

**Middle Cannon Lobe
Local Government Priorities**

LGU	Rice County Water Plan 2010-2014	Rice County SWCD Annual Plan of Work	Rice County Comp Plan 2002	North Cannon WMO	Dakota County SWCD Strategic Plan 2011-2015	Goodhue County Water Plan	NRCS Rapid Watershed Assessment	City of Faribault Surface Water Management Plan, 2004	City of Faribault Comp Plan 2003 - Environmental Resources Section	City of Northfield, Surface Water Management Plan, 2007	SWPPP for MS4 Cities (6 categories all must have)	Northfield Comp Plan 2008 - Environmental Resources & Sewer/Water Sections	City of Northfield Natural Resource Inventory 2005	
Priorities	Erosion Control.	Annual Priority: High Priority Erosion and Sediment Problems...Priority will be given to projects that have a potential to protect or improve water quality in lakes and streams.	Goal 18: Promote environmentally sensitive erosion control practices	Natural Area Protection	Soil Loss	Erosion and Sediment Control	Soil Erosion and depositions	Flood Protection	To protect the environment and preserve clean water and clean air.	Multi-level educational program including hands on training, cost-sharing with residents and using web site.	Public Education and Outreach	Objective 2: Protect and enhance environmentally significant areas. (see NRI)	Rich fen (a type of wetland) at Hauberg Woods	
	Stormwater Management.	Obj. 1: To control sheet, rill and gully erosion on Rice County cropland to tolerable levels determined by the revised universalsoil loss equation.	Goal 19: Support and implement state and federal regulations controlling the use, alteration or filling of wetlands	Wetlands	Stormwater Management	Septic System Compliance	Animal waste management	Reduce P and TSS loading to waterbodies.	To preserve the scenic and environmental qualities of the Cannon and Straight River Valleys and their tributaries.	Differing performance standards set for new development and expansion/redevelopment activities.	Public Participation/ Involvement	Objective 3: Protect and enhance water quality.	High quality floodplain forests along the Cannon	
	Waste Disposal / Management.	Obj. 2: Preserve and improve water quality of Rice County lakes and streams with the use of proper upland control measures.	Goal 20—Preserve, protect and improve the surface and underground waters including, but not limited to, rivers, streams, lakes, groundwater and aquifer recharge areas	Groundwater	Native Plant Communities	Groundwater Protection	Urban stormwater management	Prevent hazardous materials from entering storm sewere system.	To preserve sufficient natural open space in order to provide habitat for wildlife and provide scenic and recreational qualities for the community.	Limits for runoff rates generated by any new development to pre-settlement conditions	Illicit Discharge Detection and Elimination	Objective 2: Manage water resources so that the beneficial uses of wetlands, ponds and streams remain available to the existing and future community (sustainability).	Good quality maple-basswood and oak forests along the stream corridors, especially Heath Creek	
	Groundwater	Obj. 3: Promote soil and water conservation through an effective information and education program to Rice County residents.	Goal 21—Encourage the preservation of lands for open space that are substandard for development and have limited land use due to slope, soil characteristics wetlands or other physical limiting conditions	Soil Erosion		Impaired Waters	Sediment and erosion control	Involve general public, city staff and business community in water quality management efforts.	To guide development and redevelopment in a manner that protects and enhances the air, water and land resources in the City.	Limiting runoff rates generated by expansion /redevelopment to existing conditions	Post-Construction Stormwater Management in New Development and ReDevelopment	Rice Creek (trout stream) mentioned several places for protection	Rice Creek (this site is of regional significance as it is the only trout stream in Rice County, and is an uncommon resource type in southern Minnesota)	
	Surface Water	Obj. 4: Provide district services to the public through the most efficient use of public funds.	Goal 23—Encourage the protection and orderly development of Rice County shoreland areas	Surface Water and In-Stream Habitat Quality		Feedlot Water Quality Improvement	Groundwater protection	ID and protect wetland resources - maintain and improve function		Focusing on measurable standards (not just ponding) for new impervious to reduce phosphorus and sediment;	Construction Site Stormwater Runoff Control		Limestone cliffs along Heath Creek	
	Water Management Plan Coordination / Special Concern				Surface Water Quantity		Nutrient Management	Nutrient Management	Crocker's Creek designated by city as a natural resource priority.		Infiltration required on new development and redevelopment /expansion;	Pollution Prevention/ Good Housekeeping		Numerous scenic overlooks along the stream corridors and in some outlying areas
					Development			Wetland management	Greenway corridors		Identifying potential low impact development demonstration programs;			Cannon River (designated as a state Wild and Scenic River)
					Information and Education						Inspecting and maintaining stormwater system as identified in City's updated Stormwater Pollution Prevention Plan.			Open space areas on the campuses of St. Olaf and Carleton Colleges, which have high ecological value

