

St. Croix Basin Water Resources
Planning Team

Interagency cooperation

*Assimilating public use with multi-regulatory
water quality protection*

St. Croix Basin Water Resource
Planning Status Report
2001

Partners

Minnesota Department of Natural Resources (MDNR)
Minnesota Pollution Control Agency (MPCA)
Minnesota-Wisconsin Boundary Area Commission (MWBAC)
St. Croix National Scenic Riverway-National Park Service (SACN NPS)
Wisconsin Department of Natural Resources (WDNR)

Cooperating members

Board of Water and Soil Resources (BWSR)
Environmental Protection Agency (EPA)
Metropolitan Council (MCES)
Minnesota Department of Agriculture (MDA)
Minnesota Department of Health (MDH)
Minnesota-Wisconsin Boundary Area Commission (MWBAC)
Natural Resources Conservation Service (NRCS)
St. Croix Chippewa Indians of Wisconsin
United States Geological Survey (USGS)
University of Minnesota (UMN)
University of Wisconsin Extension (UW)
Washington County



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St. Croix Basin Water Resources Planning Team

St. Croix Basin Water Resources Planning Status Report 2001

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* (From: Tom Schueler. 1995. *Site Planning for Urban Stream Protection*. Center for Watershed Protection. Ellicott City, Maryland)

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St. Croix Basin Water Resource Planning Status Report

Executive Summary

State and federal agencies, nations, and local units of government are working cooperatively to address water quality protection and resolve impairments in the St. Croix River Basin. Rapid population growth with the accompanying land use changes is impacting the water resources. The St. Croix Basin Water Resources Planning Status Report (Planning Status Report) is a cooperative project among state and federal agencies and the St. Croix Chippewa Indians of Wisconsin. The Planning Status Report describes the history of water resource management in the St. Croix Basin, examines the water resources of the St. Croix Basin, lists other plans developed for the St. Croix Basin, directs water resource decision making, and provides a vehicle to create a unified plan between the two states of Wisconsin and Minnesota.

The St. Croix Basin Water Resources Planning Team (Basin Team) that oversaw this planning status report does not have legislative authority; as such this document was created to direct and facilitate water resource protection in the St. Croix Basin. The Planning Status Report is intended for four uses: a) to direct water resource decision making, b) as a source of information for funding opportunities, c) as a vehicle to create a unified plan between the two states of Wisconsin and Minnesota, and d) as an internal agency document.

Goal of the St. Croix Basin Water Resources Planning Status Report

The goal of the St. Croix Basin Water Resources Planning Status Report is to integrate into one unit a plan to protect and improve the quality of the surface and ground water resources of the St. Croix River Basin in Minnesota, Wisconsin, and Chippewa reservation land through coordinated planning and management.

The Planning Status Report

The Planning Status Report provides background and future direction for decision-making in the St. Croix Basin. Chapter One, *St. Croix Basin Planning and Accomplishments*, provides information about the Basin Team. Through an interactive decision making process the Basin Team determined the key issues (Issue Statements) of concern for St. Croix water resource protection. Other planning organizations and their activities within the St. Croix Basin are also discussed. Included in Chapter One is a list of the accomplishments of the Basin Team. In Chapter Two a physical description offers background material for water resource impacts from land use changes and habitat modifications. Chapter Three documents the water resource regulations that affect the St. Croix Basin. Summaries of recent water quality studies in Chapter Four provide a snapshot of the current conditions of the St. Croix Basin. Fourteen **Issue Statements**, or areas of concern, are discussed in Chapter Five. These **Issue Statements** identify the implementation phase of the Basin Team's work and are listed in order of priority.

Issue Statements (water resource issues) identified by the St. Croix Basin Water Resources Planning Team in Phase I of Plan of Study (revised 6/20/01)

1. Establish nutrient budgets for point and nonpoint sources
2. Secure funding for the Basin Team coordinator
3. Address the impact of urban stormwater runoff
4. Address the need for long term monitoring
5. Increase public participation and knowledge in water quality management
6. Resolve differences in water quality standards between the two states
7. Forecast the future changes in land and water resources
8. Address the impact of rural nonpoint runoff (other than nutrients, sediment, and stormwater)
9. Evaluate sediment contamination
10. Assess the impact of impoundments

11. Assess the condition of the groundwater and suggest a protection strategy, list identified areas of higher sensitivity
12. Assess the impact from recreational use
13. Develop a common protection strategy for rare and endangered species and natural communities and their habitat
14. Assess the impact of water-dependent commercial agricultural operations

The appendix offers copies of some of the documents discussed in the Planning Status Report.

Integrated Watershed Management

The St. Croix River is the resource that encouraged a sense of community and urban development into the St. Croix Basin. History has shown the importance the river plays in the lives of those who live along the river, its tributaries and within the watershed: those who come to recreate and those who use the river for commerce. The character of river communities, human and natural, is mirrored in the quality of its water.

When our predecessors analyze the ecological health of the St. Croix Basin will we be an example of vision or simply reactive management? How the growth of the Basin is addressed and managed will reflect the priorities of those responsible for the future of this scenic resource. Whether from the impact of invasive species, excessive nutrient loading, or increased recreation, the water resources of the St. Croix are at risk. Through sustainable planning and managed development, the river can maintain its health and support the uses for which it is valued.

As we advance into the twenty-first century, a shift in public attitude towards the environment, technology advances, and developments in ecosystem management support a proactive and partnership approach to water quality management. Integrated basin management can be the most effective method of addressing conflicts over water use. In integrative watershed management local citizens and organizations cooperatively share in the decision-making process and outcomes. Integrative basin management provides the best opportunity for sustainability of our water resources while protecting the uses of the river for citizens, organizations, and agencies. Understanding the biophysical and chemical components of water quality incorporates a rationale behind the decision making process. Supplied with technical and scientific analysis, we need to be able to make informed decisions about managing our natural resources.

The St. Croix Basin Water Resources Planning Team is working to assimilate public use and technical information with multi-regulatory water quality protection.

St. Croix Basin Team Partners: signature agencies in the Memorandum of Understanding

National Park Service (SACN, NPS)
Minnesota Department of Natural Resources (MNDR)
Wisconsin Department of Natural Resources (WDNR)
Minnesota Pollution Control Agency (MPCA)
Minnesota-Wisconsin Boundary Area Commission (MWBAC)

Cooperating members

Board of Water and Soil Resources (BWSR)
Environmental Protection Agency (EPA)
Metropolitan Council (MCES)
Minnesota Department of Agriculture (MDA)
Minnesota Department of Health (MDH)
Minnesota-Wisconsin Boundary Area Commission (MWBAC)
Natural Resources Conservation Service (NRCS)
St. Croix Chippewa Indians of Wisconsin
United States Geological Survey (USGS)
University of Minnesota (UMN)
University of Wisconsin Extension (UW)
Washington County

Chapter 1: St. Croix Basin Planning and Accomplishments

Chapter 1.1: St Croix Basin Water Resources Planning Status Report

St. Croix Basin Water Resources Planning Status Report (Planning Status Report) has five objectives.

Objectives of the St. Croix Basin Water Resources Planning Status Report

- 1) Describe the history of water resource management in the St. Croix Basin
- 2) Examine the water resources of the St. Croix Basin and water quality concerns
- 3) Review other plans developed for the St. Croix River corridor
- 4) Direct water resource decision making
- 5) Provide a vehicle to create a unified plan between the two states of Wisconsin and Minnesota

Chapter 1.2: St. Croix Basin Water Resources Planning Team

In the early 1990s continued development and usage of the St. Croix River concerned water resource managers about the impact on water quality. For example, research provided supporting evidence that nutrient loading from the tributaries was increasing the rate of eutrophication in Lake St. Croix, a sink of the St. Croix River Basin. Although the St. Croix River was protected as a National Park, the federal government had no control over the quality of the water flowing into the park. State and federal governments would need to work together to protect the St. Croix Basin from recreational and land use impacts. In 1993, a cooperative agreement was signed by the National Park Service, the Minnesota Department of Natural Resources, the Wisconsin Department of Natural Resources, and the Minnesota Pollution Control Agency. The Cooperative Agreement states (see Appendix 1 for complete copy):

- I. A St. Croix Basin Water Resources Planning Team (Basin Team) shall be formed to bring together periodically the parties responsible for the formulation and implementation of a joint basin water resource management plan.
- II. The membership shall consist of an appointed representative from the National Park Service; two representatives from the State of Minnesota, including one from the Department of Natural Resources (MDNR) and one from the Minnesota Pollution Control Agency (MPCA); and two representatives from the State of Wisconsin Department of Natural Resources (WDNR), including one from each of the two districts comprising Wisconsin's portion of the St. Croix River Basin. These agencies are the signature groups of the Cooperative Agreement determined by the Memorandum of Understanding. The MDNR, WDNR, MPCA and NPS regulate policy in the St. Croix Basin.
- III. The Minnesota-Wisconsin Boundary Area Commission (MWBAC) shall act as a facilitator of the joint planning effort for the St. Croix River Basin team, within the funds and staff resources available to it. (Editor's note: In the fall of 2001, the Wisconsin legislature ended a 36-year interstate compact between Wisconsin and Minnesota and shut down the MWBAC.)
- IV. The objective of this Basin Team shall be
 - A. To formulate a consolidated and uniform plan for the St. Croix River Basin covering the respective jurisdictions of the parties to this agreement with

- respect to identifying, monitoring and controlling adverse threats and impacts to the quality of the waters of the basin;
- B. To cooperate fully with the U.S. Geological Survey in the design and implementation of the National Water Quality Assessment Program Upper Mississippi River study as it relates to the St. Croix River Basin;
 - C. To develop a Plan of Study for a basin plan by September of 1993 and formulate a completed plan by June of 1995 [these dates have subsequently been revised for a Basin Planning Status Report, instead of a Basin Plan, to be completed by August 30,2001];
 - D. To coordinate implementation of said monitoring and measures on a priority watershed basis within the basin;
 - E. To act as a forum for local government and public involvement in basin water quality management planning; and
 - F. To periodically review and update said plan.

From this Cooperative Agreement (Memorandum of Understanding) the St. Croix Basin Water Resources Planning Team was created to oversee the development of a basin plan and act as a forum for interagency interaction and local government and public involvement.

The original Basin Team has grown to include numerous interested organizations in varying levels of participation.

**Organizations of the St. Croix Basin
Water Resources Planning Team**

Signatory Agencies in Memorandum of Understanding
 Minnesota Department of Natural Resources (MDNR)
 Minnesota Pollution Control Agency (MPCA)
 Minnesota-Wisconsin Boundary Area Commission (MWBAC)
 National Park Service (NPS)
 Wisconsin Department of Natural Resources (WDNR)

Cooperating Members
 Board of Water and Soil Resources (BWSR)
 Environmental Protection Agency (EPA)
 Metropolitan Council Environmental Services (MCES)
 Minnesota Department of Agriculture (MDA)
 Minnesota Department of Health (MDH)
 Natural Resources Conservation Service (NRCS)
 St. Croix Chippewa Indians of Wisconsin
 United States Geological Survey (USGS)
 University of Minnesota (UMN)
 University of Wisconsin Extension (UWExt)
 Washington County

The Basin Team has four goals:

Goals of the St. Croix Basin Water Resources Planning Team

- Protect and improve the quality of the surface and groundwater resources of the St. Croix.
- Provide a forum for water resources managers to integrate local, state, and federal policy.
- Increase public participation and knowledge in water quality management.
- Project development and implementation.

The Basin Team gathered in 1994 to develop water resource goals and a plan to accomplish these goals. The plan was divided into four phases.

Phase I: Plan of Study - In this phase, co-managers of water resources organized into a St. Croix Basin Team. Through a scoping session key surface and groundwater issues were identified and thus formed the basis upon which to direct the Basin Team’s activities. These issues are addressed as Issue Statements in Chapter 5.0 of the Basin Planning Status Report. Phase I was completed in December of 1993 as a foundation for Phase II. The original issues were recently reviewed and ranked in order of importance (6/20/01) for the Basin Team to address.

* Issue Statements (water resource issues) identified by the St. Croix Basin Water Resources Planning Team in Phase I of Plan of Study (revised 6/20/01)	Updated Ranking 6/20/01
1. Establish nutrient budgets for point and nonpoint sources	1
2. Secure funding for the Basin Team coordinator	1
3. Address the impact of urban stormwater runoff	2
4. Address the need for long term monitoring	2
5. Increase public participation and knowledge in water quality management	2
6. Resolve differences in water quality standards between the two states	3
7. Forecast the future changes in land and water resources	4
8. Address the impact of rural nonpoint runoff (other than nutrients, sediment, and stormwater)	5
9. Evaluate sediment contamination	6
10. Assess the impact of impoundments	7
11. Assess the condition of the groundwater and suggest a protection strategy; list identified areas of higher sensitivity	8
12. Assess the impact from recreational use	9
13. Develop a common protection strategy for rare and endangered species and natural communities and their habitat	10
14. Assess the impact of water-dependent commercial agricultural operations	11

*Notes to above listing of issue statements

- Initial item from Phase I: *Develop a GIS information base to track land use changes*; No ranking necessary; issue resolved
- Initial item from Phase I: *Coordinate fish consumption advisories*; No ranking necessary; issue resolved.
- New item suggested June 2001: Identify and establish goals that reflect public perceptions and intentions; determine and develop a means to measure baselines for these goals and progress towards them; develop an annual report card (Ranked 2 by those who recommended this item).

Phase II: Data Acquisition for Setting Goals - In this phase, a draft plan was created describing a list of environmental studies necessary to research the water resource issues (Issue Statements) identified through the scoping session. These studies were necessary to determine priority waterways and set water quality goals for the Basin. The plan also identified the agencies that will conduct the studies, the funds needed, and the approximate timelines (generally within two years). The Phase II document was completed in 1995 and is incorporated in the Planning Status Report. Environmental studies are ongoing. The studies discussed in the Planning Status Report are not meant to be an inclusive list of all the research completed or in progress in the St. Croix Basin. This list includes those projects targeted towards the issues addressed by the Basin Team.

Phase III: Setting Objective to Reach Goals - In this phase, water quality goals will be developed using the information obtained in Phase II. Examples of such goals might be: (1) How much phosphorus reduction is needed to protect Lake St. Croix; or (2) How much mercury reduction is needed and over what timeline to eliminate fish consumption advisories in the St. Croix River. Phase III is in process. A nutrient budget for the St. Croix Basin is discussed in Chapter 5.0, Issue Statement 1: Nutrients.

Phase IV: Project Development and Implementation - In this phase, specific projects will be developed and implemented as resources are available. Interagency partnerships with local governmental units will be used to focus financial resources and expertise on the issues of concern. It is hoped that a number of local projects can be strategically sequenced and integrated so that small successes can aggregate into an overall resolution of the environmental issues that need to be addressed. Phase IV is in process and incorporated into the Issue Statements in this plan.

Biennial Reviews - Work plans will be developed on a biennial timeline with the intention of involving the public in reviewing progress, updating the plan and redirecting resources as appropriate to address current issues. The work plans will serve as acknowledgments of commitments from the participating agencies. Issue statements will be reviewed every two years by the Basin Team.

State Basin Plans - Each state has its own basin planning process, which recognizes that waterways within the Basin have intrinsic values within the state where they exist. Waterways identified as having impacts on the main stem of the St. Croix River will receive priority attention, but not to the exclusion of more localized activities on each of the tributaries and lakes within (see *Other Planning Efforts* following this section).

Table 1 identifies the significant accomplishments of the Basin Team since its inception in 1993. Total project dollars contributed to the study of the St. Croix since 1994 that can be directly or indirectly attributed to the Basin Team's efforts exceed \$1,384,600. This does not include the freshwater mussel conservation efforts, exotics control programs, the NAWQA program, or the salary for the involvement of the Basin Team members.

Table 1. Significant accomplishments of the Basin Team.

