutrients, particularly phosphorus and nitrogen, can become pollutants when they are transported from eroding lands to surface and groundwater in runoff or are leached below the root zone.

Pesticides

Pesticide is a term that covers a wide range of chemicals such as herbicides, insecticides and fungicides. Pesticides can wash off crops and fields and into lakes and streams, where they may be toxic to fish and other aquatic organisms. Pesticides can also adversely affect water resources if they are improperly stored or disposed of.

Bacteria

Fecal coliform bacteria are prolific in the intestines of warm-blooded animals, including humans. Although these bacteria are not necessarily harmful, they are often associated with disease producing organisms or pathogens, which can cause diarrheal disease, infectious hepatitis, parasites and cholera. Common sources of bacteria are runoff or seepage from feedlots and failing septic systems.

Oxygen-Demanding Substances

When oxygen-demanding pollutants enter a lake or stream from runoff, they can upset the delicate balance between oxygen-consuming organisms and the oxygen replenishing process. If oxygen is consumed faster than it is replenished, the oxygen content can fall below the level needed to support aquatic life. Pollutants, such as inadequately treated sewage, manure, crop residues and decaying organic matter, such as leaves, create an oxygen demand on a lake or stream.

Urban Pollutants

Agriculture is not the only culprit of nonpoint source pollution. In urban areas, natural cover is removed, many areas are paved over and natural channels are modified to remove runoff faster. This scenario creates more runoff, while reducing the opportunity for natural treatment. Urban runoff may contain oil drippings, fallout from auto emissions, sediment from construction sites, road salt, pet wastes, fertilizer and pesticides from lawns and many other pollutants.

References:

Meeker County Soil and Water Conservation District
Minnesota Pollution Control Agency

Implications and Assessment

As previously described, sediment is adversely affecting water resources in the County. Sedimentation, as a result of erosion, has been identified as a major source of outer basin pollution in the County. Sediment not only decreases water clarity, but the nutrients that are attached to the soil particles (i.e. phosphorus) can result in unwanted algal growth. There are two primary sources of sediment in the County: agricultural land and newly developed land.

Because the majority of Meeker County is already intensively farmed, it is not anticipated that agricultural-related sedimentation problems will increase, as long as current best management practices (BMPs), such as windbreaks, grass strips and conservation tillage, remain in place. To further reduce erosion and sedimentation, the County should assist landowners in implementing the aforementioned BMPs on a more widespread basis.

In areas experiencing increased development, sedimentation problems related to newly developed land is increasing. To minimize this threat, landowners and developers need to minimize soil disturbance, while implementing construction site BMPs, such as silt fencing and sedimentation basins. The County should also explore developing an erosion and stormwater management ordinance.

Effects of Land Use and Cover on Runoff by Watershed Unit
(Data Item 30)

Land usage by Meeker County watershed unit was determined by using the Minnesota Land Use-Agricultural and Transition Areas Inventory, conducted by the Minnesota Land Information Center in 1989 (refer to Data Item 12). The effects of land use and cover on runoff by watershed unit is described below:

Clearwater River Watershed

According to Table 4A, cultivated agricultural land (69.4%) is the predominant land use in the Clearwater River Watershed. If managed improperly, this land use can have an adverse effect on the quality and quantity of runoff. Quality can be degraded if best management practices (BMPs), such as crop residue management and variable rate fertilization, are not implemented. The lack of these practices allows the topsoil to be exposed to the effects of water erosion, enabling sediment and nutrients to be carried and dissolved in the runoff. The quantity of runoff from cultivated agricultural land can be increased a number of ways. Extensive field tiling and drainage is the most common means by which the quantity of runoff can be increased off of cultivated land. Increased runoff quantity often leads to an increased potential for flooding further down the watershed. BMPs, such as the ones listed above, along with programs, such as CRP and RIM, should be encouraged throughout the Clearwater River Watershed.

Moderate land usages with the Clearwater River Watershed include Grassland (14.7%), Deciduous Forest (7.5%), Water (2.9%) and Wetlands (2.2%). As long as vegetative cover is maintained, these land uses should have a positive impact upon the quality of runoff, allowing for filtration of sediment and nutrients. The quantity of runoff should also be reduced because the vegetation provides resistance to the flow of water, allowing for increased soil infiltration rates. Practices and policies should be implemented to protect the integrity of these land usages.

Other land uses that have the potential to impact the quality and quantity of runoff in the Clearwater River Watershed include Farmsteads and Rural Residences (2.2%) and Urban and Industrial (1.0%). These land uses are scattered throughout the watershed. The City of Watkins is located in the northern portion of the Clearwater River Watershed. Watkins is currently served by a stormwater sewer system. Runoff from the City should be collected and properly treated by the storm sewer system. Vegetation in all of these areas should be maintained as much as possible to promote better water quality and reduced water quantity. When construction associated with these land uses occurs, measures, such as filter blankets, sediment basins, vegetative cover seeding and other erosion control practices, should be implemented to control runoff.

Table 4A:
Clearwater River Watershed Land Use

Land Use Type	Percent of Watershed (%)
Cultivated Land	69.4
Grassland	14.7
Deciduous Forest	7.5
Water	2.9
Farmsteads and Rural Residences	2.2
Wetlands	2.2
Urban and Industrial	1.0
Rural Residential Development Complexes	<0.1
Grassland-Shrub-Tree Complex	<0.1
Other Rural Developments	<0.1
Gravel Pits and Open Mines	<0.1

North Fork of the Crow River

Table 4B lists the land uses found in the North Fork of the Crow River Watershed. Cultivated agricultural (48.7%) land is the dominant land use in the watershed. If managed improperly, this land use can degrade the quality runoff, while increasing the overall quantity of runoff. BMPs, such as crop residue management, conservation tillage, variable rate fertilizer application and vegetative buffers, along with State and Federal conservation programs, such as CRP and RIM, should be encouraged throughout the North Fork of the Crow River Watershed.

Moderate land usages with the North Fork of the Crow River Watershed include Grassland (21.2%), Deciduous Forest (12.8%), Water (8.2%) and Wetlands (4.9%). As long as vegetative cover is maintained, these land uses should have a positive impact upon the quality of runoff, allowing for filtration of sediment and nutrients. The quantity of runoff should also be reduced because the vegetation provides resistance to the flow of water, allowing for increased soil infiltration rates. Practices and policies should be implemented to protect the integrity of these land usages.

Other land uses that have the potential to impact the quality and quantity of runoff include Farmsteads and Rural Residences (2.6%) and Urban and Industrial (1.3%). These land uses are scattered throughout the watershed. The cities of Darwin, Dassel, Grove City, Kingston and Litchfield are located in the North Fork of the Crow River Watershed. All communities, with the exception of Kingston, are served by stormwater sewer systems. Runoff from the cities should be collected and properly treated by a storm sewer system. Vegetation in all of these areas should be maintained as much as possible, thus to promote better water quality and reduced water quantity. When construction associated with these land uses occurs, measures, such as filter blankets, sediment basins, vegetative cover seeding and other erosion control practices, should be implemented to control runoff.

Table 4B
North Fork of the Crow River Watershed Land Use

Land Use Type	Percent of Watershed (%)
Cultivated Land	48.7
Grassland	21.2
Deciduous Forest	12.8
Water	8.2
Wetlands	4.9
Farmsteads and Rural Residences	2.6
Urban and Industrial	1.3
Rural Residential Development Complexes	<0.1
Other Rural Developments	<0.1
Grassland-Shrub-Tree Complex	<0.1
Gravel Pits and Open Mines	<0.1
Exposed Soil, Sandbars and Sand Dunes	<0.1

Sauk River Watershed

Table 4C reveals that cultivated agricultural land (73.5%) is the dominant land use in the Sauk River Watershed. If managed improperly, this land use can degrade the quality runoff, while increasing the overall quantity of runoff. BMPs, such as crop residue management, conservation tillage, variable rate fertilizer application and vegetative buffers, along with State and Federal conservation programs, such as CRP, CREP and RIM, should be encouraged throughout the Sauk River Watershed.

Moderate land usages within the Sauk River Watershed include Grassland (13.0%), Wetlands (5.2%) and Deciduous Forest (4.1%). As long as vegetative cover is maintained, these land uses should have a positive impact upon the quality of runoff and reduce the overall quantity of runoff. Practices and policies should be implemented to protect the integrity of these land usages in the Sauk River Watershed.

Other land uses that have the potential to impact the quality and quantity of runoff include Farmsteads and Rural Residences (2.4%) and Urban and Industrial (1.7%). These land uses are scattered throughout the watershed. The City of Eden Valley is located in the northern portion of the Sauk River Watershed. Eden Valley is currently served by a stormwater sewer system. Runoff from the City should continue to be collected and properly treated by the storm sewer system. Vegetation in all of these areas should be maintained as much as possible, as to promote better water quality and reduced water quantity. When construction associated with these land uses occurs, measures, such as filter blankets, sediment basins, vegetative cover seeding and other erosion control practices, should be implemented to control runoff.

Table 4C:
Sauk River Watershed Land Use

Land Use Type	Percent of Watershed (%)
Cultivated Land	73.5
Grassland	13.0
Wetlands	5.2
Deciduous Forest	4.1
Farmsteads and Rural Residences	2.4
Urban and Industrial	1.7
Other Rural Developments	<0.1
Grassland-Shrub-Tree Complex	<0.1
Water	<0.1

South Fork of the Crow River

According to Table 4D, cultivated agricultural land is (81.0%) the dominant land use in the South Fork of the Crow River Watershed. If managed improperly, this land use can degrade the quality runoff, while increasing the overall quantity of runoff. BMPs, such as crop residue management, conservation tillage, variable rate fertilizer application and vegetative buffers, along with State and Federal conservation programs, such as CRP and RIM, should be encouraged throughout the South Fork of the Crow River Watershed.