Middle Cannon Lobe
Waterbody/Watershed: Byllesby Reservoir

Study	Lake Assessment 1996, MPCA	Lake Byllesby Regional Park Master Plan, 2005, Dakota County	Byllesby Reservoir Excess Nutrient TMDL - DRAFT, 2007, MPCA and CRWP
Reason for Study / Goals	MPCA LAP program, provide assessment data, requested by Lake Byllesby Improvement Association	Park Planning	TMDL development
Issues/ Problems	Removal non-game fish and stocking unsuccessful. Avg TP 258 ppb, severe hypereutrophic conditions, high levels TN, Chl-a, TSS	invasive species	Excess Nutrients
Good Stuff	NA	outdoor rec, etc.	NA
Goals Set / Actions Suggested	P Goal of 90 ppb - limit inputs then manage internal loading. Stormwater basins, reduce soil erosion, P fertilizer and manure runoff, more detailed examination of nutrient sources, more detail analysis sediment from point and nonpoint sources, promote P reductions point sources, industrial wastes pretreat for P	Control invasives, targeted plant community restoration, naturalize shoreline from Echo point to dam, Park do its park for WQ - shoreline restoration to buffer runoff, alternative swimming facility regardless of WQ.	Site Specific standards summer mean TP <90 ppb, Chl-a < 30 ppb , Secchi 0.8 or greater. 43% P loading reduction (low flow) and 60% P loading reduction (high flow), WLA for point sources and LA for nonpoint sources. WWTP lower 1 mg/L, failing septic (no given WLA not legal), MS4 and Ag BMPs

Middle Cannon Lobe

Waterbody/Watershed: Cannon River

Study	Report of the Investigation of the Pollution of the Straight and Cannon Rivers by the Minnesota State Board of Health & Commissioner of Game and Fish 1928-30	Cannon River Pollution at Faribault Memo - 1958, DNR	A Study of the State of Pollution of the Streams of the Cannon Valley Watershed - 1972, Cannon Valley Development Association	Water Quality Evaluation Rice County 1972
Reason for Study/Goals	Samples above and below each municipality to determine causes of pollution and effects on rivers.	note conditions	Study would be a starting point in a campaign to stem the pollution of the rivers and eventually develop recreational potentials.	Assess conditions
Issues/ Problems	Owatonna, Faribault, Northfield, Cannon Falls have considerable effect on quality of the water. River sufficiently polluted to be menace to health and to fish live below Owatonna, Faribault, Northfield. Nuisances common sewer outlets. Bathing any section of river Owatonna to Welch is hazardous.	River unfit for most fishes particularly smallmouth bass. Major offenders Faribault Canning and Faribo Turkeys.	River system is an "abused treasure". Pollution from industrial sources needs kept in check. Major problem from feedlots and farming practice. Street runoff not measured - can be significant.	Influenced by municipalities, high nutrient and bacteria. River quality is poor.
Good Stuff	None	None	Juniper bluffs Falls to Red Wing, Clear water see bottom. Straight River Owatonna to Faribo exciting canoeing, Wilderness Park.	NA
Goals Set/Actions Suggested	Control sewage and industrial wastes	Faribo Canning need do more treat waste		Municipal treatment facilities need attention