Accomplishments of the St. Croix Basin Water Resources Planning Team 1993-2001	
<i>Prepared by Randy Ferrin, Chair, St. Croix Basin Water Resources Planning Team, July 13, 2001</i>	
1993	
•	Memorandum of Understanding signed between the Secretary, Wisconsin Department of Natural Resources (WDNR), the Commissioner, Minnesota Department of Natural Resources (MDNR), the Commissioner, Minnesota Pollution Control Agency (MPCA), and the Superintendent, St. Croix National Scenic Riverway (National Park Service), with facilitation from the Minnesota-Wisconsin Boundary Area Commission (MWBAC).
1994	
•	Basin Team convinces the U.S. Geological Survey (USGS) to include the St. Croix and Namekagon Rivers in its Upper Mississippi River National Water Quality Assessment Program (NAWQA). This proves to be major success for the Team and sets the stage for many of the additional studies and monitoring, which will occur over the next several years. Numerous reports have been published by the USGS highlighting the results of the NAWQA work in the Upper Mississippi and St. Croix Basins.

- USGS becomes a cooperating partner on the Basin Team.
 - WDNR releases its St. Croix Basin Water Quality Management Plan with tributary specific recommendations for water quality protection.
 - National Park Service-St. Croix National Scenic Riverway (NPS) hires its first water resources specialist who will also serve as the chief of the Riverway's natural resources division, answering directly to the Superintendent. Justification for the position includes direct involvement with the Basin Team.
 - NPS begins its own water resources plan as required by the NPS Washington Office-Water Resources Division (NPS-WRD). Funding (\$50,000) is received from the NPS-WRD and the University of Minnesota (UM) is awarded the contract. The planning process involves the Basin Team in issue identification and prioritization, identifying sources of data and information, draft review, suggestions, and endorsement.
 - UM becomes a cooperating partner on the Basin Team.
- 1995**
- After a major issue-identification effort, with MOU and non-MOU partners participating, the Basin Team releases Phase II of its planning effort in which several dozen issues are identified and discussed and recommendations for action are made. Secretary Meyer, WDNR, Commissioner Sando, MDNR, Commissioner Williams, MPCA, and NPS-Riverway Superintendent Andersen send letters of endorsement and commitment. Phase II sets the stage for the formation of several subcommittees charged with resolution of the identified issue. This includes the nutrient issue, recreational affects issue, GIS coordination, standards coordination, and other efforts.
 - Under the leadership of the MWBAC, the Lower St. Croix Management Commission, and the Basin Team, and based on a coordinated interagency report on the adequacy of pump-out facilities and enforcement, WDNR Secretary Meyer and MPCA Commissioner Williams jointly petition EPA to declare the St. Croix as off-limits for boat sanitary waste discharges. EPA accepts the petition and changes the discharge rule.
 - Interagency study lead by MDNR begins to investigate the impacts of recreation and boating on island erosion in the lower river, an issue identified by the Basin Team. Results from the study are published in 2001 and include 10 chapters describing 10 distinct components of the study. The NPS and MDNR provide funding for printing. Long-term components of the study continue with annual surveys at fixed station erosion study sites on 12 islands. Contributed time by all of the agencies to the study is roughly estimated at two-person years.
 - NPS leverages the above study's interagency involvement to secure a \$5000 challenge-cost share grant from the NPS CCS program. The money is used to buy a new Hydrolab multi-probe water quality meter.
 - USGS installs gauging station on the Namekagon River as part of the NAWQA program. NPS co-funds the site through 2001.
- 1996**
- In an effort to address one of the issues identified by the Basin Team, NPS secures \$50,000 (NPS-WRD) to conduct an aquatic habitat assessment and classification for the Riverway. UM conducts the study. The Basin Team's partnership efforts are highlighted in the proposal and the proposal gains extra review points because of this partnership. The report is released in 1999 and is titled: Assessment and Classification of Aquatic Habitat in the St. Croix National Scenic Riverway.
 - WDNR drops funding for the Danbury USGS gage on the St. Croix. NPS assumes funding for the next four years, matched by USGS funding.

- Metropolitan Council-Environmental Services becomes a cooperating partner on the Basin Team.
- Following up on an issue identified by the Basin Team, the NPS secures \$50,000 funding (NPS-WRD) to evaluate the impacts of cranberry operations on the Namekagon and St. Croix Rivers. USGS Biological Resources Division conducts the study. (The Basin Team's partnership efforts are highlighted in the proposal and the proposal gains extra review points because of this partnership.) The report is issued in 1999 and is titled: The Effects of Cranberry Operations on Water Quality, Macroinvertebrate Communities, and Pesticide Concentrations of the St. Croix National Scenic Riverway.
- With the support of the Basin Team, the UM secures a grant from the McKnight Foundation for the University of Wisconsin-Green Bay to conduct a series of risk assessment workshops for the St. Croix. The report is published in Environmental Management, Vol. 25, No. 6, pp 599-611: An Assessment of Ecosystem Risks in the St. Croix National Scenic Riverway (Wenger, Harris, and DeVault).

1997

- Working with the Basin Team's Nutrient Committee, NPS secures \$50,000 (NPS-WRD) to evaluate sediment and nutrient loading from tributaries. The USGS will conduct the project. (The Basin Team's partnership efforts are highlighted in the proposal and the proposal gains extra review points because of this partnership.) The results of this work and additional monitoring will be published in a report to be released in the summer of 2001, by the USGS.
- EPA is formally invited by letter to become a cooperating partner on the Basin Team.
- The Basin Team begins consideration of nutrient goals.

1998

- Furthering the work of the Nutrient Committee, NPS secures \$100,000 (NPS-USGS Water Quality Partnership Program) to expand the above study through the USGS. (Again the Basin Team's partnership efforts are highlighted in the proposal and the proposal gains extra review points because of this partnership.) The results are reported in the USGS 2001 report.
- Minnesota Department of Agriculture becomes a cooperating partner on the Basin Team.
- After considerable discussion and investigation, the Basin Team adopts the interim goal of no-net increase in phosphorus in the St. Croix Basin. Rush City, Minnesota voluntarily accepts the policy for their expanded wastewater treatment facility, a decision negotiated with the involvement of the MWBAC.
- To further the work of the Basin Team, NPS secures \$80,000 for water quality assessment work through the NPS Fee Demonstration Program. USGS will conduct most of the assessment and matches the work by 33% for a total expenditure of \$106,400. Much of the money goes towards keeping the long-term stations at Danbury and St. Croix Falls functioning after the NAWQA program ended.
- Nutrient Committee begins development of an interagency monitoring program. MPCA (O'Connell) and UM (Davis) develop monitoring plan along with the committee.
- St. Croix Chippewa Indians of Wisconsin become a cooperating partner on the Basin Team.

1999

- Part-time Basin Team Coordinator begins.
- Basin Team sponsors first annual Nutrient and Sediment Conference for the St. Croix Basin. Approximately 180 people attend. Continuing education credits are granted to attendees

requesting them.

- Interagency nutrient monitoring program is implemented on the St. Croix. WDNR samples Lake St. Croix, MPCA pays for analysis through MDH, Met Council samples at Stillwater and Prescott, MWBAC coordinates citizen monitoring, USGS samples tributaries, MPCA samples Sunrise, Snake, and Kettle, and individual point sources conduct phosphorus monitoring on their discharges. NPS monitors the reservoir at St. Croix Falls at three locations twice per month and monthly at 20 small tributary sites. Basin Team Chair makes a presentation at the National Water Quality Monitoring Conference in Austin, Texas, April 2000, to highlight the interagency monitoring program.
- Nutrient Subcommittee works with WDNR, USGS and St. Croix County, WI to develop funding for nutrient and sediment loading and streamflow gauging on the Willow, Kinnickinnic and Apple Rivers. USGS contributes \$15,150, WDNR contributes \$42,450 in grant awards to St. Croix County to develop and administer a contract with USGS to complete the study and report.
- NPS secures \$10,000 for E.coli bacteria study on the St. Croix and is matched by the MWBAC by \$10,000 through a grant from USGS for a total project cost of \$20,000. USGS issues the report in 2000 titled: Fecal Coliform and *Escherichia coli* Bacteria in the St. Croix National Scenic Riverway.
- Addressing another Basin Team-identified issue, NPS secures \$50,000 (NPS-WRD) funding for trace metals/urban runoff study in the St. Croix. USGS conducts the study. The existence of the Basin Team partnership contributes to the success of the proposal. The report will be released in the fall of 2001.
- NPS secures \$210,000 (NPS-Natural Resources Preservation Program) for a three-year study of the effects of ammonia on freshwater mussels. USGS Biological Resources Division undertakes the study. The existence of the Basin Team partnership and their identification of this ammonia issue contribute to the success of the proposal. Preliminary results have been reported at several professional symposia.
- With the consent of the Basin Team, NPS and MWBAC secure \$75,000 from Minnesota's Metropolitan Council-Environmental Services to hire a coordinator for the Basin Team.
- With endorsement from the Basin Team, and funding from MPCA and Metropolitan Council-Environmental Services and in-kind match from the Science Museum of Minnesota, the Science Museum's St. Croix Watershed Research Station conducts sediment-coring work on Lake St. Croix. Preliminary work, using diatoms to reconstruct total phosphorus concentrations, show an alarming increase in total phosphorus since approximately 1950. Two corings were taken in 1999 and nearly a dozen will be collected in 2001. Total cost of the project is \$325,000. This work will be a critical component in establishing nutrient goals for the St. Croix.

Deleted: ¶

2000

- Basin Team sponsors second annual Nutrient and Sediment Conference. Approximately 150 people attend. Continuing education credits are granted to attendees requesting them.
- University of Wisconsin-Extension becomes a cooperating partner on the Basin Team.
- NPS secures \$50,000 funding (NPS-WRD) for mercury/ methyl-mercury study. USGS will conduct the study in 2001-2002. The existence of the Basin Team partnership and their identification of this issue contribute to the success of the proposal.
- NPS and USGS request support from the Danbury Joint Commission and the St. Croix Chippewa Indians of Wisconsin to fund the Danbury gage. Through a state grant, they consent to help fund the Danbury gage and water quality monitoring station, with an annual price tag of about \$34,000 (of which \$14,000 is matched by the USGS).

- MPCA funds a synoptic study proposed by NPS and USGS for the St. Croix using NAWQA protocols; USGS conducts the study with assistance from MDNR. Project cost is \$50,000.
- WDNR northern region contributes \$5000 for the Basin Team Coordinator's position. Full-time coordinator hired in August.
- Minnesota Water Plan 2000 (Watermarks) is issued for all basins in the state. The St. Croix portion of the plan is heavily influenced by the input of the Basin Team.
- MPCA releases Index of Biotic Integrity Guidance for Coolwater Rivers and Streams of the St. Croix Basin. This was an issue identified by the Basin Team but not a direct result of the team's involvement.

2001

- WDNR requests run-of-river operations for the St. Croix Falls Dam. NPS and USFWS submit letters of support. Hydropower effects were an issue identified by the Basin Team.
- WDNR contributes \$5000 to the Basin Team Coordinator's position.
- Nutrient Committee works with WDNR and USGS to develop a funding source to complete St. Croix basin nutrient assessment study report. Report will be prepared by USGS and will include limnological data assessment, revised nutrient loading scenarios, water quality modeling and phosphorus sensitivity analysis for mainstem segments and Lake Mallalieu. USGS will contribute \$16,700 and WDNR will contribute \$25,000.
- USGS releases its final report for the NAWQA program for the Upper Mississippi River. The report contains important findings on the status and trends in water quality for the St. Croix.
- WDNR releases its St. Croix Basin Plan, which addresses both terrestrial and aquatic resources in the Wisconsin portion of the watershed.
- To further the work on identification of sources of phosphorus in the St. Croix Basin, NPS secures \$50,000 (NPS-WRD) for a retrospective study of phosphorus discharge from point sources in the Basin. The study will examine discharge records beginning in the late 1940's to correlate historic phosphorus discharge with sediment core data from Lake St. Croix. The study will be conducted in 2002 by the Research Station and a graduate student from UM.

Multiple-Year Efforts

- 1995-2002 NPS, USFWS, WDNR, and MDNR fund or conduct mussel studies on the St. Croix. This is indirectly in support of the issue of fresh-water mussel conservation raised by the Basin Team in 1994. Total cost is unknown but is estimated at a million dollars.
- 1994-2001+ Basin Team meets on at least a quarterly basis to communicate on issues of mutual interest and direct the work of the subcommittees.
- 1994-2001+ Many Basin Team members attend the annual St. Croix Watershed Research Station's Research Rendezvous, a forum to discuss ongoing research and monitoring in the St. Croix Basin and to identify new opportunities for study and collaboration. Often, team members make presentations on their individual study efforts and many of the studies highlighted at the symposium reflect issues raised by the Basin Team in Phase II.

Chapter 1.3: Other planning and coordinating efforts for the St. Croix Basin

1. Plans

a. Lower St. Croix National Scenic Riverway Final Cooperative Management Plan / Environmental Impact Statement (1999)

This cooperative management plan was prepared over a five-year period and benefited from extensive public participation. This plan was created to replace the outdated 1976 Master Plan and provides general direction for managing the Lower St. Croix Riverway for the next fifteen to twenty years. This *Cooperative Management Plan* (figuratively recognized as the CMP) fulfills the following purposes (as stated in the CMP):

- Preserve and protect (and restore and enhance where appropriate) the riverway's ecological integrity, its unimpounded condition, its natural and scenic resources, and its significant historic resources.
- Accommodate a diverse range of recreational opportunities that do not detract from the exceptional natural, historic, scenic, and aesthetic resources.
- Provide an environment that allows the opportunity for peace and solitude.
- Provide an opportunity for the education and study of the geological, historic, ecological, and aesthetic values to further enhance stewardship of the river.

Contacts:

- a. Questions about the Cooperative Management Plan can be directed to the Superintendent, St. Croix National Scenic Riverway, P.O. Box 708, St. Croix Falls, WI 54024-0708, telephone 715-483-3284.
- b. Questions concerning land use and water surface use rules in Minnesota can be directed to Steve Johnson, Minnesota DNR, 500 Lafayette Road, St. Paul, MN 55155-4032, telephone 651-296-4802.
- c. Questions concerning land use and water surface use rules in Wisconsin can be directed to Terry Moe, Wisconsin DNR, 3550 Mormon Coulee Road, La Crosse, WI 54601, telephone 608-785-9004.

b. National Park Service General Management Plan, Upper St. Croix and Namekagon Rivers St. Croix (1997)

The National Park Service prepared and made available for public review a *Draft General Management Plan / Environment Assessment* for the Upper St. Croix National Scenic Riverway. Three approaches were described to managing the Upper St. Croix and Namekagon Rivers over the next fifteen to twenty years. The National Park Service's Preferred Alternative was mailed to the public for review and consequently adopted as the General Management Plan (GMP). The GMP replaces the Master Plan written in 1976 and describes the general direction that the National Park Service intends to follow in managing the upper riverway for the next fifteen to twenty years. The purposes for this plan:

- Describe the National Park Service's mission for the St. Croix Riverway.
- Provide a framework for decision making.
- Define several range of alternatives for managing the riverway, suggesting a preferred plan.
- Assess the environmental impacts for each alternative.

Copies can be obtained from: St. Croix National Scenic Riverway, P.O. Box 708, St. Croix Falls, WI 54024-0708, telephone 715-483-3284.

c. Minnesota Watermarks: Gauging the Flow of Progress 2000 - 2010

As directed by the Governor, the State of Minnesota is embarking on a ten- year process towards unifying water management in Minnesota. As stated in the document, basin teams were established to determine specific goals and objectives for Minnesota's major water basins and to identify common concerns. The document contains four statewide goals, nine objectives and ten indicators to help measure results (Table 2). The statewide goals are to improve water quality, conserve the diverse characteristics of Minnesota's waters, restore and maintain healthy aquatic ecosystems, and provide diverse recreational opportunities. Most of the statewide indicators integrate a variety of water-related measurements. The entire St. Croix section can be found in Appendix 2. Updates can be found on www.mnplan.state.mn.us.

Table 2. Common goals, objectives and indicators for all major basins in Minnesota from the Minnesota Governor's Unification Initiative as discussed in *Minnesota Watermarks Gauging the Flow of Progress 2000 – 2010*.