Moderate land usages within the South Fork of the Crow River Watershed include Grassland (7.0%), Water (4.0%), Deciduous Forest (3.8%) and Wetlands (2.4%). As long as vegetative cover is maintained, these land uses should have a positive impact upon the quality of runoff, allowing for filtration of sediment and nutrients. The quantity of runoff should also be reduced because the vegetation provides resistance to the flow of water, allowing for increased soil infiltration rates. Practices and policies should be implemented to protect the integrity of these land usages.

Other land uses that have the potential to impact the quality and quantity of runoff include Farmsteads and Rural Residences (1.0%), Urban and Industrial (<0.1%), Rural Residential Development Complexes (<0.1%) and Other Rural Developments (<0.1%). These land uses are scattered throughout the watershed. The cities of Cosmos and Cedar Mills are located in the southern portion of the South Fork Crow River Watershed. Both communities are currently served by stormwater sewer systems. Urban runoff from the cities should continue to be collected and properly treated by a storm sewer system. Vegetation in all of these areas should be maintained as much as possible to promote better water quality and reduced water quantity. When construction associated with these land uses occurs, measures, such as filter blankets, sediment basins, vegetative cover seeding and other erosion control practices, should be implemented to control runoff.

Table 4D:
South Fork of the Crow River Watershed Land Use

Land Use Type	Percent of Watershed (%)
Cultivated Land	81.0
Grassland	7.0
Water	4.0
Deciduous Forest	3.8
Wetlands	2.4
Farmsteads and Rural Residences	1.0
Urban and Industrial	<0.1
Rural Residential Development Complexes	<0.1
Other Rural Developments	<0.1
Transitional Agricultural Land	<0.1
Grassland-Shrub-Tree Complex	<0.1
Gravel Pits and Open Mines	<0.1
Exposed Soil, Sandbars and Sand Dunes	<0.1

References:

Crow River Organization of Water
Meeker County Soil and Water Conservation District
Minnesota Land Management Information Center
North Fork of the Crow River Watershed District

Irrigation Areas
(Data Items 31 & 32)

Data available from the Minnesota Department of Natural Resources (DNR) Water Appropriation Permit Index provides information on permitted irrigation withdrawals in Meeker County. DNR water appropriation permits are required for withdrawals greater than 10,000 gallons per day or one million gallons per year. All active water appropriation permit holders are required to measure monthly water use with an approved measuring device to an accuracy of 10 percent and report water use yearly. Currently, there are a total of 66 water appropriation permits, covering a total of 7,589 acres, that have been issued in Meeker County for irrigation purposes. Additional information concerning water appropriation permits issued for irrigation purposes in Meeker County can be found in Appendix A.

Sources for irrigation withdrawal include both surface waters and groundwater. Withdrawals from surface water potentially include lakes, streams, rivers, wetlands, ditches and dug pits. Row crops, such as corn and soybeans, are the predominant crops irrigated within the County. A concentration of row crops and irrigation on coarse textured soils significantly increases the potential of nonpoint source contamination of surface and groundwater. In such areas, highly water soluble agricultural chemicals and fertilizers, such as nitrates, are easily leached into the groundwater.

A majority of the irrigated land within Meeker County is found in the northwestern and central portions of the County. Table 4E lists the three townships within the County, specifically Darwin, Swede Grove and Union Grove, that have more than 1,000 acres under irrigation. This area is part of the Bonanza Valley Irrigation Area, which has been thoroughly studied by the USGS in the past. Coarse textured soils, that are prone to leaching of agricultural chemicals and fertilizers, are common throughout this area. Implementation of best management practices (BMPs), such as crop residue management and site-specific fertilizer application, are needed in this area to prevent pollution from occurring.

Although the availability of water in this portion of the County is plentiful, there have been four well interference complaints involving groundwater usage for irrigation that have been entered into the Minnesota DNR Well Interference Complaint Tracking Database for Meeker County. Upon investigation, two of the conflicts were resolved with the complainant(s), one conflict was resolved by issuing the water appropriation permit and another was resolved by the applicant withdrawing the water appropriation permit.

Table 4E:
Townships with Greater Than 1,000 Acres of Irrigated Land

Township	Acres Irrigated	Township	Acres Irrigated
Darwin	2,432	Union Grove	1,655
Swede Grove	1,368		

References: Minnesota Department of Natural Resources, United States Geological Survey

Public Drainage System
(Data Item 33 & 34)

Meeker County has approximately 213 miles of public drainage ditches (see Data Item 7). Drainage systems are used where the topography of the landscape is nearly level and soils are poorly drained. Wetness is a limitation that occurs in many low-lying areas of the County. A drainage system is needed to control ponding and to lower the water table below the root zone. Open ditches drain much of the surface water and can be used as outlets for subsurface tile lines. Proper design and maintenance of drainage systems can improve and increase the productivity of the soil.

On average, Meeker County spends $60,000 to $80,000 annually on ditch maintenance. Annual disbursements may consist of, but are not limited to: beaver control, installing side inlet pipes, stabilizing banks, erosion control, major and minor ditch cleanouts and weed spraying. In 2000, total expenditures for the County's ditch system totaled $63,823. Specific annual cost per drainage system can be made available by contacting the Meeker County Highway Department.

Table 4F details the drainage ditch water quality monitoring sites in Meeker County. (See Appendix F for tabular data) The County's watershed projects and watershed districts coordinate the monitoring of these sites. Of obvious concern are sediments, fertilizers and agricultural chemicals that are carried by wind blown soil particles or by surface water runoff, especially in areas where highly erodible soils are present. The installation of new and the maintenance of existing vegetative buffers can reduce the potential for contamination from these elements.

Table 4F:
Drainage Ditch Water Quality Monitoring Sites

Site Name	Site Location	Monitoring Entity
CD-4	I mile south of Lake Koronis	North Fork of the Crow River Watershed District
CD 36	CR 21, ¾ mile west of Highway 15	C.R.O.W. *(no longer in use)*

References:

Crow River Organization of Water
Meeker County Auditor/ Treasurer's Office
Meeker County Highway Department
Meeker County Soil and Water Conservation District
North Fork Crow River Watershed District

Implications and Assessment

As stated earlier, a majority of Meeker County's public drainage system is located in areas adversely affected by both water and wind erosion. Water quality testing is currently being conducted on the County's ditches by various watershed projects and organizations. Data collected by these entities indicates that sediment, nutrients and bacteria are degrading the water quality of the County's ditches, which in turn degrades the quality of County's lakes and streams. To minimize this problem, landowners need to further implement best management practices (BMPs), such filter strips and drop inlet structures, along the County's drainage ditches. Implementation of such practices would not only improve the quality of the County's surface water, but it would also reduce the need for expensive ditch cleanout and repair.

Broadly, the Minnesota Department of Natural Resources (DNR) has observed more "flashy" stream flows throughout the State, meaning that both high and low flows are exaggerated. A large contributing factor to this is the design and operation of drainage ditch systems. Because many drainage ditch systems were designed to remove large quantities of water in a short duration, flooding problems can and do occur, especially following major storm events and the spring snowmelt. To minimize flooding impacts, upland storage needs to be increased to reduce the overall volume of water transported by the public drainage system.

Finally, in recent years the amount of pattern tiling has dramatically increased within the County. While pattern tiling has definite water quality and quantity benefits over conventional open tile intakes, the increasing installation could place a further burden on the County's drainage system. This could result in numerous negative impacts including: increased downstream flooding, increased bounce in lakes and wetlands and increased bank and instream erosion in ditches and streams. Additional assessment of tiling within the County is needed.

Potential Pollutant Sources
(Data Item 35)

Open Dumps and Sanitary Landfills

A comprehensive inventory of previously operating open dumps, both public and private, has not been conducted in Meeker County. Little information exists on the occurrence of unregulated dumps that have closed or may still be operating illegally. Under certain circumstances, individuals may dispose of refuse on their property by burning or burial, but due to the number of individual farm disposal sites, it is impractical to attempt a specific listing of these sites.

The Minnesota Pollution Control Agency (MPCA) does, however, maintain an Open Dumps Inventory Database. This inventory was originally conducted and compiled in 1980. Listed in this database are 11 open dumps in Meeker County, none of which are in operation today. Table 4G details the name and location of the open dumps within the County (note: this is not to be viewed as a comprehensive listing of all dumps that have operated in the County). Contact the MPCA for water quality monitoring data that may exist for each site.

