

## Rapid Watershed Assessment

### Upper Rainy

(MN) HUC: 09030004



# DRAFT

Rapid watershed assessments provide initial estimates of where conservation investments would best address the concerns of landowners, conservation districts, and other community organizations and stakeholders. These assessments help land-owners and local leaders set priorities and determine the best actions to achieve their goals.

## Introduction

The Upper Rainy River 8-digit Hydrological Unit Code (HUC) Subbasin lies on the United States-Canadian border and is situated in the Laurentian Mixed Forest Ecological Province of Northern Minnesota. This watershed is 335,197 acres in size. Approximately 21 percent of the land is privately owned.

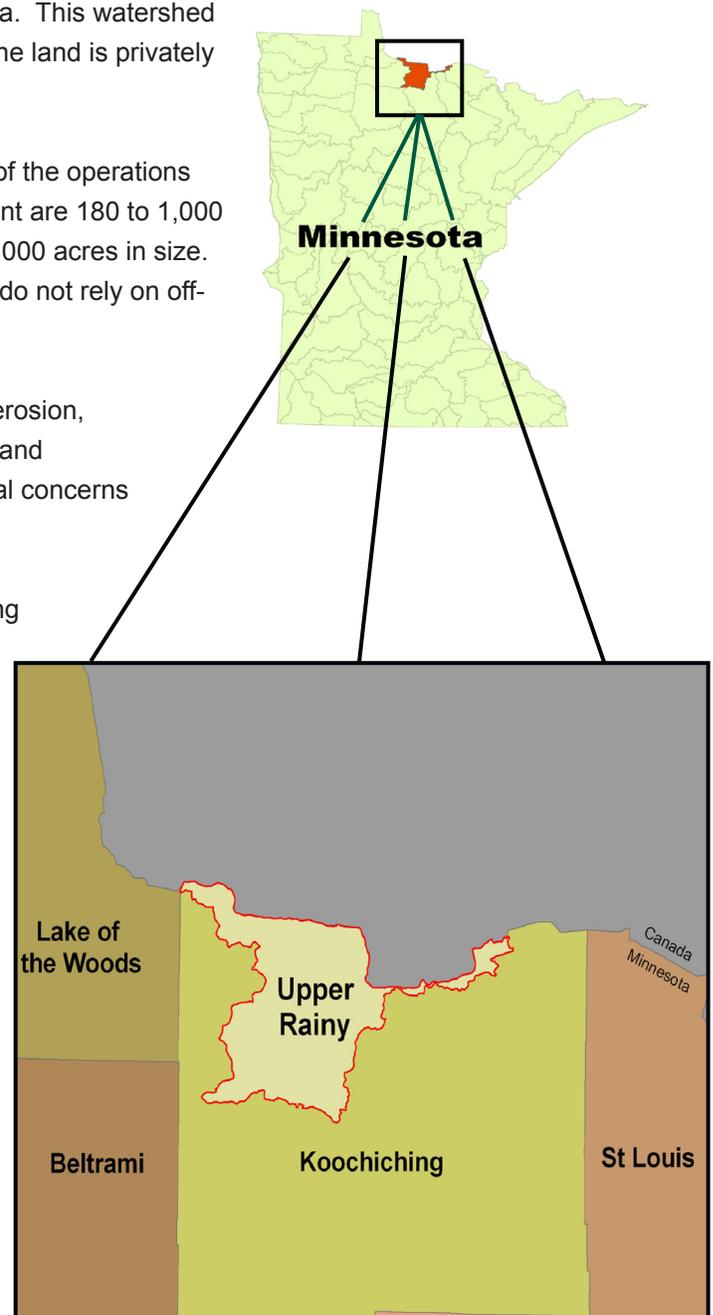
There are 43 farms in the subbasin. About 48 percent of the operations are less than 180 acres in size, approximately 44 percent are 180 to 1,000 acres in size, and the remaining farms are more than 1,000 acres in size. 41 percent of the producers are full time operators and do not rely on off-farm income.

The main resource concerns in the watershed are soil erosion, management of excessive wetness, wetland and woodland management, and the short growing season. Additional concerns include pasture management and surface water quality.

Over 99 percent of the watershed lies within Koochiching county, with an additional 19 acres (0.01%) occurring in Lake of the Woods. Wetlands cover over 229,000 acres, or approximately 69% of the watershed.

Upper Rainy is the second smallest subbasin of the Rainy Lake Basin. The subbasin is bordered by the larger Rainy Lake, Rapid, Red Lakes, Big Fork and Little Fork HUCs. Like its neighbors, Upper Rainy is characterized by extensive wetlands located on the old Glacial Lake Agassiz lake bed.

The greater Rainy River Basin is home to some of Minnesota's finest forest and water resources. Voyageurs National Park and the Boundary Waters Canoe Area Wilderness (BWCA) are located within the greater basin, as are several of the state's most famous walleye fisheries and top-notch trout streams.