Goals	Objectives	Indicators
Minnesotans will improve the quality of water resources	A. Protect and improve water quality in rivers, streams and other water courses	1. Percentage of stream miles assessed that meet water quality standards and criteria.
	B. Protect and improve lake water quality	2. Percentage of lake acres assessed that meet water quality standards and criteria.
	C. Protect and improve groundwater quality	3. Percentage of drinking wells sampled that meet nitrate standards
Minnesotans will conserve water supplies and maintain the diverse characteristics of water resources to give future generations a healthy environment and a strong economy	D. Maintain groundwater levels to sustain surface water bodies and provide water supplies for human development	4. Water levels in wells in relation to precipitation
	E. Maintain the hydrologic characteristics of surface water bodies that support beneficial uses	5. Annual stream flow in relation to precipitation 6. Lake levels in relation to the 10-year average
Minnesotans will restore and maintain healthy aquatic ecosystems that support diverse plants and wildlife	F. Ensure that aquatic environments have conditions suitable for the maintenance of healthy self-sustaining communities of plants and animals.	7. Index of biotic integrity for lakes, rivers and wetlands
	G. Limit geographic range of exotic species	8. Number of major watersheds with specific quantities of prohibited exotic species
Minnesotans will have reasonable and diverse opportunities to enjoy the state's water resources	H. Provide access to water-based recreation sites	9. Number of public access sites on lakes, rivers and streams
	I. Improve or maintain the quality of water recreation	10. Surveys of degree of satisfaction with water related outdoor experiences

Copies can be obtained from Minnesota Planning or on the internet:
Minnesota Planning, Environmental Quality Board, Room 300, 658 Cedar
Street, St. Paul, MN 55155, phone 651-296-3985,
www.mnplan.state.mn.us.

d. State of Wisconsin Integrated Basin Plan (2001)

The state of Wisconsin (WDNR) is preparing a State of the Basin report for the St. Croix Basin to replace the *Water Quality Management Plan* completed in 1994. The Wisconsin plan will include the priorities of the watershed, basin ecology, key or major resources issues and threats, recommended actions or objectives, and watershed narratives (optional). The St. Croix Basin plan will be completed the fall of 2001.

Copies of the Wisconsin Integrated Water Plan can be obtained from: St. Croix Basin Team leader, WDNR, PO Box 397, Cumberland, WI 54829, phone 715-822-3590.

e. National Park Service Water Resources Management Plan (1997)

As a water based park, a water resources management plan (WRMP) was needed to better understand and protect the water and water-dependent resources. With more focus on water related issues, the WRMP supplement's the Park's Resource Management Plan. The WRMP describes the water resources, identifies gaps in information about the river, and includes project statements written to eliminate those gaps. In developing the WRMP, three workshops were held with key St. Croix River stakeholders (agency managers, non-government organizations, and researchers). This document has been instrumental in securing funding for various environmental studies and projects within the St. Croix Basin. Parts of the WRMP are included in this Planning Status Report.

f. Local Plans

The following is a list of county (Minnesota and Wisconsin) and watershed district water resource plans (Minnesota only). For information about these plans contact the agency or phone number included in the listing. Numerous local plans have been created but were not included here. For information concerning local plans, contact the person identified in the county plans. The vision of the Basin Team is for local plans to reflect the goals of a St. Croix Basin plan (an intended outcome of the Planning Status Report) and support the implementation of these goals.

Minnesota County Plans*

1. Aitkin County; contact the Aitkin Soil and Water Conservation District, phone 218-927-6565.
2. Carlton County; contact the Carlton Soil and Water Conservation District, phone 218-384-4002.
3. Chisago County; contact the Chisago Soil and Water Conservation District, phone 651-674-2333.
4. Isanti County; contact the Isanti Soil and Water Conservation District, phone 763-689-3224.
5. Kanabec County; contact the Kanabec Soil and Water Conservation District, phone 320-679-3982.

6. Mille Lacs County; contact the Mille Lacs Soil and Water Conservation District, phone 320-983-2160.
7. Pine County; contact the Pine Soil and Water Conservation District, phone 218-384-4002.

* Counties Anoka, Ramsey, and Washington have Watershed District Water Resource Plans (see following list)

Minnesota Watershed District or Watershed Management Organization Plans

1. Brown's Creek; contact Washington County Soil and Water Conservation District, phone 651-430-8300.
2. Carnelian Marine; contact district office, phone 651-430-2793.
3. Forest Lake; contact office 651-464-4348
4. Lower St. Croix Valley Watershed District (Combined Valley Creek, Middle St. Croix WMO and the Lower St. Croix WMO); contact Washington County Soil and Water Conservation District, phone 651-430-8300.
5. Ramsey-Washington Metro; contact district office 651-704-2089.
6. Marine on St. Croix (WMO); contact office 651-433-3636.
7. South Washington; contact district office 651-714-3500
8. Sunrise River (WMO); contact Pine Soil and Water Conservation District, phone 218-384-4002.

Wisconsin County Plans: For more information about the Land and Water Resource Management Plans for the following counties in the St. Croix Basin, contact the individual phone numbers listed below or the Wisconsin Land and Water Conservation Association, One Point Place, Suite 101, Madison, Wisconsin, 53719, phone 608-833-1833, fax 608-833-7179.

1. Barron County: Phone 715-537-6315
2. Burnett County: Phone 715-349-2186
3. Douglas County: Phone 715-682-7187
4. Pierce County: Phone 715-273-6763
5. Polk County: Phone 715-485-8699
6. St. Croix County: 715-684-2874, ext. 3
7. Sawyer County: Phone 715-634-6463
8. Washburn County: Phone 715-635-2453

Chapter 1.4: Coordinating organizations

With the numerous agencies involved in the St. Croix, it is essential to have the opportunity for discussion and agreement in order for management to be effective. Management of the riverway is presently guided by several management partnerships:

- a. Formal management partnerships: originating from the 1993 Cooperative Agreement
 1. **Lower St. Croix Management Commission** (voting members from the MDNR, WDRN, NPS, and a non-voting member from the MWBAC). The Lower St. Croix Management Commission is the official coordinating body for cooperative management of the 52-mile Lower St. Croix National Scenic Riverway, a segment of the National Wild and Scenic Rivers System extending from Taylors Falls-St. Croix Falls to the Mississippi River at Prescott.

2. **Upper St. Croix Management Commission** (voting members from Xcel Energy (formerly Northern State Power), NPS, WDNR, MDNR, and a non-voting member from the MWBAC, which coordinates the administration and meetings of the Commission). The Upper St. Croix Management Commission is the official coordinating body for cooperative management of the 200-mile St. Croix National Scenic Riverway, which includes a 102-mile segment of the St. Croix River from the Gordon Dam to Taylors Falls-St. Croix Falls, and a 98-mile segment of the Namekagon River from Namekagon Lake Dam to the St. Croix River near Danbury.

2. **St. Croix Basin Water Resources Planning Team** (voting members from NPS, WDNR, MDNR, MPCA, MWBAC, and cooperative members from the USGS, MCES, BSWR, EPA, MDA, MHD, UMN, NRCS, St. Croix Chippewa, UW, and Washington County). The Basin Team is a coordinating body for basin wide water resource protection. Through the development of a water resource planning status report and integrative decision making, the partners cooperatively manage water resource use, project development and protection of the 7,760-square-mile St. Croix Basin in Minnesota and Wisconsin. The Basin Team was created under a 1993 Cooperative Agreement among the voting members. They work cooperatively on water quality monitoring, assessment and action recommendations with many other federal, state and local authorities and interests. (See Chapter 1 for information on the goals and accomplishments of the Basin Team.)

Contact:

- 1) Randy Ferrin, chair, at 715-483-3284 or email Randy_Ferrin@NPS.gov
- 2) Pam Davis, coordinator, at 651-766-8419 or email davi0395@tc.umn.edu

b. Informal management partnership:

1. **Wisconsin St. Croix Basin Partners**

This natural resource group is a mix of citizens and agency staff focusing their collective energy on natural resource issues within Wisconsin's St. Croix River Basin. Goals of the Wisconsin Partners:

- 1) Advocating for issues that foster protection and enhancement of ecological values within the Basin.
- 2) Supporting local efforts to provide workshops on priority issues.
- 3) Providing educational materials to address priority resource issues.
- 4) Promoting educational symposiums within the basin to increase understanding of ecological concepts and available protection tools.

Contact John Haack, Basin Educator, at 715-635-7406 or email john.haack@ces.uwex.edu

Chapter 1.5: Tribal responsibilities in the St. Croix Basin

The St. Croix Chippewa Indians of Wisconsin

The St. Croix Chippewa Indians of Wisconsin manage an area of approximately 3000 acres in northwestern Wisconsin spread through Barron, Burrnet, Polk, and Washburn counties. Tribal members reside in ten residential communities. The reservation lands are all contained in the St. Croix Basin.

Water Resources Management Plan St. Croix Indian Reservation

A water resources plan was developed to describe the state of the tribal water resources, document the current strengths and threats of the resource, and make recommendations for preservation.

Contact:

Aaron Colson or Steve Jenson at 715-349-2195
St. Croix Chippewa Indians of Wisconsin
PO Box 287
Hertel, WI 54845

Mille Lacs Band of Chippewa Indians

The Mille Lacs reservation in Minnesota comprises a total area 61,000 acres. 3,500 acres are owned by the Mille Lacs tribe. A small amount of this area is contained in the St. Croix Basin.

Mille Lacs, Aitkin, Crow Wing and Pine counties, Minnesota
HCR 65, Box 194
Onamia, MN 56359
(612) 532-4181

Chapter 2.0 Setting

Chapter 2.1: Physical description

Climate (amended from the National Park Service Water Resources Management Plan, the United States Geological Survey National Water-Quality Assessment reports, and the Minnesota Pollution Control Agency Draft Basin Information Document).

The St. Croix Basin climate is less affected by the sea thus has a greater range in high and low temperatures (subhumid continental). Winters are generally cold, long, and snowy. Summers are relatively short, but they can be hot and sometimes humid. The average annual temperature at Spooner, Wisconsin, in the Upper St. Croix Valley is 5.6^o C (42.00 F). In January the average monthly temperature is -11.8 ° C (10.8° F). In July the average monthly temperature is 21.9 C° (71.4° F) (Environmental Data Service 1973 as cited by Graczyk 1986). Most of the precipitation falls during the months of May through September. Average annual precipitation in the St. Croix Basin ranged from 71.1 cm (28 in) in the western portion to 81.3 cm (32 in) in the northeastern portion from 1961-1990 (USGS by Stark et al.1996). Maximum precipitation, 11.3 cm (4.45 in.), occurs in June and minimum, 1.68 cm (0.66 in.), in January and February. About 75% of the annual precipitation falls during the growing season (May to September) (USGS 1996). Mean annual snowfall in the St. Croix River basin is about 114.3 cm (45 in/yr). Evapotranspiration is lowest in the northern part of the basin and highest in the southern part.

The St. Croix is a river of low to moderate gradient, with an average slope of 0.47 m/km (2.6 ft/mi) (Fago and Hatch 1993). The Riverway is steepest (1.05 m/km, 5.73 ft/mi) in the Kettle River Rapids, a 13-km (7.8 mi) reach near the mouth of the Kettle River (Fago and Hatch 1993). The Riverway substrate is gravel and cobble in high velocity areas and coarse to fine sand in slower reaches; the latter are predominant (Montz et al. 1989).

Physiography, Geology and Soils

The physiography, geology and soils as discussed in the National Park Service Water Resources Management Plan:

The St. Croix River is a 6th order stream in northwestern Wisconsin and eastern Minnesota. The River originates in Upper St. Croix Lake near Solon Springs, Wisconsin, at an elevation of 337 m (1,105 ft); it flows southwest to its confluence with the Mississippi River at Prescott, Wisconsin (elevation 206 m, 675 ft) (Young and Hindall 1973 as cited by Graczyk 1986). The Namekagon River is a 5th order stream that drains northwestern Wisconsin. It joins the St. Croix above Danbury, Wisconsin. The drainage area of the St. Croix River at its mouth at Prescott is 20,098 square kilometers (7,760 mi²).

The Namekagon varies from a cold water trout stream enclosed in forest to a slow, meandering stream flowing through marsh and peatlands to a lake near Trego. The upper St. Croix flows through dense forests and riparian floodplains relieved by high, sandy banks and gently rolling terrain. At Taylors Falls, Minnesota the river runs a hydroelectric impoundment and then flows through the Dalles, a narrow, 40 m deep rock gorge of Keweenawan basalt. Below the Dalles, the river becomes shallower with many islands, sandbars and sloughs. The River is impounded by a sandbar at its confluence with the Mississippi River, becoming a large, deep lake from Stillwater, Minnesota to Prescott, Wisconsin. The St. Croix and Namekagon Rivers pass several small communities along their lengths, and there is significant municipal development in the lower portion of the St. Croix. The Riverway is impounded by four dams, located at Gordon, Hayward, and Trego, Wisconsin and Taylors/St. Croix Falls on the border between Minnesota and

Wisconsin. The remnants of two low-head log-crib dams remain on the Namekagon above Hayward, WI. Floods have destroyed two large dams on the St. Croix.

The Namekagon, Upper St. Croix and eastern Lower St. Croix basins are mainly in the Superior Upland physiographic province. The western and very southern portion of the Lower St. Croix basin is in the Central Lowland physiographic province (Western Lake and Wisconsin Driftless sections)(Fenneman and Johnson 1946 as cited by Stark et al. 1996). It also flows through three aquatic ecoregions: almost 58% of the basin is in the Northern Lakes and Forests ecoregion, characterized by conifer and hardwood stands with extensive areas of wetlands and lakes; 39% of the basin is in the Central Hardwoods Forests ecoregion, characterized by northern deciduous hardwood species; 3% of the basin is in the Western Corn Belt ecoregion (Fago and Hatch 1993).

The wide, deep valley of the St. Croix was formed approximately 9,000 years ago when large volumes of water drained glacial Lake Duluth (Montz et al. 1989). Under the Riverway lie Precambrian sandstone (800 million years ago (MYA) to Cambrian), lava flows (2500 to 800 MYA), Cambrian sandstone, and dolomite (Ordovician) (Bean 1949 as referenced by Graczyk 1986). The unconsolidated material under most of the basin ranges from 30 to 60 meters (100 to 200 ft) in thickness (Thwaites 1956 as cited by Graczyk 1986). The southern part of the basin is characterized by flat-topped, steep-sided hills with narrow stream valleys. The rest of the basin primarily is outwash plains and knob and kettle end moraines. There is an abundance of lakes and swamps in the basin with more located east of the St. Croix River than to the west. Most of these lakes and swamps are found in the northern two-thirds of the basin where drainage is generally poor (Graczyk 1986). Above St. Croix Falls, the river flows through pitted outwash and below St. Croix Falls it flows through both ground and end moraines (Thwaites 1956 as cited by Graczyk 1986).

The soils of the St Croix basin are primarily silt and sandy loam (Hole 1976 as cited by Graczyk 1986). Permeability of these soils ranges from 0.13-25 cm/hr (0.05 to 10 in/h). Most of the basin has a soil permeability between 2 and 6.25 cm/hr (0.8 to 2.5 in/h) (Young and Hindall 1973 as cited by Graczyk 1986). Soils in upper part of the basin are mostly spodosols and inceptisols. Spodosols soils have light-colored surface horizons and organic and aluminum-rich subsurface horizons. Spodosols are low in natural fertility and are generally formed on sandy, siliceous parent materials covered primarily by coniferous forests. Inceptisols are more recently-developed soils and are present mainly where forests, woodlands and wetlands are the primary land covers. The soils in the lower part of the basin are mainly alfisols, which have thin, gray to brown, fertile surface horizons underlain by alluvial clay horizons. These soils generally form beneath deciduous forests underlain by silty sands (USGS by Stark et al. 1996).

Chapter 2.2: Human Impact

The history of the St. Croix River mirrors the development of the states of Minnesota and Wisconsin. Table 3 shows a dateline of events in the history of the St. Croix River. Indians utilized its ecosystem for food and medicine and the water for transportation. This scenic waterway, meandering through picturesque bluffs, hardwoods and floodplain communities and prairies, provided the vehicle for removing timber from the original great white pine stands. The river supports numerous fish species, beaver, muskrat, and otters. Eagles, osprey, and ducks nest along the river. Insects, forty-one species of fresh water mussels, and hundreds of other species of plants and animals make the St. Croix their home. This park is one of the most biologically diverse national parks of the Midwest.