Table 4G:
MPCA Open Dump Inventory Sites

ID	Dump Name	Location	City
2792	Acton Township Dump	1 mile west of the junction of Highway 23 and Highway 4	Acton
2793	Cedar Mills Dump Site	1 ¾ miles northwest of the intersection of Highway 7 and Highway 26	Cedar Mills
2790	Darwin Dump Site	NW quadrant of Highway 24 and Highway 12 intersection	Darwin
2794	Dassel Dump Site	2 miles north of the Highway 15 and Highway 12 Intersection	Dassel
4016	Rath Feeds	¼ mile west of the intersection of Highway 55 and Highway 9	Eden Valley
4013	Grove City Dump Site	On the south side of Highway 12, between Highway 4 and Highway 11	Grove City
4015	Grove City Contractor Dump Site	¼ mile south of the intersection of Highway 4 and Highway 12	Grove City
4014	Kingston Former Dump	¼ mile west of the Highway 15 and Highway 27 intersection	Kingston
4076	Litchfield Former Dump	East side of Lake Ripley	Litchfield
4012	Litchfield Dump Site	NE ¼ of section 26, T119N, R31W	Litchfield
4011	Watkins Dump Site	Vicinity of the NW quadrant of the Soo Line Railroad tracks and Highway 2 intersection	Watkins

Meeker County Landfill/ Household Hazardous Waste

The Meeker County Transfer Station and Demolition Landfill represents the only MPCA permitted landfill in Meeker County. The site is located in Section 30, Township 120 North, Range 30 West (Forest City Township). The facility is owned by Meeker County and is operated by the County and Stakman Transfer out of Norwood, MN.

The Kandiyohi County Regional Household Hazardous Waste (HHW) Facility, located at 1104 22nd Street SW in Willmar, serves Meeker County households for the proper disposal of household hazardous waste. Products accepted at the HHW facility include paint, stain, varnish, fuels, pesticides, aerosols, poisons and acids. In addition to serving Meeker County, the facility also serves Big Stone, Chippewa, Kandiyohi, Laq qui Parle, Meeker, Renville and Swift counties. This facility is also licensed to accept hazardous waste from very small quantity generators on an appointment basis.

Federal Superfund Sites and Hazardous Waste Registrants

Currently, there are no Federal Superfund sites in Meeker County. A complete listing of hazardous waste registrants in Meeker County, along with their EPA identification numbers can be found under Data Item 37.

Individual Sewage Treatment Systems (ISTSs)

Individual Sewage Treatment Systems (ISTSs) are used for the treatment and disposal of wastewater from individual homes, clusters of homes, isolated communities, industries, or institutional facilities. When properly functioning, ISTSs are an effective means of treating wastewater. However, if improperly designed, installed or maintained, ISTSs have the potential to adversely impact surface and groundwater resources. Human waste contains high concentrations of microorganisms and many chemicals, including carbon, nitrogen, phosphorus, salts and trace element. These pollutants not only represent a public health concern, but also can degrade the environment.

In 1994, the first State law addressing failing ISTSs went into effect. This 1994 legislation is known as the ISTS Act and has since been codified as Minn. Rule Chapter 7080. Chapter 7080 requires that all new construction and replacement of ISTSs meet minimum statewide standards. It also puts into place a method to systematically address the adequacy of existing systems through requiring upgrading of failing existing systems before construction of an additional bedroom. The following are the State's objectives in regulating sewage systems through Chapter 7080:

- Keep inadequately treated sewage away from human contact to prevent disease;
- Reduce levels of pathogenic bacteria and viruses discharged to the environment;
- Reasonably and cost-effectively prevent groundwater contamination;
- Develop clear direction for design, construction and maintenance of sewage treatment facilities;

- Strive for cost effective methods of sewage treatment to maintain or improve property values;
- Encourage personal responsibility for treating sewage; and
- Require all counties to adopt an ISTS ordinance.

According to the 1990 U.S. Census *(2000 U.S. Census information is not scheduled to be released until late 2002)*, there were 4,777 year round housing units in Meeker County that utilized ISTSs to treat sewage. This total represents 53.1 percent of the total year round housing units within the County.

On May 1, 1992, the Meeker County Board of Commissioners adopted the County's current ISTS ordinance. Since 1992, the Meeker County Planning and Zoning office estimates that 2,700 ISTSs have been permitted, approximately 1,215 of which have been upgrades. While this is a significant number of upgrades to ensure compliance with Chapter 7080 specifications, a number of systems still exist in the County that are not adequately treating sewage. In fact, Planning and Zoning estimates that roughly 20 percent of ISTSs within the County are failing.

References:

Environmental Protection Agency
Meeker County Planning and Zoning Office
Minnesota Pollution Control Agency
Minnesota Department of Health

Feedlots, Unsealed Abandoned Wells, Underground Storage Tanks and Permitted Wastewater Dischargers
(Data Item 36)

Feedlots

The Minnesota Pollution Control Agency (MPCA) regulates and controls pollution created by animal feedlots. The MPCA's feedlot rules were first adopted in 1971 and were amended in 1974, 1978 and again in 2000. The trend in agriculture has been toward fewer but larger livestock and poultry facilities. There has also been a trend of increasing awareness about the potential environmental effects of feedlots.

In accordance with MPCA feedlot regulations, the owner(s) of an animal feedlot or manure storage area with 50 or more animal units, or 10 or more animal units if in shoreland (less than 300 feet from a stream or river, less than 1,000 feet from a lake) needed to register with the MPCA by January 1, 2002. Registration was accomplished one of three ways: 1) the owner(s) could fill out information on an MPCA registration form and return it to the MPCA or, in a delegated county, the delegated county feedlot officer, 2) the owner(s) could fill out a permit application (if required to obtain a permit), or 3) the owner(s) could be listed on a current (as of October 1, 1997) Level II or Level III inventory that also contains the required information and the inventory has been submitted to the MPCA, this serves as fulfilling the initial registration requirement. It is the owner's responsibility to ensure that his or her registration information has been forwarded to the MPCA. Registration information must be updated at least once in every four-year period after January 1, 2002. The MPCA or delegated county will notify owners that they must re-register at least 90 days before their current registration expires. Also, the MPCA or delegated county will send the owner a receipt within 30 days of receiving the registration information from the owner.

> ***Definition of an animal unit***
>
> A standardized measure to compare differences in the production of animal manure for an animal feedlot or manure storage area. A mature cow of about 1000 pounds (455 kg.) is the standard unit.

Exemptions to registration:

- Owners of livestock facilities located on county fairgrounds were not required to register.
- Owners of pasture or grazing operations that have buildings or lots with a capacity of less than 50 animal units, or less than 10 animal units in shoreland areas, were not required to register.
- Owners of pasture or grazing operations that do not have buildings or open lots were not required to register.

Once registered, owners are directed by the MPCA or delegated County to obtain any needed permits. The requirement for a feedlot permit is dependant upon the size of the operation and whether or not a pollution hazard has been identified. Owners with less than 300 animal units are not required to have a permit for the construction of a new facility or expansion of an existing facility if construction is in accordance with the technical standards contained in Minnesota State Rules. For owners with 300 animal units or more, but less than 1,000 animal units, a streamlined short-form construction permit is required for construction activities. An Interim Permit is required for owners with 300 animal units or more, but less than 1,000 animal units, if a pollution hazard has been identified. Finally, a National Pollutant Discharge Elimination System (NPDES) permit or State Disposal System (SDS) permit is required for all feedlots with 1,000 animal units or more.

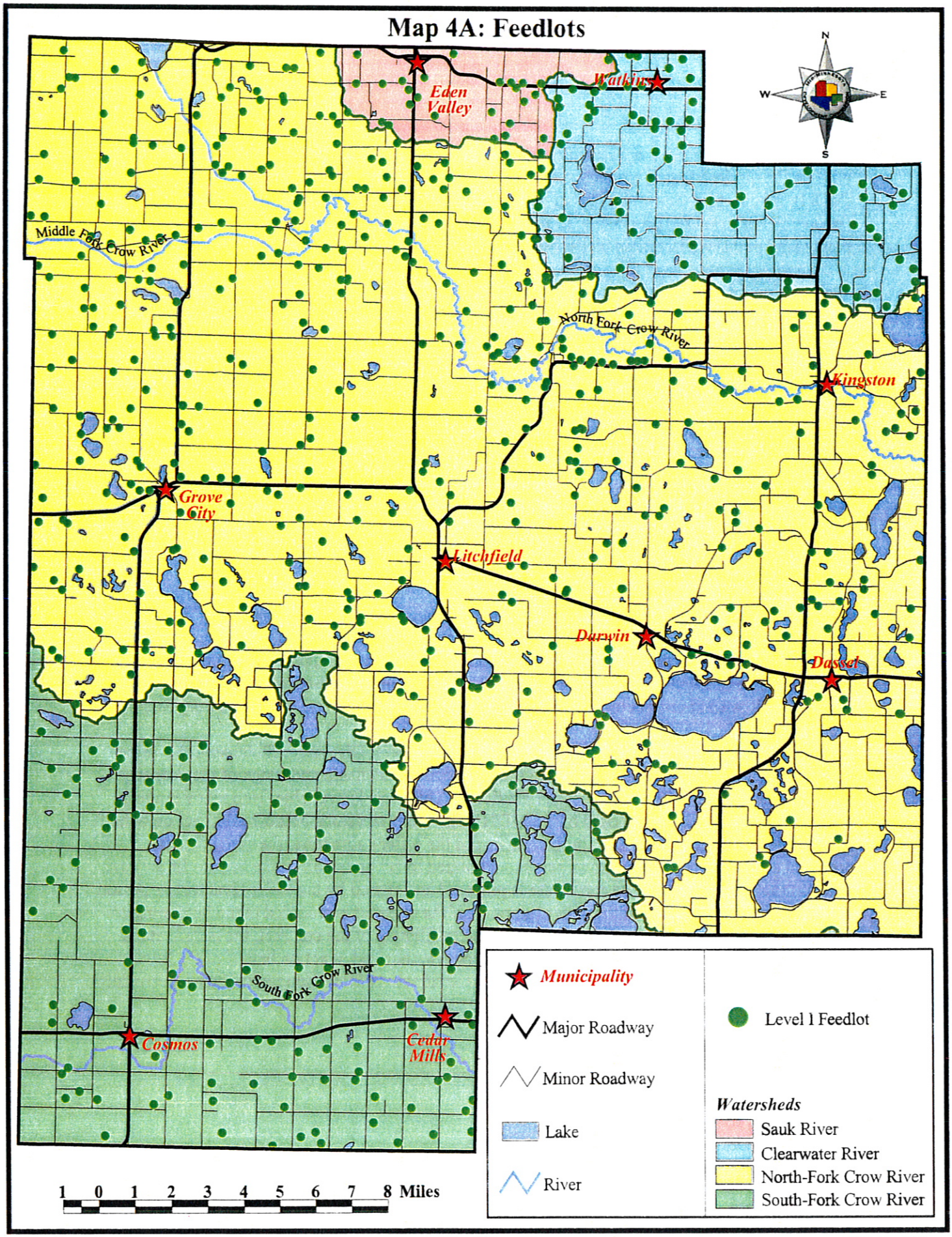
Owners of feedlots with less than 300 animal units, with passive manure-contaminated runoff from open lots, are encouraged by the MPCA to sign up for the 2005/2010 Open-lot Agreement. If an owner qualifies for the agreement, the MPCA will allow the owner to phase in any needed corrections to pollution problems. Owners are required to install clean-water diversions, vegetated buffer areas or filter strips for manure-contaminated runoff to flow through, or other corrective measures by October 1, 2005. One way owners can demonstrate compliance with these requirements is by a computer model ("An Evaluation System to Rate Feedlot Pollution Potential," more commonly known as FLEVAL) that achieves a 50 percent or more reduction in phosphorus and biochemical oxygen demand loading. The second step in the Open-Lot Agreement is for the owner to meet the discharge standard of 25 mg/L BOD by October 1, 2010.