**Physical Description**

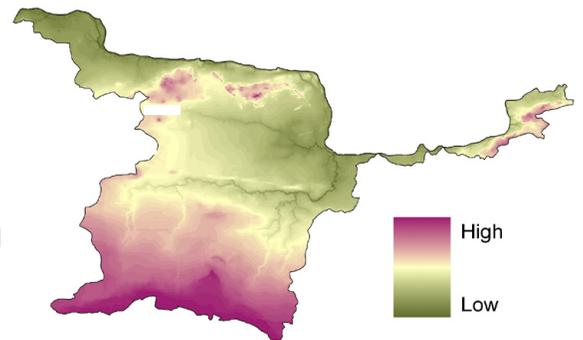
This once glaciated area is part of the Agassiz Lowlands Region, with a small part in the northeastern sliver being Little Fork-Vermilion Uplands. Soils in this HUC are generally sandy loams, with considerable deposits of glacial till and outwash over a bedrock residuum.

Elevation in the watershed ranges from 1059 feet above sea level to 1239 feet, with an average elevation of 1112 feet. The highest values occur in the Southern portions of the watershed while the lowest are found across the Northern regions, dominated by peatlands and open water.

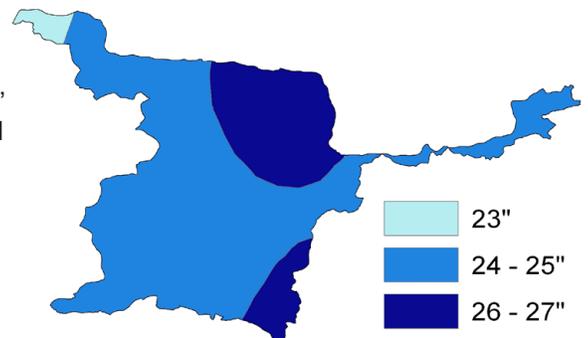
Precipitation in the watershed ranges from 25 to 27 inches annually. Most lands within this watershed are not highly erodible, and are moderately suited to agricultural uses. Predominate land uses / land covers are Wetlands (69%), Forest (23%), Grass/Pasture/Hay (3.4%), and Row Crops (1.2%).

Development pressure is negligible, with occasional lands being parceled out for timber production or recreational homes.

**Relief**

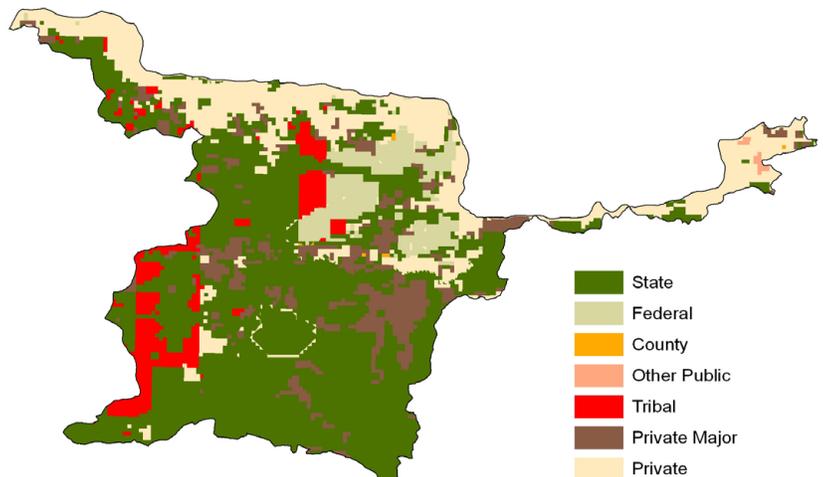


**Average Precipitation (inches)**



**Ownership**

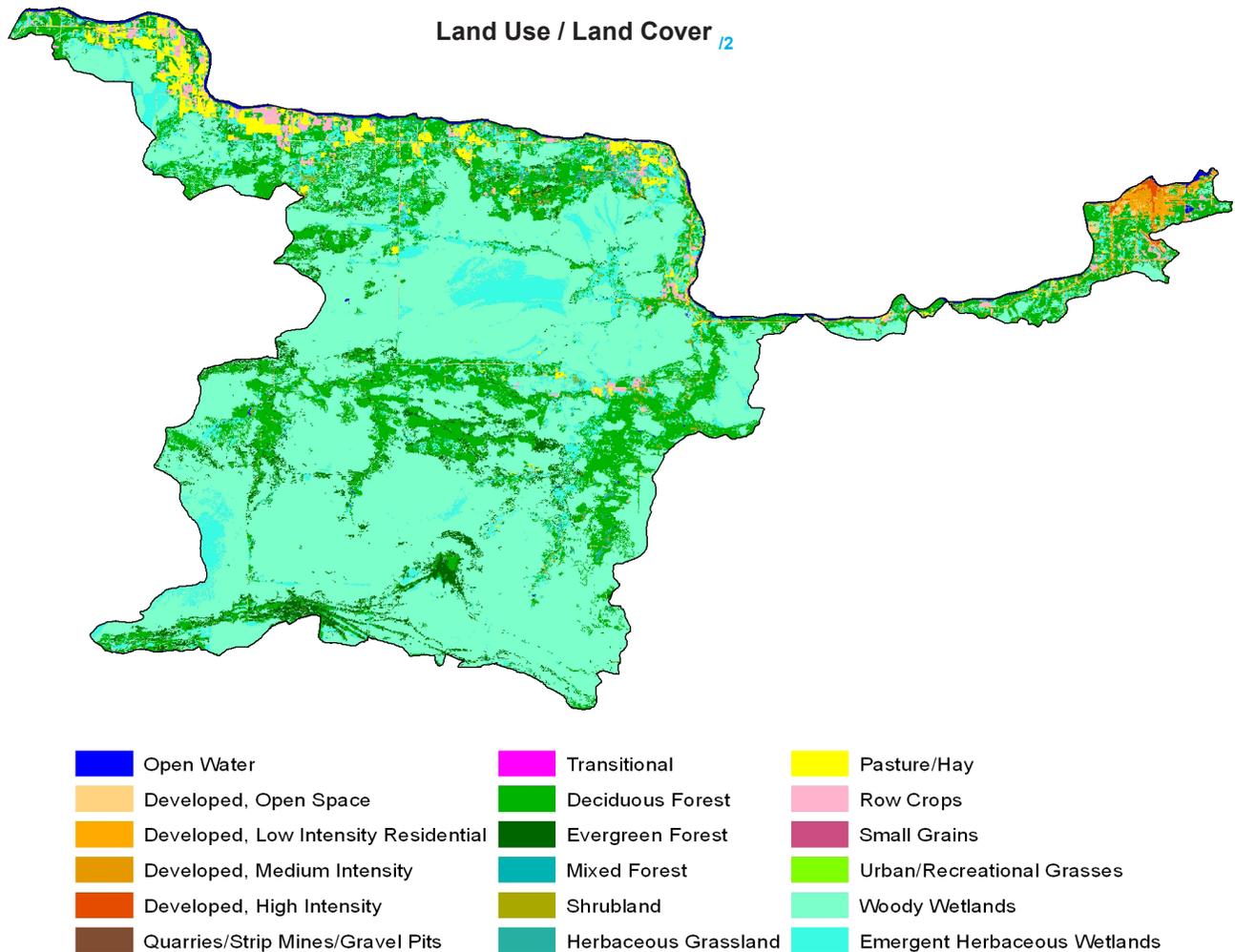
Ownership Type	Acres	% of HUC
Conservancy	-	-
County	288	0.1
Federal	22,070	6.6
State	184,567	55.1
Other	667	0.2
Tribal	21,903	6.5
Private Major	36,263	10.8
Private	69,440	20.7
<b>Total Acres:</b>	<b>335,197</b>	<b>100</b>