Table 3. Important Dates in Natural and Cultural History of the St. Croix River: From the Lower St. Croix National Scenic Riverway River Stewardship Guide, M-WBAC 1994 and the North Central Forest Experiment Station Report prepared by Barbara Andersen et al., in 1995.

Date	Event
1 billion years ago	Covered by mountains higher than the Rockies are today
600-800 million years ago	Mostly covered by lava
550 million years ago	Covered by Cambrian sandstone, then eroded; formation of the St. Croix River
1 million years ago	Beginning of glaciation in the St. Croix River area
10,000 years ago	Wisconsin Ice Sheet is retreating; the St. Croix is established as it is today (Dalles cut)
7000 B.C.	American Indians were probably hunting and fishing
5500 B.C.	American Indians mined pure copper and made arrowheads near Lac Court Orielles, ancient Indian village
4000 – 100 B.C.	Various woodland Indians inhabited the area; the presence of nomadic hunters has been found in the vicinity of Rice Lake.
1225 A.D.	Earthworks from early mound builders found at Lac Court Orielles who later abandoned the area.
1500s	Ojibwa (Chippewa) Indian tribe moved into northern and western Wisconsin from the Lake Superior area pushing the Dakotas westward.
1661	Radison and Grosseilliers (Frenchmen) were the first European travelers to the area.
1763	The French lost the area to the English during the French and Indian war
1776	American independence proclaimed
1830s	Fur was gone for commercial trading; the trapping era ended
1836	Wisconsin was granted territorial status
1837	Treaty with Indians; United States assumes control of all lands extending east of the Mississippi to the headwaters of the St. Croix River; first sawmill at Marine on St. Croix
1838	First loggers moved into the area near Chippewa Falls
1848	Wisconsin, population 210,546, was granted statehood
1858	Minnesota, population 150,037 was granted statehood
1889	Peak number of logs cut in the St. Croix Valley (Andersen et al., 1995)
1905	Dam built at Taylors Falls / St. Croix Falls
1911	St. Croix River Association was formed
1914	End of logging era
1930	Lock and Dam 3 on the Mississippi River affected water levels on lower St. Croix for 25 miles, raising the original level of Lake St. Croix by six feet (Waters 1977).
1935	Peak number of farms in St. Croix Valley; Pierce County was 98.9% farmland (Andersen et al., 194)
1953	Minnesota Board of Health said St. Croix River was polluted from Taylors Falls to Prescott
1960	Sewage treatment plants were built at Hudson and Stillwater
1965	NSP plant was built; Minnesota-Wisconsin Boundary Area Commission was formed
1968	Upper St. Croix and Namekagon Rivers included in National Wild and Scenic Rivers Bill
1972	Lower St. Croix was added to the National Wild and Scenic Rivers System
1976	Master Plans were adopted for St. Croix National Scenic Riverway and State Riverway zoning regulations are adopted

Additions to MWBAC and Andersen timetable for this Basin Plan:

1993	St. Croix Basin Water Resources Planning team formed through Cooperative Agreement (MOU)
1994	Wisconsin St. Croix Basin Water Quality Management Plan (WDNR)
1997	General Management Plan (NPS)
1997	St. Croix National Scenic Riverway Water Resources Management Plan (NPS)
1999	Lower St. Croix National Scenic Riverway Final Cooperative Management Plan / Environmental Impact Statement (NPS, WDNR, MDNR)
2000	Minnesota Watermarks, state of Minnesota Water Plan
2001	Wisconsin St. Croix Basin Water Quality Plan (WDNR)
2001	St. Croix Basin Water Resources Planning Status Report (St. Croix Basin Water Resources Planning Team)

Together the Upper and Lower St. Croix flow 154 miles from its origin at St. Croix Lake near Solon Springs, Wisconsin, until it joins the Mississippi River at Prescott, Wisconsin. Approximately 80% (129 miles) of the St. Croix River forms part of the boundary between Wisconsin and Minnesota. The upper 20% of the river is entirely within Wisconsin.

During the 1950s and '60s, a burgeoning population from the Twin Cities (St. Paul and Minneapolis, Minnesota) continued to push for development and increased recreational usage of the St. Croix River. Worried that continued urban stressors would put the natural resources of the watershed at risk, concerned citizens and politicians pushed for the St. Croix to be included in the original National Wild and Scenic Rivers Act.

The Upper St. Croix River, from the dam at Gordon, Wisconsin, downstream to the dam at Taylors Falls, Minnesota, together with its tributary, the Namekagon River downstream from the dam at Lake Namekagon near Cable, Wisconsin, were designated as one of the eight original segments nationwide of the National Wild and Scenic Rivers System by an Act of Congress on October 2, 1968. This segment, about 200 miles in length, is called "The St. Croix National Scenic Riverway". It is classified for administration as a "scenic river and administered by the National Park Service.

The Lower St. Croix River, from the dam at Taylors Falls to its confluence with the Mississippi River at Prescott, Wisconsin, was the first river segment to be added to the original National Wild and Scenic Rivers System by an Act of Congress on October 25, 1972. This segment, 52 miles in length, is called "The Lower St. Croix National Scenic Riverway." It is classified as a "scenic river" zone and administered by the National Park Service to Stillwater. The lower 25 miles is administered by the states' Departments of Natural Resources and the National Park Service jointly through a management commission.

Other Wisconsin and Minnesota state agencies, the St. Croix Chippewa Indians of Wisconsin, counties, cities, and townships along the mainstem and within the watershed have varying levels of management and regulatory authority.

Chapter 2.3: Counties and municipalities within the St. Croix Basin

The St. Croix River and its tributaries drain nine counties in Wisconsin and ten in Minnesota. On the Minnesota side, Pine, Kanabec, and Chisago Counties are almost entirely within the St. Croix Basin. About two-thirds of Washington County is included in the Basin. Carlton, Aitkin, Mille lacs, Isanti, Anoka, and Ramsey have smaller portions included in the Basin. On the Wisconsin side, the counties which are all or partly within the St. Croix Basin are Barron, Bayfield, Burnett, Douglas, Pierce, Polk, St. Croix, Sawyer, and Washburn Counties.

The Basin is experiencing tremendous growth, in particular the counties in the Lower St. Croix. For example, Hudson Township in Wisconsin has grown 70% from 1990 to 1999 (U.S. Census Bureau). The 1998 population of the St. Croix Basin is approximately 350,000 (Environmental Quality Board 2000). Table 4 is a list of counties partially or wholly located in the St. Croix Basin and their population size. The Minnesota Department of Natural Resources states:

“Urbanization can destroy or fragment natural areas, degrade surface and ground water, and reduce access to outdoor recreational areas, commercial timber, aggregate, and minerals. Low-density development is particularly disruptive. In 1982, the average population density of urban areas in Minnesota was about 1,733 people per square mile. Urban areas developed since 1982 have a density of 929 people per square mile (MDNR 2001)”.

Table 4. The population for 1999 and % of growth from 1990 to 1999 of counties partially or wholly in the St. Croix Basin (2000 U.S. Census: <http://www.census.gov>):

County	1999 U.S. Census Bureau	% increase from 1990
State of Wisconsin	5,250,446	7.3
Barron	44,093	8.2
Bayfield	15,358	9.6
Burnett	14,913	14.0
Douglas	42,967	2.9
Pierce	36,052	10.0
Polk	39,363	13.2
St. Croix	60,273	19.9
Sawyer	16,230	14.4
Washburn	15,770	14.5
State of Minnesota	4,775,508	9.1
Aitkin	14,293	15.0
Anoka	298,948	22.7
Carlton	31,492	7.6
Chisago	42,302	38.6
Isanti	30,887	19.2
Kanabec	14,427	12.7
Mille Lacs	21,350	14.4
Pine	24,616	15.8
Ramsey	486,254	0.1
Washington	202,606	38.9

Land Cover and Use as discussed in the National Park Service Water Resources Management Plan and identified in Issue Statement 1 of the Planning Status Report, Table 15:

Land cover throughout the St. Croix basin is approximately 47% forest, 37% agriculture, 12% wetlands, 3% water and 1% urban. The forested land is a mix of aspen, jack pine, and mixed northern hardwoods. Agricultural use is mainly dairy farms and grain. Over the 29-year period 1959-1987, total farm acreage declined almost 30% but forestland declined only slightly. Wetland loss from presettlement to the present has been estimated at 12%, which is small compared to other wetland losses in Minnesota, Wisconsin and the rest of the nation (Fago and Hatch 1993). Urban land use has increased over the last 30 years; although it is a small percentage of the total land area, populations in the St. Croix basin and Twin cities metro area are growing rapidly. Developmental pressures along the Riverway are increasing, particularly in the lower basin. Within the entire watershed of the Lower St. Croix River 7.5% of land area underwent some form of land use change between 1973 and 1991. Sixty two percent of the land use change involved transition into urban land uses. Within the Lower St. Croix National Scenic Riverway, 64% of the structures built since 1973 were in Wisconsin and most of these are in jurisdictions south of

Houlton. Riverway development in Minnesota during this period occurred at lower densities than that in Wisconsin. The supply of land within the riverway that could be developed in the future is more than three times greater than the amount of land developed between 1973 and 1991 (Pitt et al. 1994).

Within the past 150 years a major land use shift occurred in the Basin (see Table 5). Logging cleared much of the old growth white pine; current regrowth of forest is younger in age with few white pines remaining. Accompanying the removal of the white pine there was a significant increase in river flow from the 1920s to the 1950s (Mulla et al., 1999). Since then the flow has leveled, probably due to regeneration (Mulla et al. 1999). Agriculture increased as lands were converted to farming. Currently, the St. Croix River Basin consists primarily of forested and agricultural land. Cattle are the major livestock raised, and hay and corn are the major crops produced (USGS 1998 by Kroening). Recently, agriculture has decreased as farmland has been developed. In the northern parts of the Basin, land use has been primarily rural in nature; in the southern basin, water quality impacts has increased from residential, commercial, and recreational usage (primarily from the Twin Cities) (Stark et al., 2001).

Table 5. Land use trends in the St. Croix Basin (Mulla et al. 1999)

Land use	Production	Comments
Corn production	yr 1860 = 6,000 tons yr 1992 = 620,000 tons	
Area of land in pasture (alfalfa and hay)	yr 1930 = 586,000 ha yr 1992 = 499,000 ha	
Number of cattle	Peak in 1964 = 500,000	
Number of chickens	Peak in 1954 = 1,800,000	
Number of hogs	yr 1860 = 11,000 yr 1920 = 150,000 yr 1992 = 74,000	
Fertilizer expenditures (not adjusted for inflation)	yr 1880 = \$ 7,000 yr 1992 = \$24,000,000	Roughly 5,500 tons P fertilizer applied yearly; amounts of fertilizer applied (as P) increased dramatically from 1954 to 1974, then leveled off; the amount of P fertilizer applied is roughly 5 ½ times greater than the amount of P content in animal manure.
Soil erosion	900,000 tons annually	Lake St. Croix traps the sediment; roughly 1% of the sediment eroded in the St. Croix Basin is carried through the Basin to get deposited in Lake Pepin.

The St. Croix Chippewa Indians of Wisconsin completed a study in 2000 through the USGS on water resources in their reservation lands (USGS 2000 by Saad and Robertson). Seven of the ten Chippewa lands were included in the study. Forest covers most of the area in these seven locations. Other land use types were grassland, wetland (evenly distributed through out the area), agriculture, and open water. Agricultural and grassland land use are higher in the southern and central parts (USGS 2000 by Saad and Robertson).

Chapter 3.0: Water Resource Regulations for the St. Croix Basin

Chapter 3.1: Treaties

In 1837 several Chippewa Bands were summoned to Fort Snelling (near present-day St. Paul, Minnesota) for the negotiation of a treaty with the United States to purchase certain Chippewa lands located in present-day Wisconsin and Minnesota. The Chippewa agreed to sell the land to the United States and retain their right to hunt, fish, and gather in the ceded territory. In 1849 a resolution by the territorial legislature to remove the Chippewa from the territory was put before United States President Taylor. President Taylor revoked the treaty of 1837 and required the Chippewa to be moved. In 1851 the order to move the Chippewa was abandoned. In 1854 more land was ceded from the Chippewa and the St. Croix Chippewa Indian reservation was established.

In 1990, the Mille Lacs Band of Chippewa Indians and others filed suit in the Federal District Court seeking a statement that retained their rights under the 1837 treat. In 1997, their rights were upheld

Currently within the St. Croix Basin all the Chippewa Bands retain reservations and the right to hunt, fish and gather on ceded lands.

Chapter 3.2: Federal Regulation

Federal Acts specific to the establishment of the St. Croix National Scenic Riverway (copied from the National Park Service Water Resources Management Plan)

The St. Croix National Scenic Riverway (NSR), including the Namekagon River, was established in 1968 under the National Wild and Scenic Rivers Act. The portion of the river south of St. Croix Falls, Wisconsin, was added to the system in 1972 as the Lower St. Croix National Scenic Riverway. The National Wild and Scenic Rivers Act gives specific protection to selected rivers and their riparian areas and sets the basis for management policy for the Park:

The National Wild and Scenic Rivers Act gives specific protection to selected rivers and their riparian areas and sets the basis for management policy for the Park:

Section 1

(1.1) "It is hereby declared to be the policy of the United States that certain selected rivers of the Nation, which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations."

Section 10

(3.1) "Each component of the national wild and scenic river system shall be administered in such manner as to protect and enhance the values which caused it to be included in said system without; insofar as is consistent therewith, limiting other uses that do not substantially interfere with public use and enjoyment of these values. In such administration primary emphasis shall be given to protecting its aesthetics, scenic, historic, archaeologic, and scientific features. Management plans for any such component may establish varying degrees of intensity for its protection and development, based on the special attributes of the area."

The National Scenic Riverway designation resulted in private scenic easement acquisition, land acquisition, water use regulation, and State mandated but locally implemented zoning to control land use.

Federal and State Zones

National Wild and Scenic River	National Park Service	From its source in Wisconsin to northern Stillwater
	Wisconsin Department of Natural Resources	From Stillwater to its mouth at Prescott, Wisconsin side
	Minnesota Department of Natural Resources	From Stillwater to its mouth at Prescott, Minnesota side

Federal Acts, Regulations and policies specific to administration of National Park Units

There are four laws that constitute the primary authorities for administration of the National Park System.

National Park Service Organic Act (1916) (copied from the National Park Service Water Resources Management Plan)

In the 1916 Congress created the National Park Service in the Department of the Interior to:

“Promote and regulate the use of the Federal areas known as national parks, monuments, and reservations . . . by such means and measures as conform to the fundamental purpose of said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” (NPS organic act, 16 USC 1)

The basis for Park management policies was specifically addressed for the first time by Secretary of the Interior Franklin K. Lane in a letter to the first director of the National Park Service, Stephen T. Mather, on May 13, 1918, Secretary Lane stated that administrative policy should be based on three broad principles:

“First, that the national parks must be maintained in absolutely unimpaired form for the use of future generations as well as those of our own time; second, that they are set apart for the use, observation, health, and pleasure of the people; and third, that the national interest must dictate all decisions affecting public or private enterprise in the parks.”

National Environmental Policy Act (1969) (copied from the National Park Service Water Resources Plan)

This law requires a systematic analysis of federal actions with the potential to affect the human and natural environments. The analysis includes a consideration of reasonable alternatives and an analysis of short- and long-term irretrievable, irreversible, and unavoidable impacts. If a federal action may result in major impacts, an environmental impact statement is prepared. The EIS ensures evaluation of the impacts of proposed projects and facilitates public review.

Regulations implementing NEPA require the cooperation of federal agencies and encourage the reduction of duplication through cooperation with state and local agencies including early efforts of joint planning, hearings and environmental assessments.

General Authorities Act (1970) (copied from the National Park Service Water Resources Management Plan)

The General Authorities Act of 1970 defines the national park system as including "any area of land and water now or hereafter administered by the Secretary of the Interior through the National Park Service for park, monument, historic, parkway, recreational, or other purposes" (16 USC 1c(a)). It states that "each area within the national park system shall be administered in accordance with the provisions of any statute made specifically applicable to that area" (16 USC 1c(b)) and in addition with the various authorities relating generally to NPS areas, providing the general legislation does not conflict with specific provisions.