Middle Cannon Lobe
Waterbody/Watershed: Cannon River

Study	Report to the Environmental Quality Commission and the City Council - Northfield, 1978	Cannon River Resource Analysis 1979, DNR	A Management Proposal for the Cannon River, Draft April 1979	Rice Co Water Quality Eval 1972-1985
Reason for Study/Goals	Understand health of Cannon River and the town's effect on it.	Determine if Cannon should be included as Wild & Scenic River	Required for Wild & Scenic designation	Assess change from 1972
Issues/ Problems	DO, BOD, TSS, Fecal coliform, pH and flow, volatile solids. River water from the south was higher quality than water leaving the city. V High Coliform March, Nov. WWTP treatment need improve. Posbbile duck coliform issues.	WQ good to fair. Bacteria exceed standard. Dundas septics not work well. Fbo and Nfld WWTP not meet effluent discharges. Cfalls plant needs improve	NA	Nonpoint pollution. TSS and N. N increasing while P is decreasing
Good Stuff	Good DO levels support healthy fish population	Cannon River exhibits outstanding qualities - scenic, recreational, historical, scientific and natural	Ensure consistent minimum zoning standards. Prevent problems heavy recreational use. Easements protect land.	Improvements since 1972 - bacteria, WWTP disinfection made healthier, limiting permitted discharges.
Goals Set/Actions Suggested	Conserve two major resources - Cannon River and Sibley Marsh	meets criteri for W&Scenic river	Land use management, land acquisition for willing sellers and recreation management (apply only in Wild &Scenic Land Use district)	Erosion control, careful fertilizer application, protect and restore wetlands

Middle Cannon Lobe
Waterbody/Watershed: Cannon River

Study	A Review of Water Quality and Aquatic Biology in the Cannon River Watershed - 1989, TNC	Macroinvertebrate Assessment 1994-96, Faribault, Dundas, Randolph	Cannon River Management Plan, Wild & Scenic, MN Administrative Rules (posted 6/2008)	River Survey, Nfld to Byllesby, 1977, DNR
Reason for Study/Goals	Aid TNC in ecological evaluation of the Cannon River Watershed.	macroinvertebrate assessment	Establishes rules regarding land use, classifications, recreation, structures, etc.	Inventory and fish management
Issues/ Problems		Some P may settle out Nfld dam, N increase along river from Morristown to Randolph, possible SR influence. SR appears to carry more sediment. Randolph site number insects decreased. Silt settle out flow slows.	NA	None
Good Stuff	High BOD in SR, High TP in SR and CR. Turbidity high - bank erosion. *Limestone rich in P natural background may be higher than normal. Lake Tetonka high natural TP before ag began. Soil erosion and pasturing animals high TP. Fertilizer major source of N in river. In Cannon River above Tetonka livestock primary fecal source.	Dundas sight highest QEHI score, caddisflies dominant macroinvert. Fbo site just past SR confluence lots caddisflies pollution tolerance 3.	Protection of land and water	None
Goals Set/Actions Suggested	Top priority restrict livestock access all parts of river. Prtoect the banks - 100' corridor. Assess dams. Purchase and restoration of updalnads in native habitat. Stream bank use greater impact on river than does watershed land use.	NA	NA	None

Middle Cannon Lobe
Waterbody/Watershed: Cannon River

Study	River Survey Faribault to Byllesby 1983-84, DNR	Cannon River (above Byllesby) stream management plan	The Cannon River: Recreational Use of a Warmwater Stream. Dec 1987, DNR
Reason for Study/Goals	Inventory and fish management	Fisheries management	document current recreation, economic value
Issues/ Problems	Extensive drainage of wetlands, stream channelization and conversion of most of the watershed to cropland caused excessive erosion and siltation and extremes in	Watershed alterations extensive past 70 years, intensive ag result in unstable stream flows, high erosion and turbidity, Dams in Nfld and Faribault represent total fish migration barriers.	Cannon River watershed affected by wetland drainage, headwater stream channelization, conversion of marginal/erodible land to crop and pasture.
Good Stuff	fishing interest increasing, most bank angling	None	Tailwater fisheries most angling. Intensively fished resource, significant canoeing and tubing pressure. Anglers typically younger than 16. Tourism significant factor
Goals Set/Actions Suggested	None	Support acquisition projects restore or protect natural stream corridor. Preserve remaining integrity of riparian corridor.	Cannon River corridor primarily managed for recreation. RIM and CRP in riparian corridors. Maintain drainage ditches.