\* Ownership totals derived from 2007 MN DNR GAP Stewardship Coverage data and are the best suited estimation of land stewardship available on a statewide scale at time of publication. See the bibliography section of this document for further information.

**Ownership / Land Use**

The Upper Rainy Watershed covers an area of 335,197 acres. Approximately fifty five percent of the land in the watershed is state owned or managed land (184,567 acres). The second largest ownership type is Private, with 69,440 acres (20.7%), followed by Private Major with 36,263 acres (10.8%), Federal with 22,070 acres (6.6%), Tribal with 21,903 acres (6.5%), and miscellaneous “Other Public” lands amounting to 667 acres (0.2%). County lands account for the smallest ownership percentage, covering 228 acres (0.01%). There are no major Conservancy land holdings in the region. Land use by ownership type is represented in the table below.



**Ownership / Land Use <sup>13</sup>**

Landcover/Use	Public		Private**		Tribal		Total Acres	Percent
	Acres	% Public	Acres	% Private	Acres	% Tribal		
Forest	37,690	11.3%	37,939	11.3%	2,246	0.7%	77,875	23.3%
Grass, etc	666	0.2%	10,631	3.2%	3	0.0%	11,300	3.4%
Orchards	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Row Crops	323	0.1%	3,762	1.1%	1	0.0%	4,086	1.2%
Shrub etc	521	0.2%	1,813	0.5%	4	0.0%	2,338	0.7%
Wetlands	167,148	49.9%	43,099	12.9%	19,618	5.9%	229,865	68.6%
Residential/Commercial	928	0.3%	5,623	1.7%	11	0.0%	6,561	2.0%
Open Water*	192	0.1%	2,675	0.8%	0	0.0%	2,867	0.9%
<b>Watershed Totals:</b>	<b>207,469</b>	<b>61.95%</b>	<b>105,541</b>	<b>31.5%</b>	<b>21,883</b>	<b>6.5%</b>	<b>335,197</b>	<b>100%</b>