Meeker County is currently not delegated to administer the MPCA feedlot program. The County has completed a Level One Feedlot Inventory and may complete a Level Two Feedlot Inventory in the near future. The Level One Inventory was done to identify the location of existing feedlots. The Level Two Feedlot Inventory, if and when completed, will detail the size and type of manure storage for each feedlot within the County. Map 4A depicts the location of feedlots in Meeker County. Table 4H provides a breakdown of the number of feedlots and animals per major watershed unit in Meeker County. Both Map 4A and Table 4H are based upon the Level One Feedlot Inventory.

Table 4H:
Feedlots per Watershed

Watershed	# of Feedlots	# of Animal Units
Clearwater River	70	3,528.69
North Fork of the Crow River	436	60,004.94
Sauk River	26	200.00
South Fork of the Crow River	140	9,460.00
Total	672	73,193.63

Map 4A: Feedlots



Abandoned Wells

The Minnesota Groundwater Protection Act requires that the status and location of wells on a property be disclosed upon property sale to the buyer and the Minnesota Department of Health (MDH). The Act applies to all types of wells, including wells used for drinking water, irrigation, commercial or industrial processing, heating or cooling, or monitoring. These wells include drive-point (sand point) wells, drilled wells and dug wells.

Well disclosure is a particularly useful tool in identifying unused or "abandoned" wells. Unused wells that have not been properly sealed can be a source of groundwater contamination, allowing surface water, contaminated water and improperly disposed of waste to reach sensitive aquifers below ground. In addition to being a potential pollution hazard, unused wells also pose a potential safety hazard for children and animals and a potential liability for the property owner.

Before signing an agreement to sell or transfer real property, the seller must provide the buyer with a Well Disclosure Statement. The statement must include the following information:

1. the legal description and County;
2. a map showing the location of each well; and
3. whether each well is in use, not in use, or sealed.

A well is "in use" if the well is functioning for some purpose. A well is "not in use" if the well is not functioning or is not capable of functioning, such as when the well pump on the well is disconnected, or when the well is no longer connected to a power supply. A well is "sealed" if the well has been filled with an approved sealing material by a licensed well contractor or a licensed well sealing contractor and the MDH has received a Well and Boring Sealing Record.

At the time of closing of the sale, the information on the Well Disclosure Statement, the name and mailing address of the buyer, and the quarter, section, township and range of the property must be provided on a Well Disclosure Certificate. This form is available from many realtors, county recorders or district offices of the MDH. The seller or person authorized to act on behalf of the seller signs the certificate. In the absence of the seller's signature, the certificate is prepared and signed by the buyer or person authorized to act on behalf of the buyer. In the case of a contract-for-deed sale, the certificate is prepared and signed by the seller (grantor) or person authorized to act on behalf of the seller (grantor), if the contract is recorded at the beginning of the contract. When the contract is recorded at the fulfillment of the contract, the certificate is prepared and signed by the buyer (grantee) or person authorized to act on behalf of the buyer (grantee). Once completed, the Well Disclosure Certificate is filled along with the property deed at the County Recorders office.

If a well is not in use, the property owner has three options:

1. the well can be put back into use;

2. the well can be sealed by a licensed well contractor, or a licensed well sealing contractor; or
3. the property owner can apply for a maintenance permit.

If one of these steps has not been taken at the time of property transfer, it will be the responsibility of the buyer to choose an option and follow through with it.

The well sealing option involves permanently and completely filling a well with an approved sealing material, called "grout." State law requires that a well must be sealed by a licensed well contractor or a licensed well sealing contractor. The sealing process starts with removal of the pump, the inner pipe to the pump and any materials or obstructions in the well. A grout "tremie" pipe is then installed to the bottom of the well and the contractor pumps in the grout, usually consisting of a special cement or a special clay. In certain cases, the contractor may have to remove or perforate the well casing(s) before pumping the grout to ensure a proper sealing. After sealing the well, the contractor sends a "Well and Boring Sealing Record" to the MDH. Once a licensed well contractor or a licensed well sealing contractor seals a well, the owner of a well is no longer liable for contamination of groundwater from that well. For this reason, many financial institutions and realty companies are requiring the sealing of wells that are not in use as a condition for loans and mortgages.

The maintenance permit option allows an unused well to remain unsealed if it is properly maintained. State law requires that a well that is not in use must be sealed unless the property owner has a maintenance permit for the well. The permit is not transferable and requires a yearly fee of $100. The property owner does not have to apply for a maintenance permit if the well is put back into use or if the well is sealed by a licensed contractor or a licensed well sealing contractor. A maintenance permit will not be approved by the MDH if the well is contaminated; if the well is improperly sealed; or if the well is located, constructed, or maintained in a manner that is a safety or health hazard. Local delegated well programs may have additional requirements for maintenance permits and should be contacted for additional requirements.

As of August 2002, the MDH has recorded 1,126 wells that have been sealed in Meeker County. The MDH has recorded an additional 115 wells within the County that have been disclosed as not in use.

Underground Storage Tanks

The Minnesota Pollution Control Agency's (MPCA) Underground Storage Tank (UST) Program was created to help prevent contamination caused by leaking tanks. This program focuses on technical assistance, inspections and outreach to achieve this objective. As a part of the program, underground storage tanks throughout the State have been inventoried and entered into a database. A complete listing of underground storage tanks in Meeker County can be found in Appendix C.

The UST Program regulates all containers including tanks, vessels, enclosures, or structures and underground appurtenances connected to them that is used to contain or dispense an accumulation of regulated substances, and the volume which, including the volume of under ground pipes connected to them, is 10 percent or more beneath the surface of the ground. All tank owners and operators must comply with both State and Federal regulations for underground storage tanks. At the State level, owners and operators must comply with Minn. Rules, Chapter 7150. The Federal regulations for USTs include 40 CFR Parts 280-282, which are regulated by the Environmental Protection Agency (EPA).

Under State and Federal regulation, all UST systems must have spill protection, overfill protection, corrosion protection and leak detection to comply with state and federal requirements. However, regulated USTs that receive less than 25 gallons of product at a time are only required to have corrosion protection and leak detection. A description for each component necessary for compliance is provided below.

- **Spill Protection -** Regulated USTs are required to have spill buckets or catchment basins to catch spills that may occur when the delivery hose is disconnected from the fill pipe. The spill buckets can vary in size from a couple gallons, to much larger buckets. These spill buckets should be kept clear of debris and liquid. Spill protection has been required for regulated USTs since December 22, 1998.

- **Overfill Protection** - Regulated USTs are required to have overfill protection to minimize and eliminate the chances of delivering more product to a tank than the capacity of the tank allows. There are three options for overfill protection to comply with State and Federal requirements. They include an automatic shutoff device, an overfill alarm, or a ball float valve. Overfill protection has been required for regulated USTs since December 22, 1998.

- **Corrosion Protection** - Regulated USTs are required to have corrosion protection to prevent degradation and rusting of metal tanks and piping. USTs and piping systems that are made of fiberglass or are completely isolated from surrounding soil are not required to have additional corrosion protection. All other regulated USTs must use an impressed current system, a sacrificial anode system, or provide an interior lining of non-corrodible material for the tank system. Corrosion protection has been required for regulated USTs since December 22, 1998.

- **Tank System Leak Detection** - Leak detection for regulated UST systems was phased in between 1989 and 1993, based upon the date the tank was installed. Facilities with new tanks can use statistical inventory reconciliation (SIR), automatic tank gauges, vapor monitoring, interstitial monitoring, or groundwater monitoring as their leak detection method. Facilities with existing tanks can use these leak detection methods or inventory control performed with a tank tightness test annually. The inventory control and tank tightness test option can only be used for ten years after installation of the corrosion protection system on the tank.