Redwood National Park Act (1978) (copied from the National Park Service Water Resources Management Plan)

In a 1978 act expanding Redwood National Park, NPS general authorities were further amended to add:

"The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress." (16 USC 1a-1)

Federal Acts relevant to federal land management**Clean Water Act** (copied from the National Park Service Water Resources Management Plan)

The Federal Water Pollution Control Act, more commonly known as the Clean Water Act, was first promulgated in 1972 and significantly amended in 1977, 1987, and 1990. This law was designed to restore and maintain the integrity of the nation's water. Goals set by the act were swimmable and fishable waters by 1983 and no further discharge of pollutants into the nation's waterways by 1985. The two strategies for achieving these goals were a major grant program to assist in the construction of municipal sewage treatment facilities and a program of "effluent limitations" designed to limit the amount of pollutants that could be discharged.

As part of the act, Congress recognized the primary role of the states in managing and regulating the nation's water quality within the general framework developed by Congress. All federal agencies must comply with the requirements of state law for water quality management, regardless of other jurisdictional status or land ownership (section 313). States implement the protection of water quality under the authority granted by the Clean Water Act through best management practices and through water quality standards. Best management practices are defined by the U.S. Environmental Protection Agency (EPA) as methods, measures, or practices selected by an agency to meet its nonpoint control needs. These practices include but are not limited to structural and non-structural controls, operational procedures, and maintenance procedures. They can be applied before, during, and after pollution producing activities to reduce or eliminate the introduction of pollutants into receiving waters (Code of Federal Regulations 1990). Water quality standards are composed of the designated use or uses made of a water body or segment, water quality criteria necessary to protect those uses, and an anti-degradation provision to protect the existing water quality.

Section 404 of the Clean Water Act further requires that a permit be issued for discharge of dredged or fill materials in waters of the United States including wetlands. The Army Corps of

Engineers administers the Section 404 permit program with oversight and veto powers held by the EPA.

Clean Water Act and regulations are generally implemented by the states with the EPA serving in an oversight role. A triennial review of a state's water quality regulatory program is conducted by each state's water quality agency to determine if its standards are adequate to meet federal requirements. These standards are then forwarded to the EPA for approval.

Rivers and Harbors Appropriations Act of 1899, as amended (33 U.S.C. 401-466n) (copied from the National Park Service Water Resources Management Plan)

This was the first general legislation giving the Corps of Engineers jurisdiction and authority over the protection of navigable waters. Under it, permits from the Department of the Army are required for structures and/or work in or affecting navigable waters of the United States (33 CFR 322.3(a)). Regulation of activities under the Rivers and Harbors Act is often, though not always, used in concert with regulation under Section 404 of the Clean Water Act. Rivers and Harbors Act jurisdiction is not limited to activities in navigable waters but also includes any actions that "affect" those waters. (33 CFR 322.3(a)) The Corps is allowed broad discretion in making this determination. Jurisdiction of the Corps of Engineers over navigable waters reaches laterally to the ordinary high water mark in freshwater areas (33 CFR 329.11(a)). Also, it has been determined that jurisdiction extends to an area over which a river customarily flows from time to time in its natural meanderings (Want 1996). Activities that often require a permit include piers, ramps or docks; transmission lines, cables or pipes over, under or through the water; jetties, bulkheads, revetments or breakwaters; water withdrawals; etc. (Bridges require Coast Guard authorization under a section 9 permit).

Floodplain Management (Executive Order 11988, 1977) (copied from the National Park Service Water Resources Management Plan)

The objective of this executive order is to require agencies to "reduce the risk of flood loss, ... minimize the impacts of floods on human safety, health and welfare, and.. restore and preserve the natural and beneficial values weaved by floodplains" (Goldfarb 1988). Federal agencies are therefore required to implement floodplain planning to avoid to the extent possible the long- and short-term adverse impacts associated with occupancy and modification of floodplains. Agencies are also to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. National Park Service guidance pertaining to Executive Order 11988 can be found in Floodplain Management Guidelines (National Park Service 1993), which supersedes the Floodplain portion of the NPS Floodplain and Wetland Management Guidelines of 1980.

Protection of Wetlands (Executive Order 11990, 1977) (copied from the National Park Service Water Resources Management)

This executive order requires all federal agencies to "minimize the destruction, loss or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands" (Goldfarb 1988). This order furthers the purposes of the National Environmental Policy Act by directing federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands when practicable alternatives exist. The NPS Floodplain Management and Wetland Protection Guidelines (45 FR 35916, with minor revisions in 47 FR 36718) outline NPS requirements for complying with Executive Order 11990. These are currently under revision to improve several procedural aspects, while the wetland protection objectives will remain essentially unchanged.

Endangered Species Act (1973) (copied from the National Park Service Water Resources Management)

This act provides for the conservation, protection, restoration, and propagation of selected species of native fish and wildlife that are threatened with extinction. All federal agencies must consult with the Secretary of the Interior on activities that potentially affect endangered flora and fauna.

Section 7 outlines procedures for interagency cooperation to conserve federally listed species, species proposed for listing and for designated critical habitat and proposed critical habitat. Section 7(a)(1) requires federal agencies to use their authorities to further the conservation of listed species and section 7(a)(2) prohibits federal agencies from undertaking, funding, permitting or otherwise authorizing actions that are likely to jeopardize the continued existence of listed species or that would destroy or adversely modify critical habitat.

Water Quality Improvement Act (1970)

This act requires federally regulated activities to have state certification stating that they will not violate state water quality standards.

Water Rights (copied from the National Park Service Water Resources Management) Both Wisconsin and Minnesota administer water rights under the Riparian Doctrine (Waters and Water Rights 1991, Volume 6). Riparian rights refer to legal rights the owner of the bank of a stream or lake has in regard to uses of that water. These uses include access to the water, to build a wharf or pier, to use the water without transforming it, to consume the water, to acquire accretions (accretions are the gradual enlargement of land by fluvial processes such as the accumulation of sediment on a floodplain by stream action or the deposition of sand on a beach), and to own the bed of non-navigable streams and other private waters. In both Wisconsin and Minnesota, water is considered public water and administered by the State if it is considered navigable.

The basis and limit of water use is governed by the reasonable use doctrine in Minnesota and Wisconsin. Under this doctrine, each riparian owner is allowed to use a waterbody regardless of the effect on natural flows as long as each user does not adversely affect the equal right of another riparian to use the water (Waters and Water Rights 1991, Volume 1). Permits are a method used by States to control the amount of water use and to vest the right of a user to continue that use (Sherk 1990). In Minnesota, a State permit is required for any consumptive use of more than 10,000 gallons per day or 1,000,000 gallons per year for surface or ground water (Waters and Water Rights 1991, Volume 6). Section 30.18 of the Wisconsin Statutes states that a permit must be obtained before water can be diverted from a stream for purposes of agriculture, or restoring the level of a lake or stream. A permit must also be obtained for a diversion of surface water for any purpose if the diversion will result in a water loss of 2,000,000 gallons per day or more (Waters and Water Rights 1991, Volume 6). The surface water permits can be revoked if the diversion is harmful to other riparian water users (Sherk 1990).

Both States acknowledge in-stream flow rights for such uses as fishing, navigation, and swimming. Wisconsin also recognizes the right of the public to enjoy the scenic beauty of the water body. In an important Wisconsin Supreme Court decision concerning the Namekagon River, the court ruled that the construction of a hydroelectric dam on the river would violate the public's right to "the enjoyment and natural scenic beauty" of the riverway and denied the application (Trelease 1979).

Under Minnesota and Wisconsin law, the United States, as a riparian owner, has a right to use an unquantified amount of surface water flowing in streams within SCNSR's boundary. This includes

non-consumptive in-stream uses. The United States may also have a Federal reserved water right for the primary park purposes on those SCNSR lands reserved from the public domain. However, the applicability of the Federal reserved water rights doctrine to the Wild and Scenic River system is yet to be litigated. Therefore, the extent of resource protection available through Federal reserved water rights is uncertain. Any water development proposal that has the potential to alter the current flow regime in either river should be viewed as having potential for injury to NPS rights and actions should be taken to protect the water-related resources of SCNSR.

Chapter 3.3: State regulations

State Flood and Shore Land Management Programs

Amended from the 1975 St. Croix River Basin Water Quality Management Basin Plan, prepared by the MPCA:

These programs regulate activities in flood plain areas and shore land areas to prevent programs, which can occur due to inappropriate activities on these lands. The Wisconsin and Minnesota Departments of Natural Resources and each county administer these programs. The county flood plain management ordinances are designed to restrict inappropriate construction within the flood plain of a river..The shore land ordinances direct activities within 1,000 feet of a lake of 25 acres or more and within 300 feet of a stream with a watershed of two square miles or more..The minimal standards set for a given lake or stream depends on its classification.

State water quality regulations relevant to the St. Croix

State Water Use Classifications

Outstanding Resource Value Waters (ORVW)	State of Minnesota	Entire St. Croix River and the tributary Kettle River
Outstanding resource waters (ORW)	State of Wisconsin	A. From the source to the northern border of the city of St. Croix Falls B. From Osceola to Hudson C. The tributary Namekagon River
Exceptional resource waters (ERW)	State of Wisconsin	A. From St. Croix Falls to Osceola B. From Hudson to Prescott

Wisconsin Water Use Standards

In the state of Wisconsin water use the Wisconsin Department of Natural Resources (Table 6) regulates standards.

**Wisconsin Water Classification
NR 102.05**

- Outstanding resource waters: Outstanding Resource Waters have the highest value as a resource, excellent water quality and high quality fisheries. They do not receive wastewater discharges and point source discharges will not be allowed in the future unless the quality of such a discharge meets or exceeds the quality in the receiving water. “..This classification includes national and state wild and scenic rivers and the highest quality Class I trout streams in the state (Wisconsin).” For a listing of Wisconsin ORW see NR 102.09.
- Exceptional resource waters: Exceptional resource waters have excellent water quality and valued fisheries but already receive wastewater discharges or may receive future discharges necessary to correct environmental or public health problems. “..Surface waters which provide valuable fisheries, hydrologically or geologically unique features, outstanding

recreational opportunities, unique environmental settings, and which are not significantly impacted by human activities may be classified as exceptional resource waters (NR 102.11).” This classification includes about 1400 trout stream segments (in Wisconsin) not classified as outstanding resource waters. For a listing of Wisconsin ERW see NR 102.11.

- Great Lakes system waters: This classification includes all the surface waters within the drainage basin of the Great Lakes.
- Fish and aquatic life waters: Surface waters not listed as outstanding, exceptional, Great Lakes system, other.
- Other (variances and additions)

Table 6. Wisconsin water use standards

Class	Wisconsin Water Quality Standards Rule (from NR 102.40)
General Standard	To preserve and enhance the quality of waters, standards are established to govern water management decisions. Practices attributable to municipal, industrial, commercial, domestic, agricultural, land development or other activities shall be controlled so that all waters including the mixing zone and the effluent channel meet the following conditions at all times and under all flow conditions: <ol style="list-style-type: none"> a. Substances that will cause objectionable deposits on the shore or in the bed of a body of water, shall not be present in such amounts as to interfere with public rights in waters of the state. b. Floating or submerged debris, oil, scum, or other material shall not be present in such amounts as to interfere with public rights in waters of the state. c. Materials producing color, odor, taste or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the state. d. Substances in concentrations or combinations which are toxic or harmful to humans shall not be present in amounts found to be of public health significance, nor shall substances be present in amounts which are acutely harmful to animal, plant or aquatic life.
Fish and other aquatic life uses standards	<p><u>Cold water communities</u>: ..capable of supporting a community of cold water fish and other aquatic life, or serving as a spawning area for cold water fish species.</p> <p><u>Warm water sport fish communities</u>: ..capable of supporting a community of warm water sport fish or serving as a spawning area for warm water sport fish.</p> <p><u>Warm water forage fish communities</u>: ..capable of supporting an abundant diverse community of forage fish and other aquatic life.</p> <p><u>Limited forage fish communities</u>: ..surface waters of limited capacity and naturally poor water quality or habitat...capable of supporting only a limited community of forage fish and other aquatic life.</p> <p><u>Limited aquatic life</u>: ..surface waters of severe limited capacity and naturally poor water quality or habitat...capable of supporting only a limited community of aquatic life.</p>
Recreational Use Standard	A sanitary survey and/or evaluation to assure protection from fecal contamination is the chief criterion in determining the suitability of a surface water for recreational use.
Public Health and Welfare Standard	All surface waters shall meet the human threshold and human cancer criteria specific...criteria vary depending on whether the surface water is used for public drinking water supplies and vary with the type of fish and other aquatic life subcategory.
Wildlife Standard	All surface waters shall be classified for wildlife uses and meet the wildlife criteria specified..

Minnesota Water Use Classification (Table 7)

The Minnesota Pollution Control Agency regulates the Minnesota water use standards and classifies Minnesota water based on use. The waters are assessed as to how well they support the use or whether the designated use is attainable. Each class then has legally defined criteria (water quality standards), which must be met in order for that water body to support its designated use. Many of these classes have been further subdivided (MR Ch 7050, 7050.0410, 7050.0470). Class 1, 2, and 7 water quality standards are the standards most often cited as defining a specific water body’s water quality (<http://www.revisor.leg.state.mn.us/arule/7050/>).

Table 7. Water Use Classifications for Minnesota

Class	MN Water Quality Standards Rule (7050)
Class 1: Domestic Consumption	..all waters of the state which are or maybe used as a source of supply for drinking, culinary or food processing use or other domestic purposes, and for which quality control is or may be necessary to protect the public health, safety, or welfare“. This category includes all ground waters of the state and a limited number of surface waters of the state.
Class 2: Aquatic Life and Recreation	..all waters of the state which do or may support fish, other aquatic life, bathing, boating, or other recreational purposes, and where quality control is or may be necessary to protect aquatic or terrestrial life or their habitats, or the public health, safety, or welfare.
Class 3: Industrial Consumption	..all waters of the state which are or may be used as a source of supply for industrial processes or cooling water, or any other industrial or commercial purposes and for which quality control is or may be necessary to protect public health, safety, or welfare.
Class 4: Agriculture and Wildlife	..all waters of the state which are or may be used for any agriculture purposes, including stock watering and irrigation, or by waterfowl or other wildlife, and for which quality control is or may be necessary to protect terrestrial life and its habitat or the public health, safety, or welfare.
Class 5: Aesthetic, Enjoyment, and Navigation	..all waters of the state which are or may be used for any form of water transportation or navigation, or fire protection, and for which quality control is or may be necessary to protect the public health, safety, or welfare.
Class 6: Other uses	all waters of the state which are or may serve the above listed uses or any other beneficial uses not listed herein, including without limitation any such uses in this or any other state, province, or nation of any waters flowing through or originating in this state, and for which quality control is or may be necessary for the above declared purposes, or to conform with the requirements of the legally constituted state or national agencies having jurisdiction over such waters, or any other considerations the agency may deem proper.
Class 7: Limited Resource	<p>..surface waters of the state which have been subject to a use attainability analysis and have been found to have limited value as a water resource. Water quantities in these waters are intermittent or less than one cubic foot per second at the once in ten year, seven-day low flow as defined in part 7050.0210, subpart 7. These waters shall be protected so as to allow secondary body contact, to preserve the groundwater for use as a potable water supply, and to protect aesthetic qualities of the water. It is the intent of the agency that very few waters be classified as limited resource value waters. The use attainability analysis must take into consideration those factors listed in Minnesota Statutes, section 115.44, subdivisions 2 and 3, the agency, in cooperation and agreement with the Department of Natural Resources with respect to determination of fisheries values and potential, shall be used to determine the extent to which the waters of the state demonstrate:</p> <ul style="list-style-type: none"> A. the existing and potential faunal and floral communities are severely limited by natural conditions as exhibited by poor water quality characteristics, lack of habitat, or lack of water; or B. the quality of the resource has been significantly altered by human activity and the effect is essentially irreversible; and C. there are limited recreational opportunities (such as fishing, swimming, wading, or boating) in and on the water resource. <p>The conditions in items A and C or B and C must be established by the use attainability analysis before the waters can be classified as limited resource value waters“.</p>

The Minnesota Pollution Control Agency has adopted other informal (not legal standards) criteria for “swimmable” waters. These criteria are based on secchi disc readings, and chlorophyll-a and phosphorus concentrations.