Middle Cannon Lobe
Waterbody/Watershed: Chub Creek

Study	Chub Creek Watershed Assessment, Dakota SWCD/NCWMO, 2001	2008 NCRWMO Water Quality Monitoring Report, Dakota SWCD, 2009	Macroinvertebrate Assessment near Randolph, 1994-96, St. Olaf
Reason for Study / Goals	(1) quantitatively determine the overall health of the Chub Creek Watershed, (2) identify and prioritize resource management objectives, and (3) outline appropriate best management practices (BMPs) necessary to restore the resource.	Trend data	Macroinvertebrate assessment
Issues/ Problems	Health poor during runoff events. High levels ammonia, fecal coliform, nutrients, solids. Some wetland drainage and stream channelization	Turbidity slightly higher standards. E. coli still exceeds standards	N & P high in 1994
Good Stuff	General health fair-good during low flow. Northern pike, good bugs, buffers and wetlands	WQ fair - most parameters below State standard/ecoregion means. Bacteria may be showing a decreasing trend.	QHEI above average =healthy macro invert population, nutrients fairly low, wetland filtering
Goals Set / Actions Suggested	Upper Watershed - preservation and protection. Middle and Lower sections need work nutrients and solids. North Branch nutrients need work.	NA	NA

Middle Cannon Lobe
Waterbody/Watershed: Chub Lake

Study	Chub Lake Assessment Report, Natural Resources Information Providers, 2005
Reason for Study / Goals	Part of Byllesby TMDL project
Issues/ Problems	40% of watershed is cropland. Lake hypereutrophic, NCHF ecoregion. Model output lake conditions not predicted well by immediate watershed land use
Good Stuff	Most shoreline undeveloped
Goals Set / Actions Suggested	limited data so far. Need info on historical loading, mixing and internal loading. More detail eval of land use. Need active CLMP monitor, assess possible minnow rearing, any feedlots contributing to tribs? Was 2004 data an anomaly?

Middle Cannon Lobe
Waterbody/Watershed: Circle Lake

Study	Water Quality Evaluation Rice County 1972	Rice Co Water Quality Eval 1972-1985	Lake Assessment Program, MPCA, 1991	Lake Survey 2007 DNR	Status and Trends Montiroing for Rice County 1999, MPCA	Point Intercept Survey for Curlyleaf Pondweed 2010, DNR	Circle Lake Watershed Upland Assessment , Carleton College, 2002
Reason for Study/Goals	Assess conditions	Assess change from 1972	Forest Township Agri-Lakes Association asked for LAP	Fish survey as follow up to 2004 winter fish kill	Check status/trends	Assess curlyleaf	Upland assessment of Circle Lake Watershed
Issues/Problems	One of worst lakes in Rice County, Bacterial levels concern swimming. Shallow. Wave action may resuspend nutrient	Little change since 1972. Little or no pollution of the lake from conventional sources. Fertile runoff, shallow basin, Advancing shorelines/sedimentation, winter kills due to low oxygen	TP, Chla, Secchi worse than other lakes in area, hypereutrophic. P levels increasing since 1980s. Lake located in more fertile portion of ecoregion, nutrients from sediment may be factor. P sources Livestock pastured along stream, failing septic, lawn fertilizer	Carp very abundant	TP & Chla extremely high, TSS high - 60% algae and organic matter	Curlyleaf 20% frequency of occurrence, most in NW corner of lake	Erosion and shoreland stability
Good Stuff	NA	Little bacteria	NA	Walleyes, northern pike, yellow perch, bluegills	Secchi improving	NA	
Goals Set/Actions Suggested	NA	Aeration	CLMP, education lakeshore owners (Forest Township Agri-Lakes Association?), limit wetland drainage, limit development, setbacks and veg buffers. P conc between 70 - 178	Carp limit fishery	Lake management plan, continue CLMP, development minimize effects WQ, wetland and drainage alterations discouraged, septic, land use practices	NA	See report for recs in each township for waterways, wetlands, etc.

**Middle Cannon Lobe
Waterbody/Watershed: Fox Lake**

Study	Water Quality Evaluation Rice County 1972	Rice Co Water Quality Eval 1972-1985	Lake Assessment, MPCA, 1991	Lake Survey, DNR, 2007
Reason for Study/Goals	Assess conditions	Assess change from 1972	PCA lake assessment program	fish/plant survey
Issues/Problems	High ammonia, low BOD NE corner	Deteriorated noticeably since 1972. Human and animal waste pollution, cropland runoff sediment and P	TP, Chl-a, Secchi poorer than other lakes in region - eutrophic to hyperutrophic. Located in fertile portion of ecoregion. P values increasing past 14 years. Wolf Creek from Mazaska major source. Nitrogen from fertilizer, septic, animal waste strong influence.	decreased gill nets since 2001 natural reproduction somewhat limited. Poor WQ limited aquatic plant community. Curlyleaf present. Cattle grazing in lake south end
Good Stuff	Highest water quality in Rice County	Not seen low DO because deep kettle lake	NA	Shoreline relatively good condition, spawning habitat for some fish is good. WQ above average for area.
Goals Set/Actions Suggested	ID sources NE corner	NA	CLMP, education lakeshore owners (Forest Township Agri-Lakes Association?), limit wetland drainage, limit development, setbacks and veg buffers, septic maintenance. Cows excluded, veg buffer. Good candidate for in-lake treatment	NA