Permitted Wastewater Dischargers

The National Pollution Discharge Elimination System (NPDES) is a Federal program established under the Clean Water Act, aimed at protecting the nation's waterways from point and nonpoint sources of pollution. In Minnesota, the NPDES program is administered by the Minnesota Pollution Control Agency (MPCA), under delegation from the Environmental Protection Agency (EPA). Under the program, any industrial, municipal or private-entity point source that proposes to discharge treated wastewater to surface waters of the State must apply for a permit. As part of the permitting process, NPDES permit applicants are required to submit information to the MPCA on design flows of the facility, the route that treated wastewater will travel to a surface-waterbody and a description of the existing treatment system of the system to be built.

In addition to issuing NPDES permits, the MPCA is also responsible for setting effluent limitations to protect water quality standards and the designated uses of waters of the State. All municipal and other pointsource dischargers of sewage are required, at minimum, to provide secondary treatment. Minimum secondary treatment effluent limits include those listed in Table 4I below.

Table 4I:
MPCA's Minimum Effluent Limitations for Secondary Treatment

Parameter	Limiting Concentration or Range
5-day CBOD (CBOD5)	25 mg/L
Fecal Coliform Organisms	200 organisms/100 mL
Total Suspended Solids	30 mg/L
pH Range	6.0 – 9.0 SU
Phosphorus	1 mg/L

Effluent limits which are more stringent than the minimum secondary treatment requirement may be assigned to a discharge where stream flows are not adequate to protect water quality standards and designated uses. The MPCA considers a number of factors in developing effluent limits for a particular discharge, including the characteristics of the receiving water (use classification, water quality standards, flow characteristics) and discharge (design flow, discharge duration and frequency).

According to Table 4J, there are 34 facilities in Meeker County that are currently operating under an MPCA issued NPDES permit. Permits listed below are as of March 1, 2002. Additional NPDES permit applications, especially those issued for feedlots, may still be pending final approval. Contact the MPCA for additional permit information.

Table 4J:
NPDES Permits

Facility Name	Permit #	Permit Purpose/ Type	City (Nearest)
City of Cosmos WWTP	MN0038792	Water Quality Treatment	Cosmos
City of Darwin WWTP	MN0023159	Water Quality Treatment	Darwin
City of Dassel WWTP	MN0054127	Water Quality Treatment	Dassel
City of Grove City WWTP	MN0023574	Water Quality Treatment	Grove City
Innovex Inc.	MNG120009	Water Quality Treatment	Litchfield
City of Litchfield WTP	MNG640055	Water Quality Treatment	Litchfield
City of Litchfield WWTP	MN0023973	Water Quality Treatment	Litchfield
Palm Manufacturing & Sales	MNG120035	Water Quality Treatment	Grove City
City of Watkins WWTP	MN0051365	Water Quality Treatment	Watkins
Anderson Chemical Company	NA	Industrial Stormwater	Litchfield
Aspen Trailer	NA	Industrial Stormwater	Litchfield
BREMIX Concrete Company-Cosmos	NA	Industrial Stormwater	Cosmos
BREMIX Concrete Company-Litchfield	NA	Industrial Stormwater	Litchfield
Custom Products of Litchfield Inc.	NA	Industrial Stormwater	Litchfield
Forest Time Products Inc.	NA	Industrial Stormwater	Litchfield
Innovex Inc.	NA	Industrial Stormwater	Litchfield
Litchfield Municipal Airport	NA	Industrial Stormwater	Litchfield
Meeker Washed Sand & Gravel	NA	Industrial Stormwater	Darwin
Ollie & Son Auto Salvage	NA	Industrial Stormwater	Litchfield
Palm Manufacturing & Sales	NA	Industrial Stormwater	Grove City
Precast Systems	NA	Industrial Stormwater	Darwin
Precision Fiberglass Products Ltd.	NA	Industrial Stormwater	Grove City
RIE Coatings Inc.	NA	Industrial Stormwater	Eden Valley
Randt Used Oil Site	NA	Industrial Stormwater	Litchfield
Towmaster Inc.	NA	Industrial Stormwater	Litchfield
Jennie-O Turkey Store-White Oak Farm	093-50007	Feedlot	Willmar
RCK Inc. dba KCC Dairy	093-60381	Feedlot	Litchfield
Jennie-O Turkey Store-Ross Farm	093-50009	Feedlot	Willmar
Jennie-O Turkey Store-Roulet Farm	093-50008	Feedlot	Willmar
Jennie-O Turkey Store-Bach Farm	093-50013	Feedlot	Willmar
Jennie-O Turkey Store-Buffalo Run Farm	093-50012	Feedlot	Willmar
Jennie-O Turkey Store-Johnson Grower	093-50011	Feedlot	Willmar
Jennie-O Turkey Store-Martin Farm	093-50010	Feedlot	Willmar
Jennie-O Turkey Store-Wilcox Lake Farm	093-50006	Feedlot	Willmar

References:

Minnesota Department of Health
Minnesota Pollution Control Agency

Hazardous Waste Generators
(Data Item 37)

There are currently 51 hazardous waste generators existing in Meeker County, as listed by the Environmental Protection Agency (EPA). Hazardous wastes generated by these facilities include a wide range of environmentally damaging materials including acids, industrial solvents, petroleum products, photographic chemicals and many others. Currently, there are 4 large quantity generators and 47 small quantity generators within the County. Tables 4K and 4L identify these hazardous waste generators.

Table 4K:
Large Quantity Hazardous Waste Generators

Facility Name	EPA ID	Address	City
Custom Products of Litchfield	MND006178743	Highway 22 South	Litchfield
Gilmer Lawn and Sport	MND985682418	1213 South Sibley	Litchfield
City of Grove City	MND985681428	North 4th Street	Grove City
Innovex Inc.	MND077636397	One Precision Drive	Litchfield

Table 4L:
Small Quantity Hazardous Waste Generators

Facility Name	EPA ID	Address	City
Arnold Chevrolet	MND981802804	310 Central Avenue North	Watkins
Bonniwell Automotive	MNS062706049	Highway 15 and Atlantic	Dassel
Bremix Concrete	MND982628927	225 East Commercial Street	Litchfield
Dahl Tire	MND985687730	35 West Third Street	Litchfield
Dassel Motor Shop	MND 981533961	433 2nd Street	Dassel
Dassel Sales and Service	MND981533961	433 2nd Street	Dassel
Don's Auto Body	MND134629740	254 South Hubbard	Litchfield
Don's Standard	MND152070769	Highway 55	Watkins
Eden Valley Implement	MND981779838	Route 1	Watkins
F and F Service White Inc.	MND023103427	Highway 55	Watkins
Fenton Motors Inc.	MND022847115	1005 North Sibley Avenue	Litchfield
Flaschenriem Brothers	MND981779754	Route 2	Watkins
Forbes Auto and Service Center	MND121195192	West Highway 12	Litchfield
Forest Time Products Inc.	MND122709488	1217 South Sibley	Litchfield
Glasco Industries	MND980826127	903 East Ripley	Litchfield
I.S.D. 465 Litchfield Schools	MND020489977	901 North Gilman	Litchfield
Industrial Research and Development	MND038386462	807 Frontage Road East	Litchfield

Table 4L:
Small Quantity Hazardous Waste Generators *(continued...)*

Facility Name	EPA ID	Address	City
I.S.D. 461 Cosmos Consolidated Schools	MND985770296	320 North Saturn	Cosmos
Johnson Brothers Corporation	MND022847354	23577 Highway 22	Litchfield
Lake Earth Coating Inc.	MN0001862549	412 Gilman Avenue South	Litchfield
Lions Head Tool and Machine	MND982221228	411 North 1st Street	Darwin
Litchfield Auto Body	MND981802762	907 East Ripley	Litchfield
City of Litchfield	MND084496082	126 North Marshall	Litchfield
City of Litchfield	MND981537046	420 West 4th Street	Litchfield
Litchfield Independent Review	MND094042116	217 North Sibley	Litchfield
Litchfield Woolen Mills Company	MND006178925	111 East 10th Street	Litchfield
Lorensen's 66 Service	MND009791526	606 North Sibley	Litchfield
Mattila Diesel Service	MND141801993	Route 1	Dassel
Meeker Cooperative Light and Power Association	MND006961452	503 East Highway 12	Litchfield
Meeker County Memorial Hospital	MND071783971	612 South Sibley Avenue	Litchfield
Mid America Dairymen Inc.	MND982204919	139 Central Avenue	Watkins
Minnesota Rubber Company Litchfield	MND985674712	45 Precision Drive	Litchfield
Nortronics Company Inc.	MND108503889	145 Third Street South	Dassel
Olsen Automotive	MND982420358	Highway 4 and 7	Cosmos
Palm Industries Inc.	MND044176394	West Highway 12	
Paul's Auto Works	MND982640716	351 Parker Avenue West	Dassel
Polytank Inc.	MND982640039	Rural Route 1	Litchfield
Precision Fiberglass Products	MND980993745	Highway 12	Grove City
Roger's Transportation Systems Inc.	MN0002127017	405 South Hubbard	Litchfield
Ron's Standard Service	MND981774763	150 Parker	Dassel
Rooney's Electric Motor Company	MND985677749	1201 West Highway 12	Litchfield
Sam's Sinclair Service	MND982620056	Route 3	Litchfield
Sand's Safety Center	MND981531098	618 North Sibley	Litchfield
SuperAmerica 4013	MND985763630	225 East Depot Street	Litchfield
Theis Auto and RV Service	MND982635112	Rural Route 1	Eden Valley
Twin City Stamp and Printing	MND985683994	688 Meeker Avenue East	Eden Valley
West Side Automotive	MND982219479	West Highway 12	Dassel

Superfund Sites

The Superfund sites in Minnesota are listed on the Minnesota Permanent List of Priorities (PLP). This list was approved by the MPCA in June 2001. The PLP lists 108 sites statewide where investigation and cleanup are needed, cleanup is underway, or cleanup has been completed and long-term monitoring or maintenance continues. Currently, no Superfund sites have been identified in Meeker County.