\* ownership undetermined

\*\* includes private-major

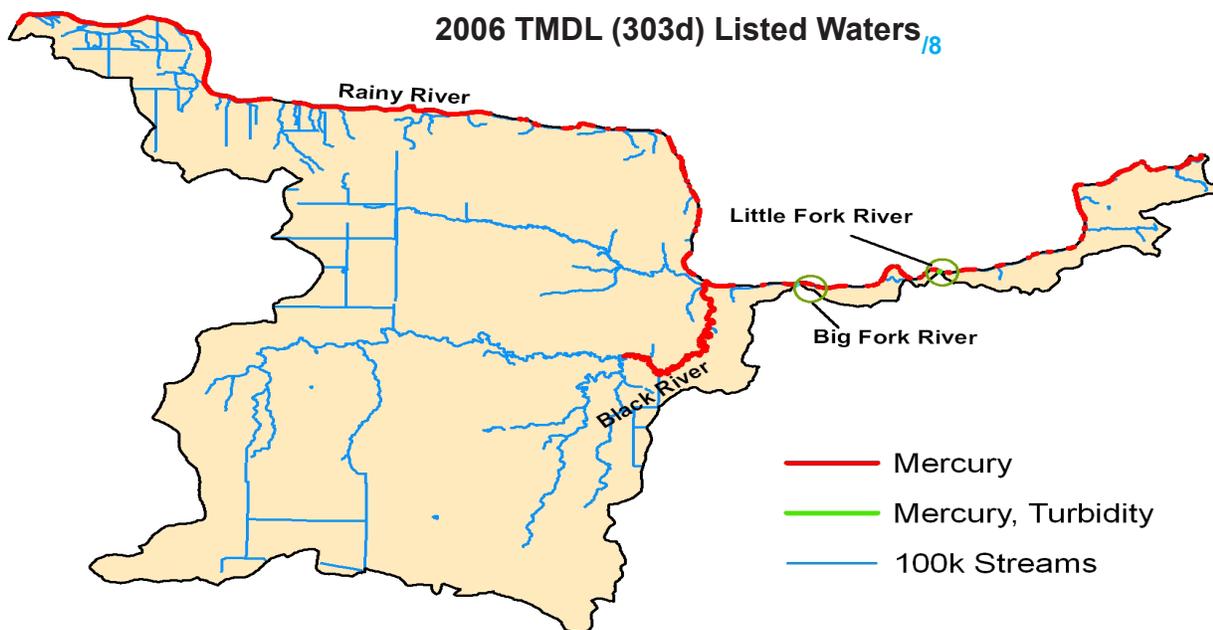
**Physical Description (continued)**

		cu. ft/sec		
<b>Stream Flow Data</b>	USGS 05133500 RAINY RIVER AT MANITOU RAPIDS, MN	<b>Total Avg.</b>	14,340	
		<b>May – Sept. Yield</b>	20,802	
<b>Stream Data</b> <sup>14</sup> (*Percent of Total HUC Stream Miles)	<b>ACRES/MILES</b>		<b>PERCENT</b>	
	Total Miles – Major (100K Hydro GIS Layer)	358.6	---	
	Total Miles – 303d/TMDL Listed Streams	51.46	14.4%	
<b>Riparian Land Cover/Land Use</b> <sup>15</sup> (Based on a 100-foot buffer on both sides of all streams in the 100K Hydro GIS Layer)	<b>Land Use Type</b>	<b>Acres</b>	<b>Percent</b>	
	Forest	3,416	40.0%	
	Grain Crops	0	0.0%	
	Grass, etc	587	6.9%	
	Orchards	0	0.0%	
	Row Crops	154	1.8%	
	Shrub etc	52	0.6%	
	Wetlands	2,774	32.5%	
	Residential/Commercial	269	3.2%	
	Open Water	1,291	15.1%	
	<b>Total Buffer Acres:</b>	<b>8,543</b>	<b>100%</b>	
<b>Crop and Pastureland Land Capability Class</b> <sup>16</sup> (Croplands & Pasturelands Only) (1997 NRI Estimates for Non-Federal Lands Only)	1 – slight limitations	0	0%	
	2 – moderate limitations	0	0%	
	3 – severe limitations	0	0%	
	4 – very severe limitations	10,600	100%	
	5 – no erosion hazard, but other limitations	0	0%	
	6 – severe limitations; unsuitable for cultivation; limited to pasture, range, forest	0	0%	
	7 – very severe limitations; unsuitable for cultivation; limited to grazing, forest, wildlife habitat	0	0%	
	8 – miscellaneous areas; limited to recreation, wildlife habitat, water supply	0	0%	
	<b>Total Crop &amp; Pastureland</b>	<b>10,600</b>	<b>---</b>	
	<b>Irrigated Lands</b> <sup>17</sup> (1997 NRI Estimates for Non-Federal Lands Only)	<b>TYPE OF LAND</b>	<b>ACRES</b>	<b>% of Irrigated Lands</b>
Cultivated Cropland		0	0%	0%
Uncultivated Cropland		0	0%	0%
Pastureland		0	0%	0%
<b>Total Irrigated Lands</b>		<b>0</b>	<b>0%</b>	<b>0%</b>

**Assessment of Waters**

Section 303(d) of the Clean Water Act states that water bodies with impaired use(s) must be placed on a state’s impaired waters list. A water body is “Impaired” or polluted when it fails to meet one or more of the Federal Clean Water Act’s water quality standards. Federal Standards exist for basic pollutants such as sediment, bacteria, nutrients, and mercury. The Clean Water Act requires the Minnesota Pollution Control Agency (MPCA) to identify and restore impaired waters.

Minnesota’s impaired waters list, updated every two years, identifies assessed waters that do not meet water quality standards. The primary tool for addressing impaired waters is a pollution reduction plan called a Total Maximum Daily Load, or TMDL. After impaired use(s) have been identified, the TMDL process identifies all sources of each pollutant. The plan then determines how much each source must reduce it’s contribution in order to meet the applicable water quality standard. The Clean Water Act requires a completed TMDL for each water quality violation identified on a state’s impaired waters list. Lakes or river reaches with multiple impairments require multiple TMDLs.