Middle Cannon Lobe
Waterbody/Watershed: Heath Creek

Study	Hydrology and Geochemistry of Heath Creek, Sarah Berger et al.	Geomorphology and Watershed Studies of the Cannon River and its Tributaries: Wolf Creek, Rice Creek, and Heath Creek by Mary Savina	Rice County Water Quality Evaluation 1986
Reason for Study / Goals	Establish baseline of hydrological, physical and geochemical characteristics of Heath Creek and its floodplains, and second, to correlate these characteristics to the surrounding land use.	Establish baseline geomorphic and environmental conditions for the three tributaries so their status can be monitored in the future.	To ascertain how well Rice County waters have fared since 1972.
Issues/ Problems	Installation of tile drains, culvert networks, and removal of natural riparian buffers have increased the rate of runoff into the channel immediately following precipitation events. As a result, the downstream reaches of Heath Creek are experiencing bank instability. Restoration of natural riparian buffers along the stream would help to reduce land loss due to erosion during high runoff events. The visual water quality of Heath Creek improves with distance from Union Lake, despite increased concentrations of N and P downstream. Coliform levels are very high throughout. P peaks at Baldwin Ave.	Longitudinal changes in water quality in Heath Creek may be related to geomorphology (location of wetlands below Union Lake) and land use.	Lonsdales influence on the (H1) upper reaches is obvious. High fecal, nutrient, and suspended solids measurements are due to the limited dilution offered by the stream. Further downstream (H2), these pollutants continue to appear. The pollution detected here is probably unrelated to the impacts detected upstream because of the great separation of the two points....Total suspended solids at points H2 is consistently higher than H1. This "muddying of the waters" is perhaps the most widespread pollution problem we face. Erosion of streambanks, exposed agricultural lands, and drainageways is robbing the land of nutrients and filling in waterways.
Good Stuff		Woodland riparian buffers are much more extensive now than at the time of the first aerial photo survey in 1938.	
Goals Set / Actions Suggested	For future study, 1) study during a period with precipitation 2) long-term monitoring of streambanks for relative stability and/or bank loss to erosion 3) chemical analysis of wq at high discharge 4) comparison of nutrient levels before planting and after seasonal harvests 5) location of tile drains and springs and geochemical analysis of their discharge.		

Middle Cannon Lobe
Waterbody/Watershed: Lake Mazaska

Study	MPCA Lake Assessment Program 1992	Rice County Water Quality Evaluation 1986	Rice County Water Quality Evaluation 1972
Reason for Study / Goals	Shieldsville Sportsmen Club concerned about an increase in the frequency of the toxic blue-green algae blooms in the last 10 years, a dramatic increase in aquatic vegetation, the potential for increased pressure on the lake resource as demographics change.	To ascertain how well Rice County waters have fared since 1972.	Preliminary evaluation of a large number of lakes and sites on those lakes on which to base water management decisions.
Issues/ Problems		This study showed Point B on Mazaska's south shore, highly and consistently polluted with human or animal waste. The source is probably malfunctioning sewage systems in the village of Shieldsville, and failing sewage systems along Highway #21 also.	There was noted a high phosphate and ammonia level at the southeast sampling site at the winter sampling time. This area may receive a lot of runoff.
Good Stuff	Total phosphorus, chlorophyll, and Secchi disk transparency in Mazaska are about the average of similar lakes in the North Central Hardwood Forest ecoregion.	Mazaska has retained good water quality. Recent data (1984-1985) indicates that the phosphorus concentration is within the expected range for Mazaska although it is up from both 1980 and 1981. Most inflowing waters are buffered by large wetlands along the north lobe.	The best lakes in the county would be Fox and Myzaska. Levels of coliform bacteria were below the point at which they would be of concern.
Goals Set / Actions Suggested		Stabilizing the stream entering the south side between points B and C and controlling erosion in this area might lessen the problem of the creek building a delta out into Mazaska.	