References:

Environmental Protection Agency
Minnesota Pollution Control Agency

Implications and Assessments

Special pollution sources in the County that have the potential to affect water resources include: abandoned wells, feedlots, hazardous waste generators, open dumps, storage tanks, failing septic systems (ISTSs) and municipal wastewater treatment facilities.

As of August 2002, the Minnesota Department of Health (MDH) has documented the sealing of 1,126 abandoned wells in the County. The MDH has also documented an additional 115 wells in the County that have been disclosed as not in use. These unused wells could be targeted for sealing through a County cost share program.

Meeker County has completed a level one feedlot inventory. The inventory revealed a total of 672 active and abandoned feedlots, distributed throughout all parts of the County. While there have been few documented reports of feedlots contaminating surface water in the County, a number of feedlots are located within vulnerable shoreland areas, or in close proximity to ditches and other surface water areas. Water quality data collected by watershed projects has revealed high levels of nutrients and fecal coliform bacteria in many of the County's ditches, lakes and streams, which could be possibly attributed to feedlots. The County should work with the MPCA to provide technical assistance to feedlot owners to ensure compliance with County and State regulations.

Hazardous waste generators, open dumps and above ground and underground storage tanks are regulated by the Minnesota Pollution Control Agency (MPCA). To date, MPCA has documented 47 hazardous waste generators, 11 open dumps and several hundred storage tanks located throughout Meeker County. The County should continue to work with the MPCA in investigating and remediating pollution from these sources.

Failing individual sewage treatment systems (ISTSs) present a significant problem for water quality in the County, especially for lakes. Meeker County Planning and Zoning has estimated that 20 percent of ISTSs in the County are failing to properly treat sewage. Meeker County currently regulates sewage treatment systems through its ISTS and shoreland ordinances. Through land use controls, approximately 125 ISTSs are installed/upgraded per year. To complement this effort, the County should continue to provide educational and technical assistance to the public on proper ISTS installation, treatment, disposal and maintenance.

Finally, the discharge of effluent from wastewater treatment facilities has been included as potentially affecting water quality within the County. When properly treated to State and Federal standards, the effluent from wastewater treatment facilities has a minimal impact on the quality of County's water resources. However, problems arise when these facilities are forced to release minimally treated sewage, due to lack of capacity. This can occur in communities that

have inflow & infiltration (I&I) problems or have their sewage and storm sewer combined. While these flaws may not pose a problem a majority of the year, during large storm events and the spring snowmelt, the capacity of these systems can be reduced to the point where it becomes necessary to bypass wastewater to prevent sewage from backing up into homes. Such bypasses can have a significant impact on the quality of water resources in the County. According to the MPCA, the City of Litchfield is in need of wastewater treatment facility upgrades to become or 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.

Known Geologic Conditions
(Data Item 38)

Meeker County has several unconfined, surficial aquifers distributed throughout the County that are geologically sensitive. These aquifers are primarily composed of coarse textured, highly transmissive sand and gravel. The upper limit of these aquifers is the water table and the base is generally glacial till. These areas are highly susceptible to contamination by farm pesticides, livestock waste, solid wastes, etc.

References:

Minnesota Geological Survey
United States Geological Survey

Implications and Assessments

Meeker County has several unconfined, surficial aquifers that are sensitive to groundwater pollution. These areas are characterized by rapid and indiscriminate groundwater recharge. The County should work with landowners to target best management practices (BMPs) related to the application of fertilizers and pesticides in these areas to prevent groundwater contamination.

To better understand the geological characteristics of the area, Meeker County should work together with the DNR and Kandiyohi, McLeod and Renville counties to conduct a Regional Hydrogeologic Atlas. Once completed, the atlas could be utilized as a tool for land use planning decisions and to assist public water suppliers in the development of wellhead protection plans.

National Wetlands Inventory Maps
(Data Item 39)

There are three major sources of wetland inventory maps for Meeker County, including the U.S. Fish and Wildlife Service (USFWS), Natural Resource Conservation Service (NRCS) and Minnesota Department of Natural Resources (DNR). The USFWS has identified wetlands through its National Wetlands Inventory. Wetlands located within cropland have been inventoried by the NRCS. Finally, the Minnesota DNR has identified wetlands as part of the Protected Waters Inventory. The following definitions of wetland types are derived from the USFWS National Wetlands Inventory.

- **Type 1: Seasonally Flooded Basins or Flats.** Soil is covered with water or is waterlogged during variable seasonal periods, but usually is well drained during much of the growing season. Vegetation varies greatly according to season and duration of flooding.

- **Type 2: Inland Fresh Meadows.** Soil is usually without standing water during most of the growing season, but is waterlogged within at least a few inches of the surface. Vegetation includes grasses, sedges, rushes and various broad-leaf plants. Meadow may fill shallow basins, sloughs, or farmland sags, or these meadows may border shallow marshes on the landward side.

- **Type 3: Inland Shallow Fresh Marshes.** Soil is usually waterlogged early during growing season; often covered with as much as six inches or more of water. Vegetation includes grasses, bullrushes, spike rushes and various other plants such as cattails, arrowheads and smartweed. These marshes may nearly fill shallow lake basins or sloughs, or may border deep marshes on the landward side.

- **Type 4: Inland Deep Fresh Marshes.** Soil is usually covered with six inches to three feet or more of water during the growing season. Vegetation includes cattails, reeds, bullrushes, etc. Deep marshes may completely fill shallow lake basins, potholes, limestone sinks and sloughs, or may border open water in such depressions.

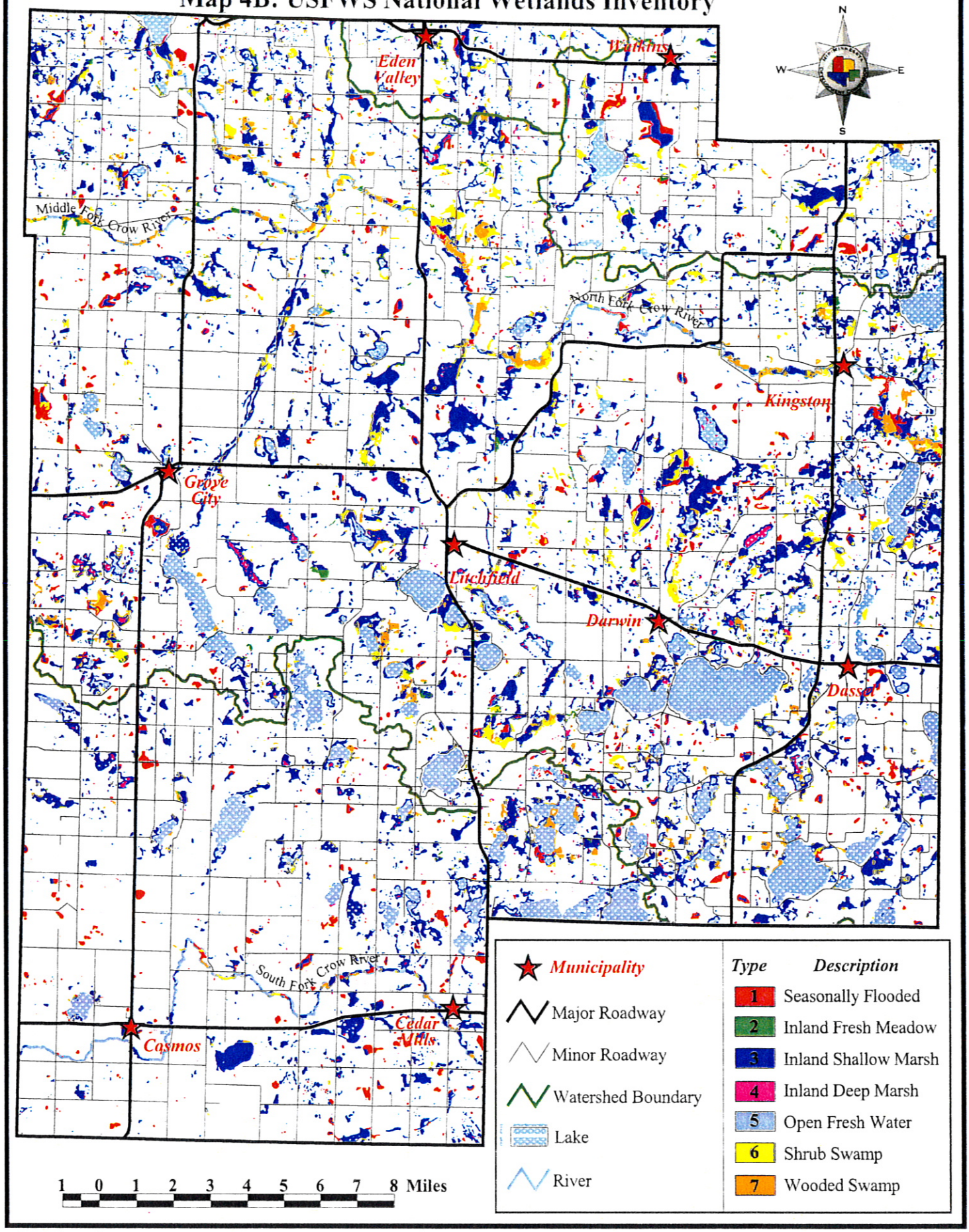
- **Type 5: Inland Open Fresh Water.** Shallow ponds and reservoirs are included in this type. Water is usually less than ten feet deep and fringed by a border of emergent vegetation similar to open areas of Type 4.