- Fully supported (FS)
- Not Supported (NS)

- Partially Supported (PS)

Each stream is then assessed separately (by reach, as defined by the Environmental Protection Agency) as to whether it achieves those water quality standards assigned to it. These assessments are based on multiple observations of water chemistry data and / or biological and habitat data. The parameters and minimum assessment requirements are included in Table 8.

Table 8. Minnesota Pollution Control Agency (MPCA) Stream Water Quality Assessment Parameters

Assessment	Parameters	Minimum Requirements for Assessments
Water Chemistry Data	Conventional Pollutants <ul style="list-style-type: none"> ▪ Dissolved oxygen ▪ PH ▪ Turbidity 	10 or more observations over 10 years
	Toxics <ul style="list-style-type: none"> ▪ Un-ionized ammonia ▪ Chloride ▪ Arsenic ▪ Cadmium ▪ Chromium ▪ Copper ▪ Lead ▪ Nickel ▪ Selenium ▪ Zinc 	Five or more observations
	Nonpoint Source Indicators <ul style="list-style-type: none"> ▪ Total phosphorus ▪ Nitrate/nitrite ▪ Total suspended solids ▪ Biochemical oxygen demand 	10 or more observations
Biological / Habitat Data	Index of Biotic Integrity (IBI) <ul style="list-style-type: none"> ▪ A composite index evaluating 10 – 12 characteristics of a fish 	A single sampling event during normal to low summer or fall flows is sufficient. Must be compared to the best sites in the Basin or ecoregion
Nonpoint Source Survey	Best judgement of local resource managers	Done in 1991

Chapter 3.4: Regulations regarding nutrients in the St. Croix River

Minnesota Water Quality Standards Rule 7050.0211 for Facilities

Subpart 1. Minimum secondary treatment for municipal point source and other point source dischargers of sewage. It is established that the agency shall require secondary treatment as a minimum for all municipal point source dischargers and other point source dischargers of sewage. For purposes of this part, municipal has the adjective meaning of municipality as defined in part 7001.1020, subpart 18. Secondary treatment facilities are defined as works which will provide effective sedimentation, biochemical oxidation, and disinfection, or the equivalent, including effluents conforming to the following (Table 9):

Table 9. Minnesota Pollution Control Agency Standards for Wastewater Treatment Facilities

Substance or Characteristic	Limiting Concentration or Range*
Five-day carbonaceous biochemical oxygen demand*	25 milligrams per liter
Fecal coliform group organisms **	200 organisms per 100 milliliters
Total suspended solids*	30 milligrams per liter
Oil	Essentially free of visible oil
Phosphorus	See subpart 1a
PH range	6.0 - 9.0
Toxic or corrosive	Concentrations of toxic or pollutants: corrosive pollutants shall not cause acute toxicity to humans or other animals or plant life or directly damage real property or exceed the final acute value unless the effluent satisfies the whole effluent toxicity test below. If a whole effluent toxicity test performed on the effluent results in less than 50 percent mortality of the test organisms, the effluent will not be considered acutely toxic unless the commissioner finds that the test species do not represent sensitive organisms in the affected surface water body or the whole effluent test was performed on a sample not representative of the effluent quality. The final acute value and whole effluent toxicity test are defined in part 7050.0218, subpart 3, items O and HH, respectively

*The arithmetic mean for concentrations of five-day carbonaceous biochemical oxygen demand and total suspended solids shall not exceed the stated values in any calendar month. In any calendar week, the arithmetic mean for concentrations of five-day carbonaceous biochemical oxygen demand shall not exceed 40 milligrams per liter and total suspended solids shall not exceed 45 milligrams per liter.

**Disinfection of wastewater effluents to reduce the levels of fecal coliform organisms to the stated value is required from April 1 through October 31 (Class 2 waters) and May 1 through October 31 (Class 7 waters) except that where the effluent is discharged 25 miles or less upstream of a water intake supplying a potable water system, the reduction to the stated value is required year around. The stated value is not to be exceeded in any calendar month as determined by the geometric mean of all the samples collected in a given calendar month. The application of the fecal coliform group organism standards shall be limited to sewage or other effluents containing admixtures of sewage and shall not apply to industrial wastes except where the presence of sewage, fecal coliform organisms, or viable pathogenic organisms in such wastes is known or reasonably certain. Analysis of samples for fecal coliform group organisms by either the multiple tube fermentation or the membrane filter techniques is acceptable.

Phosphorus regulations in Wisconsin

NR 102.06

"In addition to the requirements established in ch. NR217, any wastewater discharger, regardless of population, volume or type of waste discharge, or geographic location, may be required to remove excess amounts of phosphorus. Effluent limitations for total phosphorus based on surface

water quality may be established where, in the best professional judgement of the department, such limitations will result in an improvement in water quality, or preserve the quality of surface waters where long-term discharges may result in impairment of water quality. Such limitations for phosphorus shall include an evaluation of the discharges from point sources, nonpoint sources, background sources, tributaries, and a consideration of a margin of safety”.

NR 217

EFFLUENT STANDARDS AND LIMITATIONS

The purpose for establishing standards for point source discharges is to reduce the amount of pollutants in effluent discharged to surface waters of the state.

NR217.04 Effluent standards and limitations for phosphorus

- 1) GENERAL. Effluent limitations for total phosphorus shall be imposed in WPDES permits for wastewaters discharged to surface waters as specified in this section.
 - a) An effluent standard for total phosphorus shall apply as follows:
 1. An effluent limitation equal to 1 mg/l total phosphorus as a monthly average shall apply to publicly owned treatment works and privately owned domestic sewage works subject to ch. NR 210 which discharge wastewater containing more than 150 pounds of total phosphorus per month, unless an alternative limitation is provided under sub. (2).
 2. An effluent limitation equal to 1 mg/l total phosphorus as a monthly average shall apply in cases where the discharge of wastewater from all outfalls of a facility other than those subject to ch. NR210 contains a cumulative total of more than 60 pounds of total phosphorus per month, unless an alternative limitation is provided under sub. (2).
- 2) ALTERNATIVE EFFLUENT LIMITATIONS TO THE EFFLUENT STANDARD FOR PHOSPHORUS
 - a) Permittee ...may request an alternative effluent limitation for total phosphorus...

Minnesota Phosphorus Strategy

In 1997 the USEPA was required to develop a national nutrient strategy as part of the 1997 Clean Water Action Plan. Accompanying this effort, the Minnesota Pollution Control Agency developed its own phosphorus strategy. The complete strategy is shown in Appendix 3. The following is a list of the action steps of the “Phosphorus Strategy” as presented by Steve Heiskary at the second annual conference titled *Protecting the St. Croix: Reducing and Managing Nutrients and Sediment* (Heiskary 2001).

1. Develop education/outreach/information on environmental impacts of phosphorus.
2. Co-sponsor basin-wide phosphorus forum(s).
3. Use basin management as the main policy context for implementing the phosphorus strategy.
4. Broadly implement Minnesota’s point-source phosphorus controls.
5. Broadly promote lake protection initiatives.
6. Address phosphorus impacts on rivers.
7. Modify water-quality standards if necessary.

Minnesota total phosphorus effluent limits (Sub. 1a)

Where the discharge of effluent is directly to or affects a lake or reservoir, phosphorus removal to one milligram per liter shall be required. The limit must be a calendar month arithmetic mean unless the commissioner finds, after considering the criteria listed in items A and B, that a different averaging period is acceptable. In no case shall the one-milligram per liter limit exceed a moving mean of 12 monthly values reported on a monthly basis, or a simple mean for a specified period, not to exceed 12 months. Calendar month effluent limits in effect on February

7, 2000 must remain in effect unless an assessment of the criteria listed in items A and B indicate a different averaging period is acceptable. A different averaging period is acceptable when:

- A. the effects of the phosphorus loading from the facility on the receiving water or downstream water resources is generally not measurable; and
- B. the treatment technologies being considered offer environmental, financial, or other benefits.

In addition, removal of nutrients from all wastes shall be provided to the fullest practicable extent wherever sources of nutrients are considered to be actually or potentially detrimental to preservation or enhancement of the designated water uses. Dischargers required to control nutrients by this subpart are subject to the variance provisions of part 7050.0190.

St. Croix Basin Water Resources Planning Team Nutrient Program

No Net Increase of Nutrients in Permitted Dischargers (Appendix 4)

Concerned about the impact of nutrients on water quality in the St. Croix Basin, the St. Croix Basin Water Resources Planning Team began a nutrient study in 1998. The purpose of this study was to create a basin wide nutrient budget. In the interim, a statement explaining the voluntary program of "no net increases of nutrients" was written. By submitting this document and attending hearings of reissuance discharge permits, the Basin Team has asked point source dischargers to voluntarily adopt this program until a Basin plan can be developed.

Chapter 4.0: Water quality

Chapter 4.1: Impact on Water Quality from Natural Factors

Water flowing primarily through the Lower St. Croix has greater alkalinity and concentrations of suspended sediment. These impacts result from the clay-rich, calcareous (calcium carbonate) glacial deposits. Water flowing primarily through the Upper St. Croix drains through siliceous (rich in silica), sandy glacial deposits resulting in lower alkalinity lower and concentration of suspended sediment (USGS 2001 by Stark et al.).

During the NAWQA study (USGS 2001 by Stark et al.) snow melt and rain falling on saturated or frozen soils caused the greatest runoff to occur during the months of March through July. Mean annual runoff in the St. Croix River is greater than 14 inches in the headwaters (USGS 2001 by Stark et al.). The average flow of the St. Croix River at St. Croix Falls, Wisconsin, is 4770 ft³ per second (USGS 1999 by Stark et al.). At its mouth in Prescott, Wisconsin, the mean discharge is about 5000 ft³ per second (Waters 1977).

Chapter 4.2: Impact on Water Quality from Land Use Changes

Land use activities affect water quality. Impacts from land use changes include changes in suspended sediment load, nutrients loads, organic matter and biological and chemical oxygen demand, temperature, bacteria and viruses, heavy metals, toxins, acidification, and changes in the water flow. The impact on water quality is listed in Table 10. St. Croix Basin residents rank development pressures and land use changes as major concerns (Environmental Quality Board Minnesota Watermarks report, 2000).

Table 10. Land use impacts on water quality (revised from Perry and Vanderklein 1996).

Variable	Water quality impact
Increased sedimentation	<ul style="list-style-type: none"> ▪ Reduces water clarity ▪ Clogs gills in fish ▪ Decreased photosynthetic ability of aquatic plants ▪ Smothers fish eggs and macroinvertebrates
Increased nutrient loading	<ul style="list-style-type: none"> ▪ Eutrophication (increased production of vegetation, primarily algae) ▪ Reduced water clarity ▪ Reduced oxygen levels
Increased biological and chemical oxygen demand (BOD, COD)	<ul style="list-style-type: none"> ▪ Reduced oxygen levels due to decomposition of organic matter
Temperature	<ul style="list-style-type: none"> ▪ Higher temperatures causes increased respiration rates in aquatic species, impacts eggs and fry, effect changes in migration and spawning and competitive behavior
Bacteria and viruses	<ul style="list-style-type: none"> ▪ Transmit water-borne, -based, and -related diseases
Heavy metals	<ul style="list-style-type: none"> ▪ Toxic to humans and aquatic species
Toxic chemicals	<ul style="list-style-type: none"> ▪ Impacts survival, growth rates, and health of fish ▪ Increases risk of cancer and other health related functions in humans
Acidification	<ul style="list-style-type: none"> ▪ Changed species composition in water ▪ Increased water clarity ▪ Release of trace metals
Changes in water flow	<ul style="list-style-type: none"> ▪ Reduction in flow: reduces aeration, increases water temperature, concentrates pollutants ▪ Increases in flow: moves water faster through the system leading to scouring and increased sedimentation rates ▪ Water withdrawal: decrease in quantity, increased concentration of pollutants in remaining water

Habitat modification	<ul style="list-style-type: none"> ▪ Decreases species diversity ▪ Habitat destruction ▪ Exotic species ▪ Alters scenic view
Synergistic effects	<ul style="list-style-type: none"> ▪ The compound effect of numerous water quality impacts (stressors) causes long term impacts.

To determine water quality impact from land use the Basin Plan reviewed various reports. In 1991 the U.S. Geological Survey (USGS) implemented a National-Water Assessment (NAWQA) program to assess the nations waters. The St. Croix River, the Upper Mississippi River and the Minnesota River basins were included in the Upper Mississippi River Study Unit. The USGS in Wisconsin conducted a study in 1998-1999 on nutrient and sediment loading. Dr. Dave Mulla at the University of Minnesota prepared a report to the Metropolitan Council Environmental on historical trends affecting accumulations of sediment and phosphorus in the St. Croix Basin (the study included the Minnesota and Upper Mississippi Rivers). The results from these studies as well as the environmental studies listed in the Introduction will also be included in the appropriate sections within the Planning Status Report.

The NAWQA study included three land uses: forested, agriculture and urban. The major influences from land use changes on stream and rivers of the St. Croix were identified (USGS 2001 by Stark et al.):

- Applications of pesticides and fertilizers in agricultural and urban areas
- Discharge from wastewater treatment facilities
- Runoff from agricultural and urban areas
- Stream modifications and artificial drainage
- Destruction of riparian cover along stream banks
- Contaminants in precipitation and the atmosphere

In general, land use changes from human disturbance and high population densities have the greatest effect on water quality, hydrology, and aquatic biology.

In urban areas of the NAWQA study unit, contamination resulted from urban runoff, discharge from industrial and wastewater treatment facilities and toxic substances released to groundwater from industrial activities and nonpoint sources. In agricultural areas the artificial drainage systems and the input of point and nonpoint contaminants impact water quality. Stressors from urban and agricultural areas impact eutrophication and habitat.

Nitrate and phosphorus yields were compared among the three land uses in the NAWQA study (Table 11). The forested streams were in the St. Croix Basin; the agriculture streams were in the Minnesota River Basin in Minnesota; the urban streams were in the Twin Cities (St. Paul and Minneapolis) of Minnesota.

Table 11. Nitrate and phosphorus yields in pounds per square mile per year in forest, agriculture, and urban streams, 1996-1998 (USGS 1999 by Stark et al.).

	STREAM	NITRATE	PHOSPHORUS
Forested (streams in the St. Croix Basin)	Namekagon River	260	Below analytical reporting limits
	St. Croix River	160	50
Agriculture (streams in the Minnesota River Basin)	North Fork Crow River	1400	190
	Little Cobb River	15,000	330
Urban (streams in the Twin Cities)	Shingle Creek	400	130
	Nine Mile Creek	510	140

Wastewater treatment facilities supply the major point source loading of phosphorus. During high flow conditions, non point sources contribute the highest amounts of phosphorus. During low flow conditions point sources contribute the highest amount of phosphorus.

Disturbances in forested areas

In the St. Croix Basin there are less land cover disturbances in the forested areas than the urban and agricultural areas. Most of the area originally logged of white pine is now covered with second-growth forests. The water quality impacts are less in forested areas. The water quality impacts that do occur result from the development of small towns and farms, logging practices, fertilizer runoff, and recreational use of the riverway. These land use practices result in the following (USGS 2001 by Stark et al.):

- Applications of herbicides to farms and lakes (to control weeds)
- Discharges of wastewater effluent
- Faulty septic systems
- Disturbances to small streams from forestry practices
- Drainage of wetlands

Pesticides were sometimes detected in shallow groundwater and stream. Trace-element concentrations were from natural factors. Bacteria concentrations passed USEPA criteria for swimming, but not necessarily for human consumption.

Forested areas generally have a rich and diverse biota and habitat. The St. Croix supported diverse aquatic biological communities and relatively undisturbed riffle-pool morphology as evident by the more sensitive invertebrate species found (USGS 2001 by Stark et al.). The dam at St. Croix Falls forms a barrier to fish migration resulting in different species composition. Downstream from the dam supports a more diverse fish community than upstream (USGS 2001 by Stark et al.). Cold water species can be found above St. Croix Falls. As urbanization increased water quality degraded due to development and recreational activities (USGS 2001 by Stark et al.).