Middle Cannon Lobe
Waterbody/Watershed: Prairie Creek

Study	Prairie Creek Draft TMDL, Tetra Tech for MPCA, December 2001	Macroinvertebrate Assessment near Randolph, 1994-96, St. Olaf
Reason for Study / Goals	Prairie Creek listed as impaired for swimming designated use due to excessive fecal coliform load.	
Issues/ Problems	Generally, spring concentrations are lowest and fall concentrations highest. In Spring cattle manure, hog manure, and septic systems are the largest sources. In Summer, cattle manure and septic systems. In Fall, cattle manure.	
Good Stuff	Wildlife (background), point sources (Dennison wastewater treatment lagoons), pets/birds/urban and poultry manure are negligible sources of fecal coliforms.	The amazing thing about this site is the fact that Lakey Byllesby downstream is severely impacted and the mid reach stie on Prairie Creek is moderately impacted. However, this site which lies between those two locations is one of the least impacted of all the sites monitored in the Cannon River watershed. The QHEI at this site is 80, which is the highest score for any stream in the water. This site had a variety of riffles, runs, and pools and scored very high in channel morphology. Water temperature ranked just behind Pine and Belle for the lowest in the watershed.
Goals Set / Actions Suggested	Fix failed and direct discharging systems, retrofit/improve design efficiency and operation of new and current systems to result in 75% efficient effluent polishing (75% less fecal coliform reaching the stream), and reduce surface contributions by 32 to 74%.	

Middle Cannon Lobe
Waterbody/Watershed: Spring Creek

Study	Sources and Sinks of Nitrogen in the Spring Creek Watershed, Cailin Orr and Shaili Pfeiffer, 1995	A Study of Fecal Pollution in Spring Creek, Mark Banks, 1969
Reason for Study / Goals	Measure nitrate concentrations and explore possible sources and sinks for nitrate within the watershed	To study fecal pollution in Spring Creek, the creek feeding Lyman Lakes on Carleton's campus.
Issues/ Problems	Nitrate levels were highest (75ppm) where field tiling pipes were the main source of water. Mean at the top of the watershed is 50.3 ppm. Data suggest that the primary source of the nitrate is diffuse agricultural pollution.	Identified four sources of pollution: the first from a septic tank draining into a storm sewer running into the creek just south of the golf course, the second from a corrugated pipe entering the creek just north of the golf course, the third presumably from manure at a farm just north of 4th Street, and the fourth from a pipe of unknown origin entering the creek just below Evan's dormitory, near the bridge to Goodhue dormitory.
Good Stuff	Levels decreased along the length of the watershed (3.7s-10ppm at lowest site). Mean at Lyman Lakes is 5.9 ppm. The main sink is likely to be the wetland areas along the stream bed.	
Goals Set / Actions Suggested	In planning for future development in the Spring Creek watershed and for water quality improvement in the Cannon River Valley, the potential for natural areas to mediate diffuse pollution should be considered.	

Middle Cannon Lobe

Waterbody/Watershed: Rice Creek (aka Spring Brook)

Study	Geomorphology and Watershed Studies of the Cannon River and its Tributaries: Wolf Creek, Rice Creek, and Heath Creek by Mary Savina	Spring Brook Committee Report, 1999, CRWP	Rice Creek (Spring Brook) Water Quality Assessment Report, Aug 2008, CRWP	Tracing Nitrate-N from a Drainage Tile through Surface Waters of the Cannon River Watershed -Carleton - 2006
Reason for Study / Goals	Establish baseline geomorphic and environmental conditions for the three tributaries so their status can be monitored in the future.	LCCMR project - Citizen committee to understand trout streams, land use planning, protection - recommendations.	DNR grant to do some basic characterization of water quality, temperature and flow.	Nitrate samples along Cannon River and tirbutaries
Issues/ Problems	Rice Creek is channelized (a section is a County Ditch) and managed for agriculture. Much of the water that may originally have entered the stream through springs now enters through agricultural tile drains. The hydrograph shows a flashy response to precipitation	Prevention of excessive stormwater flows, stream disruption, temperature increases through P& Z. Protect Stream through permanent open space. Protect fish passage use bridge. Repair and prevent bank erosion. Maintain and Improve natural resource management. Monitor stream.	Max TSS, TP, E. coli values far exceed standards. Daily max temps around 75 F, avg daily temps ~ 61 F still ok for trout	Median and max N values at Decker and Armstrong much greater ecoregion range. Appears ag drain tile contirbutions to higher N levels. N levels higher in June than August
Good Stuff	Rice Creek, the coldwater trout stream, is indeed consistently colder than the other two creeks. Woodland riparian buffers are much more extensive now than at the time of the first aerial photo survey in 1938.		TSS, TP, E. coli median values within ecoregion ranges. Macroinvertebrates samples overall acceptable. Fish populations pretty good.	Median N values ecoregion range upstream of Cates Ave tile outlet.
Goals Set / Actions Suggested	Future research could look more closely at sediment accumulation and movement in the stream channels, especially along Rice Creek and Heath Creek, where measurements and anecdotal evidence from residents show stream depth increasing with time.		Problems flow monitoring, should be redone. Land preservation, zoning ordinances, ag BMPs, buffers, restoration of wetlands.	