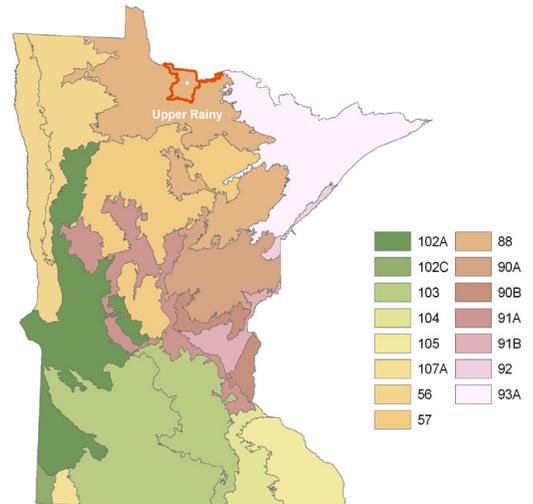
Listed Stream	Impairment	Affected Use
Rainy River Black R to Rapid R	Mercury	Aquatic Consumption
Rainy River Rainy Lk to International Falls Dam	Mercury	Aquatic Consumption
Rainy River International Falls Dam to Little Fork	Mercury	Aquatic Consumption
Rainy River Little Fork R to Big Fork R	Mercury	Aquatic Consumption
Rainy River Big Fork R to Black R	Mercury	Aquatic Consumption
Black River Unnamed Cr to W Fk Black R	Mercury	Aquatic Consumption
Little Fork River Beaver Brook to Rainy R	Mercury, Turbidity	Aquatic Consumption and Aquatic Life
Big Fork River Bear R to Rainy R	Mercury	Aquatic Consumption

## Common Resource Areas <sup>/9</sup>

The Upper Rainy Watershed is located within two common resource areas, **CRA 88**, and **93A**.

**88 - Northern Minnesota Glacial Lake Basins:** Nearly level to gently sloping areas formed in lake washed till, lacustrine and organic soil material. Generally the soils are silty, clayey and loamy with small amounts of sandy and gravelly soils on beach ridges. Timber land is the main use. Scattered cropland and grazing land for beef and dairy are present. Cropland is used mostly for small grain, silage and hay. Resource concerns include management of excessivewetness, short growing season, pasture management, and water quality.

**93A – Superior Upland Bedrock and Till Complex:** Gently sloping to very steep soils that generally formed in loamy, dense glacial till. Bedrock control is common and outcrops in many places, especially in the Boundary Water area. Bogs are common, both dysic and euic in reaction. Deciduous and coniferous forestland is the main land use. Small areas of cropland, pasture and hayland occur. Resource concerns are timber harvest management, wildlife habitat management, forage production, and riparian management.



Only the major CRA units are described above.

For further information, go to:

<http://soils.usda.gov/survey/geography/cra.html>

## Soils / Geology <sup>/10</sup>

Soils in the watershed generally consist of loamy sands, with underlying bedrock a major characteristic in the Northeast portion. The soils are derived from a mantle of acid, cobbly, and gravelly glacial till of variable depth. Coarse-loamy to coarse soil textures are most common. There are small areas of sandy and clayey lacustrine soil in the western portion of the subsection.

Given the moisture regime of the region, soils are generally representative of wet forest soils known as Aqualfs, a sub order of the Alfisols found in Minnesota. Because of their position on the landscape, these soils are wet during much of the growing season. In northern Minnesota aqualfs support aspen forests with mixtures of black ash and alder. They are most common in the basins of glacial lakes that formed in the latter part of the Ice Age. The aqualfs that extend across the northern border of Minnesota lie in the basin of glacial Lake Agassiz.

Thin glacial drift covers much of the subsection, and bedrock exposures are common. The subsection has Precambrian-age (Late Archean and Early Proterozoic) bedrock, including gneiss, undifferentiated granite, and metamorphosed mafic to intermediate volcanic and sedimentary rocks (Sims et al. 1970c, Morey 1976).

Visit the online Web Soil Survey at <http://websoilsurvey.nrcs.usda.gov> for official and current USDA soil information as viewable maps and tables. Visit the Soil Data Mart at <http://soildatamart.usda.gov> to download SSURGO certified soil tabular and spatial data.

## Drainage Classification

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Drainage class (natural) refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil.

Seven classes of natural soil drainage are recognized—excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the “Soil Survey Manual.”



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## Farmland Classification

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Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland.

Farmland classification identifies the location and extent of the most suitable land for producing food, feed, fiber, forage, and oilseed crops.

NRCS policy and procedures on prime and unique farmlands are published in the Federal Register, Vol. 43, No 21, January 31, 1978.



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## Hydric Soils

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This rating provides an indication of the proportion of the map unit that meets criteria for hydric soils. Map units that are dominantly made up of hydric soils may have small areas, or inclusions of nonhydric soils in the higher positions on the landform. Map units of dominantly non-hydric soils may therefore have inclusions of hydric soils in the lower positions on the landform.



Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as “soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part” (Federal Register 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field.



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## Highly Erodible Land (HEL)

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The erodibility index (EI) for a soil map unit is determined by dividing the potential erodibility for the soil map unit by the soil loss tolerance (T) value established for the soil in the FOTG as of January 1, 1990.

A soil map unit with an Etof 8 or greater is considered to be highly erodible land (HEL).

Potential erodibility is based on default values for rainfall amount and intensity, percent and length of slope, surface texture and organic matter, permeability, and plant cover. Actual erodibility and EI for any specific map unit depends on the actual values for these properties.



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## Land Capability Classification

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Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management.

The criteria used in grouping the soils does not include major and generally expensive land forming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.