Disturbances in Agricultural Areas

In agricultural lands wetlands have been drained, channels straightened, ditches excavated, and sometimes farmed right up to the river's edge. These practices increase erosion and runoff of nutrients and chemicals. Nitrate yields were greatest in agricultural streams. Phosphorus concentrations sometimes exceeded the goal of 0.1 mg/l recommended by the USEPA to prevent eutrophication (USGS 2001 by Stark et al.). Suspended sediment concentrations were higher in streams with fine grained surficial deposits that were artificially drained (USGS 2001 by Stark et al.). Alterations to the stream channel, changes in the riparian cover, and tile drainage have resulted in changes in stream morphology, hydrology, and in stream habitat. Concentrations of pesticides, herbicides, and insecticides were found in streams. Herbicides were detected more frequently than insecticides (USGS 2001 by Stark et al.). Pesticide concentrations were greatest from May to July (Fallon and McNellis 2000).

Changes have occurred in the algal, invertebrate, and fish communities in agricultural areas. Increases in algal abundance and primary production occur from increases in nutrient loading. Composition in algal communities changes to a high percentage of blue-green algae and thus not suitable for invertebrate communities. Agricultural streams had less diverse invertebrate communities possibly due to the disturbances and contaminants from agricultural practices.

Disturbances in Urban Areas

Intense land use changes in urban areas have impacted water quality. Non-point source pollutants result from automobiles, road de-icing chemicals, construction, application of pesticides and fertilizers, atmospheric deposition, debris from street runoff, and animal and plant refuse (Hambrook and others, 1997, as stated in USGS 2001 by Stark et al.). Dissolved-oxygen concentrations in most urban streams were greater than the minimum 5-mg/l aquatic-life criterion determined by the UPEPA (USGS 2001 by Stark et al.). Elevated concentrations of sodium and chloride were found in urban streams. Nitrate and phosphorus concentrations were less than agricultural streams. Polycyclic aromatic hydrocarbons (PAHs), organochlorine compounds (Ocs), and trace elements were common in urban streams, often at concentrations greater than aquatic-life guidelines (McNellis and others, 2000 and Talmadge and others 1999 as listed in USGS 2001). Fecal coliform counts varied largely in the study area; some exceeded the freshwater standard for recreational use (200 col/100mL) (Minnesota Pollution Control Agency as stated in USGS 2001 by Stark et al.). The St. Croix River did show an increase in nitrate concentrations and a decrease in total ammonia concentrations in the Twin Cities between the years 1984-93.

Factors effecting urban streams (Riley 1998 as discussed in USGS 2001 by Stark et al.):

- Impervious surfaces
- Drainage of wetlands
- Construction of detention ponds
- Loss of riparian cover
- Stream channel modifications

Groundwater

In the entire Upper Mississippi River Study Unit in the NAWQA study, 59% of the public water supply comes from groundwater (percentages specific to the St. Croix Basin are not available) (USGS 2001 by Stark et al.).

Shallow wells, commonly found in rural and suburban areas, often contained pesticides, nutrients and industrial chemicals.

The NAWQA study identified the variables impacting groundwater (USGS 2001 by Stark et al.):

- Applications of pesticides and fertilizers
- Confining units and depth to water
- Urban contaminants (road salts, volatile organic carbons)
- Naturally occurring radon gas

Urban impacts on groundwater come from spills, improper disposal of chemicals and landfill leachate. Pesticides, herbicides, insecticides, and volatile organic compounds were frequently detected in urban streams and shallow groundwater (insecticides were detected in only 5% of groundwater) (USGS 2001 by Stark et al.). Nitrate concentrations in the St. Croix River did not exceed the USEPA drinking water standards of 10 mg/l.

Reservation Land (Saad and Robertson, 2000)

The St. Croix Reservation lands are spread over 10 locations in Barron, Burnett, Polk, and Washburn Counties in northwestern Wisconsin and comprise a total of about 3000 acres. The USGS, in cooperation with the St. Croix Chippewa Indians of Wisconsin, reviewed studies and data found in literature, data bases, and various agencies to compile a report on the status of

water resources in 7 of the 10 locations. The focus of this report was on the area near the Reservation rather than on the St. Croix River Watershed upstream from Danbury, Wisconsin. The lakes of special interest to the Tribe are Bashaw, Big Round, Big Sand, Clam, Gaslyn, and Sand Lakes. The streams of special interest are Loon Creek and the St. Croix and Yellow Rivers upstream from St. Croix Reservation lands near Danbury, Wisconsin. The study area including these lakes and streams is an area 707 mi² and is divided into four main watersheds. The dominant land use is forest; other common land use types are grassland, wetland, agriculture, and open water. Water use in the Upper St. Croix River Watershed (which includes the study area) is defined in Table 12.

Table 12. Water use, in million gallons per day, in the Upper River Watershed, Wisconsin, which includes reservation land (Ellefson et al., 1993 and 1997 as cited in Saad and Robertson 2000).

Water use	Year 1990	Year 1995
Domestic	1.81	1.97
Agriculture	3.33	0.54
Irrigation	1.14	1.55
Industrial	0.14	.25
Commercial	0.23	.37
Public	0.32	.27
Percent from groundwater	73%	99%

During the summer months the lakes in the study area phosphorus had an average concentration of 0.029 mg/l, chlorophyll a had an average concentration of 9.9 ug/l and secchi depth averaged 7.3 feet. Drainage lakes had an alkalinity of hard or moderately hard and seepage lakes were soft to very soft. In the few streams that were sampled phosphorus concentrations were generally less than 0.1 mg/l except in the tributaries to Kirby Lake (0.17 mg/l). The St. Croix River at Danbury has been extensively monitored by the USGS. The following data has been collected: average alkalinity was 54 mg/l, average specific conductance was 124 uS/cm, average pH was 7.5, average total phosphorus was 0.02 mg/l, average total nitrogen was 0.52 mg/l and suspended sediment was 10 mg/l.

Chapter 5: Issue Statements

This section of the St. Croix Basin Water Resources Planning Status Report addresses the issues identified as posing the greatest concern to the water resources of St. Croix Basin. These issues were identified through a scoping session and have directed the research and activities of the St. Croix Basin Water Resources Planning Team. The issue identified titles each issue statement. Included in the Issue Statements are the recommendations made by the Basin Team as to how to address each issue, background about the issues, and current research specifically addressing each issue. The research accompanying the issues is not an inclusive list of research about the St. Croix; they represent research specifically addressing the water quality issues identified through the scoping session (see Chapter 1.2, Phase I). The Issue Statements are listed in order of importance recently updated by the Basin Team (6/20/01).

Issue statement identified in Phase I of Plan of Study	Ranking	Page
Establish nutrient budgets for point and nonpoint sources	1	39
Secure funding for the Basin Team coordinator	1	44
Address the impact of urban stormwater runoff and suggest BMPs	2	46
Address the need for long term monitoring	2	47
Increase public participation and knowledge in water quality management	2	50
Resolve differences in water quality standards between the two states	3	53
Forecast the future changes in land and water resources	4	55
Address the impact of rural non point runoff (other than nutrients, sediment, and stormwater)	5	56
Evaluate sediment contamination	6	57
Assess the impact of impoundments	7	59
Assess the condition of the groundwater and suggest a protection strategy, list identified areas of higher sensitivity	8	61
Assess the impact from recreational use	9	63
Develop a common protection strategy for rare and endangered species and natural communities and their habitat	10	66
Assess the impact of water-dependent commercial agricultural operations	11	69
*Develop a GIS information base to track land use changes	No ranking	
*Coordinate fish consumption advisories	No ranking	
Note: New item suggested: Identify and establish goals that reflect public perceptions and intentions; determine and develop a means to measure baselines for these goals and progress towards them; develop an annual report card.	Ranked 2 by those who recommended this item	

*Two issues initially listed in the introduction under the Phase I were not ranked:

- Develop a GIS information base to track land use changes
This item was not ranked because agency websites have links to GIS maps and this issue was no longer determined a priority for the Basin Team to address.
- Coordinate fish consumption advisories
This item was not ranked because it was decided that it is beyond the scope of the Basin Team to recommend changes.

St. Croix Basin Water Resources Planning Team

Issue statement 1: Nutrients

St. Croix Basin Water Resources Planning Status Report

Interagency cooperation

Assimilating public use with multi-regulatory water quality protection

ISSUE STATEMENT 1 Nutrients

Outcome

- Establish nutrient budgets for tributaries and main stem
- Develop management scenarios
- Develop management nutrient goals for the mainstem
- Assess the ability to manage nutrient loading from nonpoint and point sources of nutrients in the Basin.
- Details of process to reach goals
- Partition nonpoint source nutrient load by land use and assess potential nutrient loading reductions by land use type.
- Determine a long-term nutrient monitoring program (see Monitoring Program Issue Statement 4)

Recommendations

- Access the current condition of the St. Croix River and tributaries
- Model the data to determine tributary and point source loading into Lake St. Croix
- Develop nutrient goals for the basin and management scenarios through a Basin wide involvement with point source, non point source, tribal nations, public, local, state, and federal agency personnel and organizations.
- Develop a long term monitoring program and parameters
- Develop and incorporate volunteer monitoring into the program
- Identify nutrient loading reduction potential by watershed and land use
- Develop basin nutrient loading reduction strategies

Accomplished to date:

- Implemented the interagency Nutrient Monitoring, Modeling and Management Project
- Assessed the mainstem water quality in Lake St. Croix and St. Croix Falls flowage
- Assessed acceptable water quality perceptions in the main stem from volunteer water quality monitoring
- Developing a model of nutrient loading and reports on nutrient conditions
- Developing a sensitivity analysis of the St. Croix main stem and tributaries
- Developing management scenarios
- Established a voluntary program of “no net increase in nutrients” for point sources in the St. Croix River
- Implementing Project NEMO (Non point education for municipal officials)

Background

Excerpt from Phase II Document

This subcommittee should recommend monitoring sites and parameters to enable development of a nutrient budget for the watershed, in Coordination with the NPS Water Resources Management Plan and NAWQA Study. The nutrient budget would be stratified by ecoregion with particular attention to Lake St. Croix. A citizen monitoring program should be considered as part of the strategy.

The St. Croix River is generally considered to have good water quality, but there are indications of degradation in some portions of the river. A paleolimnological assessment conducted in Lake St. Croix has indicated that the lake has become more eutrophic when compared to presettlement water quality conditions (Troelstrup et al, 1993). Water quality studies have indicated that some tributaries to the St. Croix River have higher concentrations of nutrients than the St. Croix. These higher nutrient levels result from point source discharges, non-point source pollution, major land use changes and naturally high soil fertility.

St. Croix Basin Water Resources Planning Team

Issue statement 1: Nutrients

St. Croix Basin Water Resources Planning Status Report

Interagency cooperation

Assimilating public use with multi-regulatory water quality protection

Recommendation: Water quality nutrient goals should be established for the entire St. Croix River basin, which represent a best managed condition for nutrient inputs. Achieving these goals may require the

reduction of both point and non-point sources of phosphorus to the St. Croix River. Point sources of phosphorus include discharges from municipal and industrial wastewater treatment facilities. Non-point sources of nutrients develop from urban and rural land use conditions that increase nutrient concentrations in surface runoff and in groundwater that ultimately discharges to streams. The objective of developing a nutrient budget for the St. Croix River Basin is to identify tributary watersheds contributing the largest quantities of nutrients to the St. Croix River.

Related research

- ***Nutrient Sources Within the Upper Mississippi River Basin, Minnesota and Wisconsin, 1991-1993***, Sharon Kroening, United States Geological Survey, 1998.

Understanding the source of nutrients within a basin can assist in the management of surface and groundwater. This study summarizes the amount of nitrogen and phosphorus in each basin (Lower Mississippi River Basin, St. Croix River Basin, Upper Mississippi River Basin, and the Minnesota River Basin) of the Upper Mississippi River Basin during the years of 1991-1993. The Minnesota and Wisconsin Agricultural Statistics Services provided the data on the production per study area by land use. The total amount of phosphorus and nitrogen from the sources studied (fertilizer, livestock manure, municipal wastewater, atmospheric deposition, and legume residue) in the St. Croix Basin are 8 tons of nitrogen and 0.9 tons of phosphorus per year per square mile. Table 13 shows the amounts of nitrogen and phosphorus by source in the St. Croix River Basin.

Table 13. Amounts of phosphorus and nitrogen in the St. Croix Basin in tons per year per square mile (USGS 1998 by Kroening).

Source	Nitrogen tons/year/mi ²	Phosphorus tons/year/mi ²
Fertilizer	2.5 (July 1990-June 1991 estimate)	0.45
Livestock manure	2.09 (1992 estimate)	0.45
Legume residues	1.5 (1993 estimate)	-
Atmospheric deposition	1.99 (1993 estimate)	-
Municipal wastewater	0.02 (1993 estimate)	0.007
Yield in stream at basin outlet	0.78 (1991-93 average)	0.03

- ***Nutrients and Suspended Sediment in Snowmelt Runoff from part of the Upper Mississippi River Basin, Minnesota and Wisconsin, 1997***, James Fallon and Ryan McNellis, United States Geological Society, 2000.

Conditions during fall of 1996 and spring 1997 lead to flood conditions during the spring snowmelt study. Twenty sites were sampled on the St. Croix River. Percentages of land use (forested, agriculture, urban, wetland, water, or other, which includes rangeland) and surficial geology were computed for each site. During the study, snowmelt concentrations of suspended sediment peaked on the rising limb of the hydrograph. Agricultural streams and areas with low permeable soils transported the greatest proportions of loads during snowmelt, followed by forested areas. Urban areas contributed the lowest proportions of loads from nutrients and sediment. During 1997 agricultural and forested streams delivered proportionately more of their loads during snowmelt than during other periods.

The following sites were sampled on the St. Croix: 1) St. Croix River near Woodland Corner, WI., 2) Namekagon River at Leonards, WI., 3) Namekagon River near Woodland Corner, WI., 4) St. Croix River near Danbury, WI., 5) Yellow River near Danbury, WI., 6) Crooked Creek near Hinkley, MN., 7) Clam River near Webster, WI., 8) Kettle River below Sandstone, MN., 9) Snake River near Pine City, MN., 10) Wood River at State Highway 70 near Grantsburg, WI., 11) Sunrise River at Sunrise, MN., 12)

Trade River near Trade River, WI., 13) St. Croix River at St. Croix Falls, WI., 14) St. Croix tributary near Osceola, WI., 15) Apple River near Range, WI., 16) Apple River near Somerset, WI., 17) Browns Creek at Stillwater, MN., 18) Willow River at Burkhardt, WI., 19) Kinnickinnic River near River Falls, WI., 20) St. Croix River as Prescott.

- **Phosphorus, Chlorophyll, and Suspended Sediment in the Lower St. Croix River: 1976 – 1996**, Abstract, Meyer et al., Metropolitan Council, Environmental Services, 1999.

The Metropolitan Council Environmental Services (MCES) established a river monitoring program in 1976. Two sites on the St. Croix River were included: Prescott, WI. and Stillwater, Minnesota. Table 14 summarizes the results from 1976 to 1996 for total phosphorus, soluble reactive phosphorus, chlorophyll-a, total suspended solids and suspended volatile solids at Prescott for the St. Croix Basin.

Table 14. Results for MCES monitoring from 1976-1996 at Prescott

Variable	Prescott
Total phosphorus concentrations (TP) (annual mean)	0.05 mg / l
Total phosphorus loads (annual mean)	262 ton / yr
Total phosphorus annual yield (annual mean)	0.14 lb/ac/yr
Soluble reactive phosphorus (SRP) (annual mean)	113 ton / yr
Chlorophyll-a (annual mean)	9 ug / l

Non-point sources dominated the phosphorus loads during high flow years, and point source phosphorus dominated during low flow years. Annual mean total phosphorus loads were predominately soluble reactive phosphorus in low flow years. 51 ton TP / yr are discharged from the 46 wastewater treatment facilities in the St. Croix Basin.

- **Post-settlement Nutrient and Sediment Analysis in Lake St. Croix,**

Abstract, Edlund, Mark, St. Croix Watershed Research Station Science Museum of Minnesota, *Protecting the St. Croix: Reducing and Managing Nutrients and Sediment* 2nd Annual Conference. Cores were recovered in 1999 from Lake St. Croix to determine historical sediment loading, changes in total phosphorus concentrations and diatom assemblages. Since presettlement conditions several changes have occurred: a three fold increase in sediment accumulations, changes in the percentages of inorganic to organic, fifty-fold increase in diatom accumulation, changes from benthic-dominated to planktonic-dominated productivity, and total phosphorus values changed from a 2 ½ - to 3 fold increase.