- **Type 6: Shrub Swamps.** Soil is usually waterlogged during the growing season and is often covered with as much as six inches of water. Vegetation usually includes alders, willows, dogwood, etc. Swamps occur mostly along sluggish streams and occasionally on floodplains.

- **Type 7: Wooded Swamps.** Soil is waterlogged within a few inches of the surface during the growing season and is often covered with as much as one foot of water.

- **Type 8: Bogs.** Soil is usually waterlogged and supports a spongy covering of moss. Vegetation is woody, herbaceous or both.

Map 4B: USFWS National Wetlands Inventory



Wetlands provide many benefits to humans including the reduction of flooding by means of storage during high flows, filtration of pollutants and sediment, groundwater and aquifer recharge, wildlife habitat and aesthetic appeal. Much of the drainage of wetlands within the County occurred prior to the 1980s, when policies were enacted to prevent future wetland loss. The Minnesota Wetland Conservation Act (WCA), DNR Protected Waters, U.S. Army Corps of Engineers regulations and Swampbuster provisions of the USDA Farm Program, are examples of such policies. Wetland policies are discussed in greater detail in Data Items 7 and 41.

Map 4B displays the USFWS National Wetlands Inventory for Meeker County. Wetlands are distributed almost evenly throughout the County and its four major watersheds. In general, a majority of the small Type 1 and 2 wetlands have been drained in the past for agricultural purposes, leaving behind larger Type 3, 4 and 5 wetlands. One exception is the extreme eastern portions of the South Fork of the Crow River and North Fork of the Crow River watersheds, where many wetlands have been unaffected by agricultural drainage.

References:

Meeker County Soil and Water Conservation District
Minnesota Department of Natural Resources
Natural Resource Conservation Service
United States Fish and Wildlife Service

Plans for Wetlands with Controlled Outlets
(Data Item 40)

Most restored wetlands in Meeker County have structures of varying degrees of complexity to control water elevations within the given basin. Restored wetland water levels are commonly controlled via fixed risers, emergency spillways and dikes. The elevation of the riser is then set at the pool elevation desired for the wetland. This gives excess water a means of escape without washing out the dike or impacting adjacent landowners. All tiles within the restored basin are broken. This practice is done by removing approximately 100 feet of tile, and compacting the trench. Special care is taken to maintain drainage service to upstream landowners not involved in the restoration project. This is achieved by re-routing tile to maintain upstream service.

In rare situations, it is desired to design water control structures that can be manipulated to bring pool levels up or down as desired. This can be achieved by incorporating a "stop-log" bay as part of the control. In such a structure, planks or "logs" can be removed or added as desired to increase or decrease pool depth. Such manipulations are a means of controlling aquatic vegetation in a given basin, which is necessary to provide optimum wildlife habitat conditions. The stop-logs can be included in a variety of structure types: full-round riser, half-round riser, earthen, metal or wood dams may have stop-log bays.

Meeker County has seen many wetlands restored in the past few years due to favorable State and Federal conservation programs such as RIM and WRP. These wetlands act as sediment traps and nutrient sponges. This is especially important in an area where there are lakes or streams that are the recipients of large quantities of runoff waters. When dense stands of aquatic vegetation exist in a wetland, current is slowed, causing suspended sediments to settle out. The lush vegetation, such as cattails, can utilize and/or tie up huge quantities of nutrients, thereby cleansing the water.

Because of the common occurrence of hydric soils and extensive drainage, Meeker County has a large number of potentially restorable wetlands. Natural resource agencies should continue to pursue restorations to aid in relieving farmers, landowners and the County of poorly functioning drainage systems and marginal agricultural land prone to flooding.

Reference:

Minnesota Department of Natural Resources, Division of Wildlife, Willmar Area Office

Wetland Regulations
(Data Item 41)

U.S. Army Corps of Engineers, Section 404

The U.S. Army Corps of Engineers has been regulating activities in the nation's waters since 1890. Laws and court decisions to consider the full public interest in both protection and utilization of water resources have broadened this regulatory program. These regulatory activities and responsibilities are based on Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), which prohibits obstruction or alteration of navigable waters of the United States without a permit from the Corp of Engineers.

Section 404 of the Clean Water Act (33 U.S.C. 1344) prohibits discharge of dredged or fill material into waters of the United States without a permit from the Corps of Engineers. Waters of the United States include adjacent wetlands and tributaries to navigable waters of the United States and other waters where the degradation or destruction of which could affect interstate or foreign commerce. If a project involves discharge of dredged or filled material, the Corps will evaluate the proposed activity under the Section 404 guidelines prepared by the Environmental Protection Agency (EPA). These guidelines restrict discharge into aquatic areas where less environmentally damaging practical alternatives exist.

The Corps of Engineers and the EPA define wetlands as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas, under these rules.

Activities in wetlands that normally require permits include, but are not limited to:

- Placement of fill material.
- Ditching activities when excavated materials is sidecast.
- Levee and dike construction.
- Land clearing involving relocation of soil material.
- Land leveling.
- Most road construction.
- Dam construction.

The Corp of Engineers must consider other Federal laws during permit review. These other laws include:

- National Environmental Policy Act
- Fish and Wildlife Coordination Act
- Endangered Species Act
- National Historic Preservation Act
- Federal Power Act
- Wild and Scenic Rivers Act
- National Fishing Enhancement Act of 1984

The Corps of Engineers uses four different types of review processes depending upon the nature of the work to be done:

Letter of Permission. This is used for minor non-controversial projects in navigable waters of the United States, and concerns docks and small dredging projects.

Nation Wide General Permit. This permit is a blanket authorization for activities that will have minimal environmental effects such as navigational aids, fill for minor road crossings, certain outfall structures, discharges into certain waters, bank stabilization and fill for utility lines.

Regional General Permit. This permit authorizes certain projects in Minnesota where a DNR permit is usually required, and includes projects including larger bank stabilization projects, bridge and culvert replacements, sand blankets, dredging and rough fish barriers.

Full Public Interest Review. This is required for large projects such as new marinas or harbors in navigable waterways, large dredging projects, highway projects through wetlands or waters, fill in wetlands to convert them to upland and large drainage projects.

Wetlands Conservation Act

In 1991, the Minnesota Legislature passed Chapter 354, the Wetlands Conservation Act (WCA), which created a statewide "no-net loss" policy for wetlands. The law requires anyone proposing to drain or fill a wetland; first to try to avoid disturbing the wetland; second, to try to minimize any impact on the wetland; and, finally, to replace any lost wetland acres, functions and values. Certain wetland activities are exempt from the act, allowing projects with minimal impact or projects located on land where certain pre-established land uses are present to proceed without regulation. The Meeker County Planning and Zoning Office implements the act locally. The Minnesota Board of Water and Soil Resources (BWSR) administers the act statewide, and the Department of Natural Resources (DNR) enforces it.

The WCA recognizes a number of wetland benefits deemed important, including:

- Water quality, including filtering pollutants out of surface water and groundwater, using nutrients that would otherwise pollute public waters, trapping sediments, protecting shoreline and recharging groundwater supplies;
- Floodwater and stormwater retention, including reducing the potential for flooding in the watershed;
- Public recreation and education, including hunting and fishing areas, wildlife viewing areas, and nature areas;
- Commercial benefits, including wild rice and cranberry growing areas and aquaculture areas;
- Fish and wildlife benefits; and
- Low-flow augmentation during times of drought.

Since its adoption more than a decade ago, the WCA has been revised and amended numerous times. In 2000, the legislature passed Chapter 382 (Senate File 83), which amended parts of Minnesota Statutes 1998, Section 103G in order to consolidate State wetland laws. The law was changed to maintain wetland protection to current standards, to better coordinate with Federal wetland programs and to simplify and make wetland regulation consistent for landowners. Specific details of the bill included the refinement of the Protected Waters Inventory, established a consistent statewide definition of wetland, gave State conservation officers enforcement flexibility in pursuing Wetland Conservation Act and DNR violations, standardized wetland replacement/mitigation standards among state wetland agencies and added an appeals process for landowners to challenge a wetland boundary or type determination.

Swampbuster

The Wetland Conservation provision (Swampbuster) of the 1985 Natural Food Security Act and its subsequent amendment grants the Natural Resources Conservation Service (NRCS) the primary authority over wetlands related to agricultural lands. Swampbuster requires all agricultural producers to protect the wetlands on the farms they own or operate if they want to be eligible for USDA farm program benefits. Producers will not be eligible if they plant an agricultural commodity on a converted wetland that was converted by drainage, leveling, or any other means after December 23, 1985, or convert a wetland for the purpose of or to make agricultural commodity production possible after November 28, 1990.