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**Performance Results System Data**

Watershed Name: Upper Rainy				Watershed Number: 09030004						
PRS Performance Measures	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	TOTAL
Total Conservation Systems Planned (acres)	0	3,003	0	506	1,800	N/A	1,950	753	2,003	10,015
Total Conservation Systems Applied (acres)	0	530	0	597	597	N/A	663	1,792	1,704	5,883
<b>Conservation Practices</b>										
Total Waste Management (313) (numbers)	0	1	0	0	0	0	0	0	0	1
Riparian Forest Buffers (391) (acres)	0	0	0	65	54	170	11	64	0	364
Erosion Control Total Soil Saved (tons/year)	0	20	0	110	81	N/A	N/A	N/A	N/A	211
Total Nutrient Management (590) (Acres)	0	735	54	42	81	0	430	430	287	2,059
Pest Management Systems Applied (595A) (Acres)	0	0	0	0	26	10	0	0	0	36
Prescribed Grazing 528a (acres)	0	204	322	389	196	0	0	0	0	1,111
Tree & Shrub Establishment (612) (acres)	0	3	0	73	26	261	109	176	100	748
Residue Management (329A-C) (acres)	0	0	0	0	0	0	0	98	0	98
Total Wildlife Habitat (644 - 645) (acres)	0	257	240	527	28	0	527	196	642	2,417
Total Wetlands Created, Restored, or Enhanced (acres)	0	6	0	0	0	0	0	3	0	9
<b>Acres enrolled in Farmbill Programs</b>										
Conservation Reserve Program	0	0	0	55	240	N/A	11	80	0	386
Wetlands Reserve Program	0	0	0	0	0	N/A	0	0	0	0
Environmental Quality Incentives Program	0	521	497	481	478	N/A	615	979	1,046	4,617
Wildlife Habitat Incentive Program	0	9	0	50	0	N/A	0	8	0	67
Farmland Protection Program	0	0	0	0	0	N/A	0	0	0	0

**THREATENED AND ENDANGERED SPECIES** <sup>14</sup>

NRCS assists in the conservation of threatened and endangered species and avoids or prevents activities detrimental to such species.

NRCS' concern for these species includes the species listed by the Secretary of the Interior (as published in the Federal Register) and species designated by state agencies.



The following is a list of threatened, endangered, candidate species and species of special concern that occur in the basin.

Scientific Name	Common Name	Type
<i>Acipenser fulvescens</i>	Lake Sturgeon	Zoological
<i>Cicindela denikei</i>	Laurentian Tiger Beetle	Zoological
<i>Drosera anglica</i>	English Sundew	Botanical
<i>Drosera linearis</i>	Linear-leaved Sundew	Botanical
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Zoological
<i>Ichthyomyzon fossor</i>	Northern Brook Lamprey	Zoological
<i>Juncus stygius</i> var. <i>americanus</i>	Bog Rush	Botanical
<i>Oxyethira itasca</i>	A Caddisfly	Zoological

## RESOURCE CONCERNS

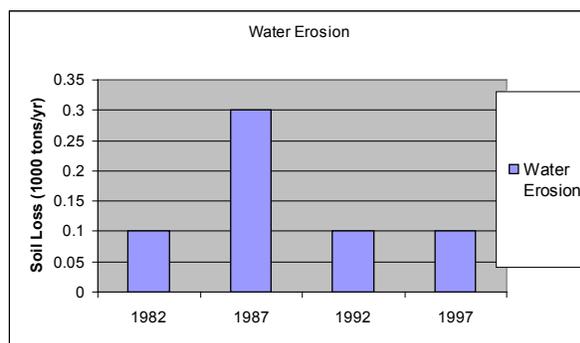
County Soil and Water Conservation Districts have identified the following resource concerns as top priorities for conservation and cost sharing efforts:

- Soil Quality, Excessive Erosion.** Soil erosion from exposed surface areas, logging sites, streambank and lakeshore areas, and roadside erosion are considerable conservation issues in the watershed.
- Management of Excessive Wetness:** The nature of much of the basin's soils limits productivity and viability of land for agricultural and some silvicultural uses. Efforts such as ditching, species selection, critical planting, and wetland mitigation aid in combating the wetness common to the area.
- Surface Water Quality:** Enhancement of surface waters. Excessive amounts of sediments, nutrients, and bacteria degrade the water quality causing a fish community with depressed populations and limited diversity. Reduction of priority pollutants and sediments in surface waters will enhance economic development opportunities by preserving the environmental features that promote and attract tourists and fishermen to the area and improve the quality of water supply in the region.
- Wetland Management.** Physical changes have taken place, wildlife and plant species composition have been altered, greatly changing the function and value of the areas plentiful wetlands. Establishing high priority wetland areas and enforcing future wetlands legislation provides opportunities to enhance the wetland resources of the watershed.
- Short Growing Season:** Given the short growing season, timely planting, management of moisture, and appropriate seed selection is crucial for a successful crop. Planting delay and short-time concentrated precipitation in the growth season are the main causes of yield reduction.
- Woodland Management.** Management opportunities include planting trees or shrubs, timber stand improvement, timber sales, enhancing wildlife habitat, prescribed burning, control of invasive species, and other conservation measures.



### NRI Erosion Estimates

- NRI Estimates for Sheet and rill erosion by water on crop and pastureland average 150 tons annually for the 1982 to 1997 reporting period. <sup>13</sup>



**Socioeconomic and Agricultural Data (Relevant)**

The Upper Rainy subbasin has an estimated population of 8,156 people. Median household income throughout the district is \$34,916 yearly, roughly 75% of the national average. Unemployment in the basin is estimated at 5.7 percent, and approximately 11% of the watershed's residents are living below the national poverty level.