Middle Cannon Lobe
Waterbody/Watershed: Union Lake

Study	Rice County Water Quality Evaluation 1986	Rice County Water Quality Evaluation 1972
Reason for Study / Goals	To ascertain how well Rice County waters have fared since 1972.	Preliminary evaluation of a large number of lakes and sites on those lakes on which to base water management decisions.
Issues/ Problems	Water quality of Union Lake has remained poor. Phosphorus concentration remains high. One indicator of the heavy pollution is the high conductivity readings. Algae blooms and suspended material keep transparency low. Winter kills will continue to plague the lake without aeration. Union's large watershed includes Lonsdale's sewage treatment plant, Knowles and Heath Creek.	Algae bloom through spring and summer. Phosphate levels were quite high throughout the season. Phosphate was extremely high in the north end in the winter. Ammonia levels were quite high throughout the period of this evaluation. The shallow nature of Union Lake and subsequent resuspension of bottom material may be responsible for the high nutrient levels found in this evaluation.
Good Stuff		Levels of coliform bacteria were not of the magnitude which would cause concern from the public health standpoint.
Goals Set / Actions Suggested	Considering the size of Union Lake's watershed, the depth of the lake, and the extent of eutrophication, little can be done to improve its water quality. Recreational use, sailing and waterfowl hunting will not be impaired as long as fecal contamination is kept under control.	

Middle Cannon Lobe
Waterbody/Watershed: Wolf Creek

Study	Geomorphology and Water Quality of the Wolf Creek Basin, Kizzy Charles-Guzman et al, 2001	Geomorphology and Watershed Studies of the Cannon River and its Tributaries: Wolf Creek, Rice Creek, and Heath Creek by Mary Savina, 2001	Macroinvertebrate Assessment near Rice County 8, 1994-96, St. Olaf
Reason for Study / Goals	Characterize geomorphology and water chemistry of the Wolf Creek basin, to propose possible major water sources for the creek, and to compare the creek's water quality indicators with the standards of the MPCA	Establish baseline geomorphic and environmental conditions for the three tributaries so their status can be monitored in the future.	
Issues/ Problems	Three main factors indicating poor water quality. 1) pH levels markedly high compared to Heath Creek and Rice Creek. 2) High nutrient levels, nitrate and nitrite levels don't meet water quality standard. 3) Fecal coliforms levels 20 times higher than water quality standard.	Discharges in Wolf Creek doubles between Circle Lake and the confluence with the Cannon, but water quality does not improve. Although there are some discrete springs, much water apparently enters the stream through small seep sources in the lower reach of the streams.	Phosphorus levels were very high in 1994 and 1995 in surface water and pore water. Coincided with algae blooms in Circle and Fox lakes.
Good Stuff		Woodland riparian buffers are much more extensive now than at the time of the first aerial photo survey in 1938.	There is good diversity in the macroinvertebrate community. The ICI, Diversity and Equitability Indices were all in the slight impact range and Richness was in the upper part of the moderate range. Nitrogen values were low in both surface and pore water samples compared to most other sites.
Goals Set / Actions Suggested	1) longer term study, 2)examine groundwater's influence on the creek and provide more information on the locations and chemistry of tile drains and any other agricultural use, 3) explain the high PH and current trophic levels of Circle Lake and Wolf Creek, 4) analysis of portion of Wolf Creek upstream of Circle Lake.		