The NRCS categorizes wetlands according to Swampbuster exemptions. There are four categories of wetlands subject to Swampbuster restrictions and three categories of wetlands with Swampbuster exemptions. Each wetland classification includes its own unique set of regulatory requirements. The following is a list of the different NRCS wetland categories and a brief definition of each.

Regulated Wetland Categories

Wetlands (W) - Areas meeting wetland criteria under natural conditions that have typically not been manipulated by altering hydrology and/or removing woody vegetation.

Farmed Wetlands (FW) - Wetlands that were drained, dredged, filled, leveled, or otherwise manipulated before December 23, 1985, for the purpose of making the production of an agricultural commodity possible, and continue to meet specific wetland criteria. Under this category drainage may be maintained but not improved.

Farmed Wetland Pasture or Hayland (FWP) - Wetlands manipulated and used for pasture or hayland, including native pasture and hayland, prior to December 23, 1985 that still meet specific wetland hydrology criteria and are not abandoned; or were in agricultural use and met FWP criteria on December 23, 1985.

Converted Wetland (CW) - Wetlands drained, dredged, filled, leveled, or otherwise manipulated for the purpose of, or to have the effect of, making possible the production of an agricultural

commodity. These lands must have been W, FW, or FWP and not highly erodible prior to the conversion. They may have been converted by any activity, including the removal of woody vegetation, that impaired or reduced the flow, circulation, or reach of water; provided the conversion activity was such that agricultural production on the land would not have been possible without its application.

Exempted Wetland Categories

Prior Converted Cropland (PC) - Converted wetlands where the conversion occurred prior to December 23, 1985; an agricultural commodity had been produced at least once before December 23, 1985; and as of December 23, 1985, the converted wetland met certain specific hydrologic criteria and did not support woody vegetation.

Artificial and Irrigation-Induced Wetland (AW) - Wetlands in an area that was formerly non-wetland, but now meets wetland criteria due to human activities. This definition includes wetlands created by an irrigation system on an area that was formerly non-wetland.

Non-Wetland (NW) - Land that under natural conditions does not meet wetland criteria. This definition includes wetlands which were converted to the extent that wetland criteria was not present prior to December 23, 1985 but were not cropped.

Reference: Meeker County Soil and Water Conservation District, Natural Resources Conservation Service, Minnesota Department of Natural Resources, United States Army Corps of Engineers

Implications and Assessment

Wetlands in Meeker County serve many important functions, including flood attenuation, wildlife habitat, improved water quality, recreational opportunities and aesthetics. Many of the County's type 3 or larger wetlands remain, however, many type 1 and 2 wetlands have been drained for agricultural production. Much of the wetland draining in the County occurred in the 1960s and early 1970s, when the Federal government's farm policies compensated agricultural producers up to 90 cents on the dollar to install artificial drainage systems. As result of these Federal government payments and policies, an extensive artificial drainage system was installed in Meeker County.

Today, due in part to regulations such as the Minnesota Wetland Conservation Act (WCA), State Protected Waters Inventory, Swampbuster and Section 404 of the Clean Water Act, very few, if any wetlands are being lost through drainage. In fact, conservation programs, such as the Wetland Reserve Program and Reinvest in Minnesota Program, actually provide landowners an opportunity to restore previously drained wetlands and preserve existing wetlands. These programs and others like them should continue to be promoted to landowners within the County.

To further wetland preservation efforts, Meeker County should work with the Minnesota Department of Natural Resources (DNR) to explore options to inventory existing wetlands in the County. Current wetland inventories are not comprehensive enough for preservation purposes. The County should also continue to designate wetlands in shoreland and floodplain areas as high priority areas for preservation and administration of WCA.

Floodplains and Flood Prone Areas
(Data Items 42 & 43)

Historically, development occurs in floodplains adjacent to waterways and lakes. In order to protect property and structures within the floodplain, Federal and State governments require floodplain regulations to be adopted by counties and municipalities when areas of anticipated flooding have been identified. Areas of land regulated are based on the 100-year frequency flood, and these areas are designated as floodplain. The Minnesota Department of Natural Resources (DNR) and the Federal Insurance Administration, under the Federal Emergency Management Agency (FEMA), are responsible for defining areas of flood hazard and notifying local government of regulatory need.

Structural flood control projects of the past, such as dikes, levees, reservoirs, or diversion channels, which kept flood waters away from developed property, are generally expensive and do not insure protection against flood damage to life and property. Current Federal and State regulations address comprehensive floodplain management to encourage wise land use as well as needed structural projects. Regulatory, nonstructural methods of flood control include floodplain zoning, flood insurance, building permits, flood proofing, flood warning systems and disaster planning.

The State of Minnesota, through the Floodplain Management Act, requires local governments to adopt a floodplain ordinance compliant with minimum State and Federal standards. This ordinance stresses the reduction of flood damages through nonstructural controls, such as wise land use, in addition to structural controls, and encourages a community floodplain management program with preventive actions to reduce flood risk. The DNR administers and enforces the Floodplain Management Act, serves as the coordinating agency for the National Flood Insurance Program and oversees local enforcement of county or municipal floodplain ordinance. Local enforcement is generally through the county or municipal zoning official and the regional DNR hydrologist. Land use and building permits are strictly regulated within the floodplain, local governments have the authority to issue conditional use permits after a special administrative review. Meeker County has adopted a Floodplain Ordinance and participates in the National Flood Insurance Program offered through FEMA. Please contact the Meeker County Planning and Zoning Office to view a copy of the 100-year floodplain for the County.

References:

Federal Emergency Management Agency
Meeker County Emergency Management Office
Minnesota Department of Natural Resources

Flood Damage
(Data Item 44)

Annual flooding causes various degrees of damage in Meeker County. Damage often occurs to wetlands, wildlife habitat, floodplain woodlands and natural areas. Damage may also occur to structures, croplands and other land improvements made within the floodplains of the County. Under normal circumstances, the County or State does not record flood damage and associated monetary costs. However, if a flood related Presidential Disaster were to be declared, local and State emergency services would be responsible for reporting flood damage.

References:

Meeker County Emergency Management Office
Natural Resource Conservation Service

Implications and Assessment

Meeker County has adopted a floodplain ordinance that is up to date and compliant with the State's Floodplain Management Act. While the County is adequately enforcing the provisions of its ordinance, concern has been raised that existing floodplain maps are not entirely accurate to protect floodplain areas. Meeker County should work with Federal Emergency Management Agency (FEMA) and the Minnesota Department of Natural Resources (DNR) to update the existing County floodplain maps. The DNR should be encouraged to develop a Statewide Digital Elevation Model (DEM), which could be used as a tool to accomplish this task. The County should also encourage the DNR and other agencies and groups to purchase and remove flood prone agricultural land from production.

Approved Municipal Shoreland Ordinances
(Data Item 45)

The Minnesota Shoreland Management Act was initially implemented in 1969 to reduce the effect of uncontrolled and unplanned development on public waters, to maintain the economic value of shoreland property and to preserve the intrinsic qualities of natural shoreland and waters. As a result of this act, Minnesota counties and specified municipalities were required to regulate land use and compatible development on public water shoreland through State approved shoreland zoning ordinances. In addition to the Shoreland Management Act, the State of Minnesota also regulates shoreland use through the 1969 Floodplain Management Act and the 1973 Minnesota Wild and Scenic Rivers Act.

1n 1989, the Minnesota Department of Natural Resources (DNR) adopted revised statewide shoreland regulations. The revision required all units of government that were implementing shoreland controls to amend their shoreland ordinances within two years to conform with the State's revised regulations.

Local units of government that have a DNR approved shoreland ordinance include Meeker County and the cities of Eden Valley and Litchfield. All of these ordinances are believed to be in compliance with the Minnesota Shoreland Management Act.

References:

Meeker County Planning and Zoning Office
Minnesota Department of Natural Resources, Division of Waters

Protected Waters and Shoreland Classification
(Data Item 46)

Meeker County, with assistance from the Minnesota Department of Natural Resources (DNR), has developed a shoreland classification system for Protected Waters, including lakes and rivers in the County. The classification system is based upon development classes. Development classes for both lakes and rivers are provided below:

Lakes

- **Natural Sensitive Lakes** are a subcategory of the Natural Environment Lakes classification that Meeker County has developed to protect lakes that are more "wetland" in nature. Shoreland standards for these lakes are more restrictive for preservation purposes.

- **Natural Environment Lakes** usually have less than 150 total acres, less than 60 acres per mile of shoreline and less than 3 dwellings per mile of shoreline. They may have some winterkill of fish; may have shallow, swampy shoreline; and are less than 15 feet deep.

- **Recreational Development Lakes** usually have between 60 and 225 acres of water per mile of shoreline, between 3 and 25 dwellings per mile of shoreline and are more than 15 feet deep.

- **General Development Lakes** usually have more than 225 acres of water per mile of shoreline and 25 dwellings per mile of shoreline, and are more than 15 feet deep.

Rivers

- **Remote Rivers** are primarily in roadless, forested, sparsely populated areas.

- **Forested and Transition Rivers** are a mixture of cultivated, pasture and forested lands.

- **Agricultural, Urban and Tributary Rivers** are in intensively cultivated and developed areas. They also include all other rivers in the Protected (Public) Waters Inventory not classified above.

Table 4M lists the County shoreland standards for each lake and river development class. Separate standards are in place for lakes that are sewered and unsewered.