There are 43 farms in the subbasin. About 45 percent of the operations are less than 180 acres in size, approximately 46 percent are 180 to 1,000 acres in size, and the remaining farms are more than 1,000 acres in size. 41 percent of the producers are full time operators and do not rely on off-farm income.

<b>(MN) HUC# 9030004</b>		<b>Total Acres:</b>	<b>335,197</b>
<b>Population Data*</b>	Watershed Population	8,156	
	Unemployment Rate	5.7%	
	Median Household Income	34,916	
	% below poverty level	11%	
	Median Value of Home	63,200	
<b>Farm Data</b>	# of Farms	43	
	# of Operators	41	<b>Percent</b>
	# of Full Time Operators	17	41%
	# of Part Time Operators	24	59%
	<b>Total Cropland Acres</b>	<b>6,644</b>	<b>2.0%</b>
<b>Farm Size</b>	1 to 49 Acres	5	10%
	50 to 179 Acres	15	35%
	180 to 499 Acres	14	33%
	500 to 999 Acres	6	13%
	1,000 Acres or more	4	9%
	<b>Average Farm Size</b>	<b>24</b>	
<b>Livestock &amp; Poultry</b>	Cattle - Beef	507	30%
	Cattle - Dairy	47	3%
	Chicken	183	11%
	Swine	8	0%
	Turkey	5	0%
	Other	916	55%
	<b>Animal Count Total:</b>	<b>1,666</b>	
	<b>Total Permitted AFOs:</b>	<b>3</b>	
<b>Chemicals (Acres Applied)</b>	Insecticides	19	
	Herbicides	675	
	Wormicides	0	
	Fruiticides	20	
	<b>Total Acres Treated</b>	<b>714</b>	
	<b>% State Chemical Totals</b>	<b>0.0%</b>	

\* Adjusted by percent of HUC in the county or by percent of block group area in the HUC, depending on the level of data available

## Watershed Projects, Plans and Monitoring

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- Long-term water quality monitoring in the Rainy River Watershed. The Northeast Region Sustainable Development Partnership joined with the Minnesota DNR and seven partners in both Canada and the United States to support water quality monitoring and environmental education involving an interagency, inter-scholastic and international cooperation. Koochiching County Environmental Services is the project coordinator. The sponsoring entity was the Rainy / Rapid River Board



- Local River Planning, MN DNR. This project assisted local units of government in the wise management of rivers within their jurisdiction. Collaborative teams created river plans -- consisting of land use zoning criteria, recreational objectives, water quality considerations, and historic/cultural recommendations for the St. Louis, Cloquet, Whiteface, Rainy, and Rapid rivers. These locally designed plans all contain more restrictive zoning provisions than the statewide standards and are tailored to specific local needs and concerns.

- Rainy River First Nations Watershed Program, Rainy River First Nations. A comprehensive ecosystem approach that considers all threats to the watershed. The effort is committed to using traditional ecological knowledge and values in combination with current natural resource management techniques to enhance and sustain aquatic resources in the Rainy River and its tributaries.

- Rainy / Rapid River Plan, MPCA and International Joint Commission. Goals may include delineation of specific stream segments to be restored or protected, loading reductions to be achieved, type and amount of habitat to be restored, identification of water management issues and problems, conservation district goals, priority issues and waters, and coordination of citizen monitoring programs and efforts.

\* Have a watershed project you'd like to see included? Submit suggestions online @ <http://www.mn.nrcs.usda.gov/technical/rwa/>

## Conservation Districts, Organizations & Partners

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- **BWSR Regional Office**  
394 S Lake Ave Rm 403 Duluth, MN 55802  
Phone 218-723-4752

- **Koochiching County SWCD**  
715 4th St International Falls, MN 56649  
Phone 218-283-1174

- **International Joint Commission Great Lakes Office**  
100 Ouellette Ave., 8th Floor Windsor, ON N9A 6T3  
Phone: 519-257-6733

- **Lake of the Woods County SWCD**  
PO Box 217 Baudette, MN 56623  
Phone 218-634-1842

- **Laurentian Resource Conservation and Development Council**  
4850 Miller Trunk Hwy, Suite 2A Duluth, MN 55811  
Phone (218) 720-5225

- **MPCA Regional Office - Duluth**  
525 Lake Avenue S. # 400 Duluth, MN 55802  
Phone 218-723-4660 or 800-657-3864

- **MN DNR Area Hydrologist**  
1201 E. Hwy. 2 Grand Rapids, MN 55744  
Phone 218-327-4263

- **U of MN Extension Service Regional Office**  
1307 3rd St. NE, Suite 102 Roseau, MN 56751  
Phone 218-463-0291 or 888-241-4546

- **Rainy River First Nations**  
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## Footnotes / Bibliography

1. Ownership Layer – Source: MN Stewardship Data: Minnesota Department of Natural Resources, Section of Wildlife, BRW, Inc, 2007. This is the complete GAP Stewardship database containing land ownership information for the entire state of Minnesota. Date of source material is variable and ranges from 1976 to 2007, although a date range of 1983 to 1985 predominates. Land interest is expressed only when some organization owns or administers more than 50% of a forty except where DNR could create sub-forty accuracy polygons.
2. National Land Cover Dataset (NLCD) - Originator: U.S. Geological Survey (USGS); Publication date: 19990631; Title: Minnesota Land Cover Data Set, Edition: 1; Geospatial data presentation form: Raster digital data; Publisher: U.S. Geological Survey, Sioux Falls, SD, USA.
3. Ownership layer classes grouped to calculate Public ownership vs. Private and Tribal ownership by Minnesota NRCS Rapid Watershed Assessment Staff. Land cover / Land use data was then extracted from the National Landcover Dataset Classification System and related to ownership class polygons.
4. U.S. Geological Survey National Hydrography Dataset (NHD) 1:100,000-scale Digital Line Graph (DLG) medium resolution hydrography data, integrated with reach-related information from the U.S. Environmental Protection Agency Reach File Version 3.0 (RF3). The Hydro 100k layer was compared to MPCA's 303(d) data to derive percentage of listed waters.
5. Land Cover / Land Use / Hydro 100k Buffer. Using the 100k Hydrology dataset, All streams within HUC were spatially buffered to a distance of 100 ft. National Landcover Dataset attributes were extracted for the spatial buffer to demonstrate the vegetation and landuse in vulnerable areas adjacent to waterways.
6. Land Capability Class. ESTIMATES FROM THE 1997 NRI DATABASE (REVISED DECEMBER 2000) REPLACE ALL PREVIOUS REPORTS AND ESTIMATES. Comparisons made using data published for the 1982, 1987, or 1992 NRI may produce erroneous results. This is because of changes in statistical estimation protocols and because all data collected prior to 1997 were simultaneously reviewed (edited) as 1997 NRI data were collected. All definitions are available in the glossary. In addition, this December 2000 revision of the 1997 NRI data updates information released in December 1999 and corrects a computer error discovered in March 2000. For more information: <http://www.nrcs.usda.gov/technical/NRI/>
7. 1997 NRI Irrigated Land Estimates. Irrigated land: Land that shows evidence of being irrigated during the year of the inventory or during two or more years out of the last four years. Water is supplied to crops by ditches, pipes, or other conduits. Water spreading is not considered irrigation; it is recorded as a conservation practice. [NRI-97] For more information: <http://www.nrcs.usda.gov/technical/NRI/>
8. 303(d) Stream data. Minnesota's Final Impaired Waters (per Section 303(d) Clean Water Act), 2006. Data obtained from Minnesota Pollution Control Agency (MPCA). The Minnesota Pollution Control Agency (MPCA) helps protect state water by monitoring quality, setting standards and controlling inputs through the development of TMDL plans. <http://www.pca.state.mn.us/water/tmdl/index.html#maps>.

## Footnotes / Bibliography (continued)

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9. National Coordinated Common Resource Area (CRA) Geographic Database. A Common Resource Area (CRA) map delineation is defined as a geographical area where resource concerns, problems, or treatment needs are similar. It is considered a subdivision of an existing Major Land Resource Area (MLRA) map delineation or polygon. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area

10. Soil Survey Geographic Database (SSURGO) Tabular and spatial data obtained from NRCS Soil Data Mart at <http://soildatamart.nrcs.gov>. Publication dates vary by county. Component and layer tables were linked to the spatial data via SDV 5.1 and ARCGIS 9.1 to derive the soil classifications presented in these examples. Highly Erodible Land Classification Data obtained from USDA/NRCS EFOTG Section II, County Soil Data. HEL classifications were appended to SSURGO spatial data via an ARCEdit session. Addendum and publication dates vary by county.

11. Lands removed from production through farm bill programs. County enrollment derived from the following: CRP Acres: [www.fsa.usda.gov/crpstorpt/07Approved/r1sumyr/mn.htm](http://www.fsa.usda.gov/crpstorpt/07Approved/r1sumyr/mn.htm) (7/30/04). CREP Acres: <http://www.bwsr.state.mn.us/easements/crep/easementssummary.html> (7/31/03). WRP Acres: NRCS (8/16/04). Data were obtained by county and adjusted by percent of HUC in the county.

12. Socioeconomic and Agricultural Census Data were taken from the U.S. Population Census, 2000 and 2002 Agricultural Census and adjusted by percent of HUC in the county or by percent of zip code area in the HUC, depending on the level of data available. Data were also taken from MPCA AFO/CAFO counts provided by county for 2005.

13. 1997 NRI Estimates for sheet and rill erosion (WEQ & USLE). The NRI estimates sheet and rill erosion together using the Universal Soil Loss Equation (USLE). The Revised Universal Soil Loss Equation (RUSLE) was not used in the 1997 NRI. RUSLE was not available for previous inventories, therefore the use of USLE was continued to preserve the trending capacity of the NRI database. Wind erosion is estimated using the Wind Erosion Equation (WEQ). For further information visit <http://www.mn.nrcs.usda.gov/technical/nri/findings/erosion.htm>

14. Federally listed endangered and threatened species counts obtained from NRCS Field Office Technical Guide, Section II, Threatened and Endangered List. <http://www.nrcs.usda.gov/Technical/efotg/>. Where listed, Essential fish habitat as established by Magnuson-Stevens Fishery Conservation and Management Act, Public Law 94-265, as amended through October 11, 1996 <http://www.nmfs.noaa.gov/sfa/magact/>

15. Watershed Projects, Plans, Monitoring. Natural Resources Conservation Service, Watershed Projects Planned and Authorized, <http://www.nrcs.usda.gov/programs/watershed/Purpose>. Additional Information on listed individual projects can be obtained from the noted parties.