- **Sampling Strategies and Nutrient and Sediment Concentrations and Loads in Tributaries to the St. Croix National Scenic Riverway – 1997-99**, Bernard Lenz, United States Geological Society, 2001.

This study involved intensive tributary monitoring on the St. Croix during 1998 and summaries of two prior studies. The first study, in 1997, was a synoptic study included in the NAWQA program. This study surveyed nutrient and suspended sediment concentrations during snowmelt. In 1998, synoptic studies measured nutrients and sediment on 11 tributaries during snowmelt, base-flow, and storm-runoff periods. In the third study extensive water quality sampling was done monthly and during high flow events in water year 1999. Incorporating the results of the three studies nutrient and sediment loads and yields were determined for the tributaries. Land use for each drainage basin was calculated (Table 15). Due to the great variability in rain events in the region in 1999, annual yields in the northern forested basins were higher than those from the southern, agricultural areas (contrary to common knowledge). Lack of a significant spring snowmelt runoff lead to lower than average spring flows and lower than normal spring loads. The northern portion of the Basin had higher intensity rain events with higher erosivity causing high runoff. The southern portion of the basin had longer duration, smaller storms causing limited runoff. The environmental factors found to best predict yields were soil characteristics (clay, permeability of soil, and K factor from universal soil loss equation), basin slope and area, and the percentages of wetland and urban areas in the basins.

Table 15. Land use by selected tributaries in the St. Croix Basin (USGS 2001 by Lenz et al.)

Basin	Urban	Agr	Forest	Open Water	Forested wetland	Non-forested wetland	Barren Land
Apple	0.5%	62.7%	24.4%	5.2%	5.2%	1.9%	0.1%
Brown	4.2%	82.3%	5.8%	4.3%	2.9%	0.0%	0.5%
Carnel	0.0%	86.0%	11.2%	2.7%	0.0%	0.0%	0.0%
Clam	0.3%	32.1%	54.6%	3.1%	7.1%	2.8%	0.0%
Crook	0.0%	17.5%	69.2%	1.4%	7.6%	4.3%	0.0%
Kettle	0.5%	26.8%	52.5%	1.7%	12.9%	5.4%	0.1%
Kinnick	2.3%	92.9%	4.6%	0.2%	0.0%	0.0%	0.0%
Low tam	0.0%	3.7%	74.7%	0.1%	16.4%	5.1%	0.0%
Namekag	0.7%	1.8%	77.9%	6.3%	12.3%	0.1%	1.0%
Sand	0.0%	23.2%	62.0%	0.1%	3.3%	11.4%	0.0%
Silver	0.4%	90.2%	1.7%	7.2%	0.0%	0.0%	0.6%
Snake	0.4%	40.4%	41.7%	1.2%	10.8%	5.6%	0.0%
Sunrise	2.6%	58.1%	8.3%	5.3%	17.7%	8.0%	0.1%
Trade	0.5%	47.2%	37.5%	2.6%	4.3%	8.0%	0.0%
Up tam	0.0%	2.4%	74.8%	0.3%	19.6%	2.9%	0.0%
Valley	1.9%	86.1%	9.9%	0.6%	0.0%	0.0%	1.5%
Willow	0.8%	89.3%	8.0%	0.9%	0.3%	0.7%	0.0%
Wood	0.4%	55.2%	37.7%	4.5%	1.3%	0.9%	0.0%
Yellow	0.8%	20.4%	58.5%	8.8%	7.0%	2.8%	1.9%

The Sunrise River had the highest total phosphorus and sediment annual yield of the tributaries studied. The highest total phosphorus and sediment annual loads were found in Kettle River. Significant sediment contributions came from Sand Creek, Snake River, Upper Tamarack River. Significant phosphorus contributions were made from Snake, Apple, Upper Tamarack, and Kinnickinnic Rivers. The snowmelt runoff study (USGS 2000) indicated the Sunrise, Kinnickinnic, Apple, Willow, Kettle, Snake, Trade, Wood, Sand, Crooked, and Lower Tamarack Rivers to be the significant contributors to the St. Croix Basin loading.

A study of the benthic invertebrates was also included in this study. Biotic indexes for Valley Creek and Willow River showed them to be slightly impaired from organic pollution. Biotic indexes showed Kettle River to be impacted with a low diversity. The other St. Croix tributaries were found to have good to excellent water quality.

- **Volunteer Monitoring: Water Quality and Perceptions, Integrated Watershed Management,** Pamela Davis, St. Croix Basin Water Resources Planning Team, 2001.

Volunteer monitoring was started on Lake St. Croix the summer of 1999 as part of the tributary monitoring study by the USGS (2001). In addition to the importance of building a stewardship program, water quality perceptions as obtained from weekly volunteer monitoring surveys were part of developing integrated watershed management. Determining a relationship between chlorophyll a concentrations and physical condition ratings integrates public perception into a basin wide nutrient goal setting process. Analyzing two years of data (summers 1999 and 2000) found an r^2 of 0.548 ($p = 0.0143$) between viable chlorophyll a concentrations and physical condition ratings.

Related documents

- Effects of Ammonia on Unionid Mussels: A Threat to Their Biodiversity in the St. Croix National Scenic Riverway

- Historical Trends Affecting Accumulations of Sediment and Phosphorus in Lake Pepin
- Minnesota Pollution Control Agency phosphorus strategy
- Nutrient Sources Within the Upper Mississippi River Basin, Minnesota and Wisconsin, 1991-1993
- Nutrients and Suspended Sediment in Snowmelt Runoff from part of the Upper Mississippi River Basin, Minnesota and Wisconsin, 1997
- Phosphorus strategy of Minnesota Pollution Control Agency
- Post-settlement Nutrient and Sediment Analysis in Lake St. Croix
- Protecting Water Quality in Urban Areas, Best Management Practices for Dealing with Storm Water Runoff from Urban, Suburban and Developing Areas of Minnesota
- St. Croix River Basin Information Document 1999 Draft
- St. Croix River Basin Nutrient Monitoring, Modeling, and Management Project Plan
- St. Croix River Water Quality Management Plan
- Water Quality Assessment of Part of the Upper Mississippi River Basin, Minnesota and Wisconsin – Design and Implementation of Water-Quality Studies, 1995-1998
- Water Quality in the St. Croix National Scenic Riverway, Wisconsin
- Water Quality in the Upper Mississippi River Basin, Minnesota, Wisconsin, South Dakota, Iowa, and North Dakota, 1995-1998
- <http://scwatershed.org/basinteam>
- Project NEMO: <http://www.lib.uconn.edu/CAN/ces/nemo>

St. Croix Basin Water Resources Planning Team

Issue statement 2: Coordinator

St. Croix Basin Water Resources Planning Status Report

Interagency cooperation

Assimilating public use with multi-regulatory water quality protection

St. Croix Basin Water Resources Planning Status Report, Issue statement 2: Coordinator

ISSUE STATEMENT 2

Securing funding for the St. Croix Basin Team Coordinator

Outcome

- Coordinate the administrative needs, activities, and projects of the Basin Team
- Write the St. Croix Basin Water Resources Planning Status Report
- Develop and sustain links to other water quality organizations associated with the Basin
- Support and assist in developing the stewardship program and volunteer monitoring
- Assist in securing funding for projects
- Represent the Basin Team at conferences
- Administer the Implementation Phase of the Basin Plan
- Support the continuation of the Basin Team, in particular with the demise of the Minnesota-Wisconsin Boundary Area Commission

Recommendations

- A full time permanent Basin Team coordinator needs to be hired, in particular since the Minnesota Wisconsin Boundary Area Commission is no longer in operation to support the team. Accomplishing the Implementation Phase of the Planning Status Report and other Basin planning and decision making programs will be impossible without a permanent coordinator. Commitments to programs and other activities cannot be made given the uncertainty of this position.

Coordinator accomplished to date:

- Creation of a basin wide water quality plan with a detailed Implementation Phase Organized and facilitated basin team meetings and subcommittee meetings
- Coordinated the volunteer monitoring program on Lake St. Croix
- Created a Basin Team brochure and poster
- Contributed to a website for the Basin Team
- Coordinated the yearly Basin Team nutrient conference
- Writing funding proposals for project development
- Served as liaison to other organizations serving the St. Croix Basin, including presentations
- Initiated a pilot project for Non point Education for Municipal Officials (NEMO) in the St. Croix Basin
- Issued letters or requests of our *no net increase in nutrients* interim goal upon public notice of reissuance of NPDES permits
- Analyzed the data for the Lake St. Croix Volunteer Monitoring program
- Administered communication and programs on behalf of the Basin Team and among Basin Team members through email, letters, phone, and meeting notes

Background

Funding for a coordinator position was initiated through the National Park Service, Minnesota Wisconsin Boundary Area Commission and the Metropolitan Council Environmental Services (MCES) in 1999. Metropolitan Council provided \$75,000 for two years to initiate the position and complete the Planning Status Report. The Wisconsin Department of Natural Resources has contributed \$4900 yearly. The Minnesota Wisconsin Boundary Area Commission provided in kind contributions. The National Park Service provided an office and administrative support for the first two years. The initial two-year funding from MCES ended July 31, 2001. The objective was to turn this position into a permanent position funded by the Basin Team members' agencies, which has not been achieved. \$15,900 additional funding was secured through a

National Park Service challenge grant. The challenge grant plus funding from the Wisconsin Department of Natural Resources will extend the position on a part time basis to the end of April 2002. A three year proposal was written for EPA / MPCA 319 funding. Results will be announced the end of January 2002.

Interagency cooperation

Assimilating public use with multi-regulatory water quality protection

**ISSUE STATEMENT 3
Urban stormwater runoff**

Outcome

- Determine management scenarios and best management practices
- Documentation of existing conditions
- List of goals for management scenarios
- Details of process to reach goals
- Recommend a strategy for identifying and prioritizing areas where stormwater planning and management will be necessary to protect the water resources in the St. Croix Basin from stormwater impacts.

Recommendations

- Evaluate impact on water quality from stormwater runoff
- Identify current stormwater practices (ie., Preventing Stormwater Runoff Problems Through Watershed Land Design, Department of Landscape Architecture, University of Minnesota)

Background

Excerpt from Phase II Document

This subcommittee should recommend a strategy for identifying and prioritizing areas where stormwater planning and management will be necessary to protect the water resources in the St. Croix Basin from stormwater impacts.

Stormwater has the potential of being one of the last uncontrolled sources of pollution to the St. Croix watershed. Both urban and rural areas can contribute very large loads of pollutants to the watershed. The rural sources include barnyards, agricultural practices, upland erosion, and gully or streambank erosion. Urban sources include construction practices and runoff from streets, parking lots, driveways, large buildings and other impervious surfaces that form the urban landscape. Urban pollutants of concern include sediments, heavy metals, pesticides and PAH's.

Recommendation: The St. Croix Basin planning process should consider inputs to and effects on the water resources of the basin caused by stormwater runoff and management practices. The interstate planning process should identify stormwater management practices that should be implemented or improved to protect water resources in the St. Croix Basin from stormwater impacts. Project NEMO (Non Point Education of Municipal Officials) needs to be implemented in the St. Croix Basin.

Related documents

- Preventing Stormwater Runoff Problems Through Watershed Land Design
- Protecting Water Quality in Urban Areas, Best Management Practices for Dealing with Storm Water Runoff from Urban, Suburban and Developing Areas of Minnesota
- Project NEMO: <http://www.lib.uconn.edu/CAN/ces/nemo>

Report, Issue statement 3: non point runoff

St. Croix Basin Water Resources Planning Team

Issue statement 4: Monitoring

St. Croix Basin Water Resources Planning Status Report

Interagency cooperation

Assimilating public use with multi-regulatory water quality protection

ISSUE STATEMENT 4 Monitoring Program

Outcome

- Develop and implement a long term monitoring program including volunteer monitoring and goals to be achieved
- Secure funding for a long term monitoring program

Recommendations

- Create a list of variables to be monitored and why
 - Ammonia
 - Sediment (turbidity, suspended sediments)
 - Biomonitoring : IBI (insects, fish)
 - Heavy metals (lead, mercury)
 - Pathogens
 - Nutrients
 - Fish tissue (for fish advisory)
 - NAWQA study variables: recommend study be continued
 - Endangered species
 - Land use changes / variables
- Integrate the St. Croix Chippewa tribe monitoring plan
- Coordinate existing volunteer monitoring in the Basin; initiate new programs
- Develop a Basin wide monitoring program

Accomplished to date

- Interagency tributary and mainstem nutrient study
- Volunteer monitoring program on Lake St. Croix
- Coordinating monitoring program with Washington County in Minnesota
- *Index of Biotic Integrity Guidance for Coolwater Rivers and Stream of the St. Croix River Basin* by Scott Niemela and Michael Feist.

Background

Excerpt from Phase II Document

This subcommittee should develop and recommend a coordinate monitoring and data management program for the St. Croix River and its watershed. Currently, monitoring coordination occurs only between the MPCA and WDNR. These two agencies have semiannual meetings to discuss issues of mutual interest on the Mississippi and St. Croix Rivers on the interstate border. Coordination of monitoring is only one of several issues discussed at these meetings.

Recommendations: There is a need for coordination of monitoring beyond the informal consultation level. The state and federal agencies should, to the extent possible, develop a joint monitoring program to identify those adverse impacts which degrade water quality systemically in the St. Croix River and its drainage basin. All monitoring efforts should be coordinated with the St. Croix Stewardship Project, Upper Mississippi NAWQA program, the Tri-State Biodiversity Assessment program, and other ongoing studies. The St. Croix Basin Water Quality Management Plan should include the design, parameters, protocols and reporting procedures for any joint monitoring programs undertaken by the cooperating agencies. Consideration should be given to the establishment of a cooperative, permanent long-term water quality monitoring network for the entire St. Croix River Basin. The planning process should include an investigation of the need for an Upper St. Croix Basin water quality research effort, similar in scope to the Lower St. Croix

St. Croix Basin Water Resources Planning Team

Issue statement 4: Monitoring

St. Croix Basin Water Resources Planning Status Report

Interagency cooperation

Assimilating public use with multi-regulatory water quality protection

Stewardship Project. This effort should be coordinated with USGS Biological Resources Division and the St. Croix Watershed Research Station of the Science Museum of Minnesota.

The cooperating agencies should seek to develop compatible water quality data management and retrieval capabilities reflective of their common interest in and commitment to the improvement and protection of the quality of the waters of the St. Croix River Basin. For trend analysis long term monitoring is required. In 1976 the MCES started monitoring two sites: Stillwater and Prescott. These two sites provide the only long term monitoring data (see Issue Statement 1, Table 13). The USGS NAWQA program begins again in 2004 and will include the St. Croix Basin (the specifics are uncertain at the time of printing this document). Several localized monitoring programs have begun on the St. Croix River and the tributaries. The St. Croix Chippewa Tribe of Wisconsin has developed a monitoring program for their general geographical location (St. Croix Water Quality Assessment QAPP 2001). Local volunteer monitoring programs are starting around the Basin, such as the Sunrise River coordinated by the PICKM group (Pine, Isanti, Chisago, Kannabec, and Milles Lacs County local agencies).

A coordinated effort of all the monitoring and the initiation of new volunteer programs need to be incorporated into Basin planning. From a directive from the governor, Minnesota is engaging in a 10-year process toward unifying water management in the state. As part of this process basin teams have materialized to determine specific goals and objectives for Minnesota's major water basins and to identify common concerns. The resulting document entitled *Minnesota Watermarks: Gauging the Flow of Progress 2000-2010* details the results of the first phase of this 10 year initiative and explains the goals and objectives by watershed (www.mnplan.state.mn.us). The St. Croix section of *Minnesota Watermarks* emphasized the need for long term monitoring and data collection in the Basin. The common goals and objectives for all Minnesota major basins are listed in Chapter One, Table 1. Included in the Basin Plan is the four-page section on the St. Croix Basin copied from *Minnesota Watermarks* (Appendix 2).

Related information

The Water Resources Management Plan for the National Scenic Riverway prepared by the National Park Service (Holmberg 1997) includes water quality monitoring within each of the top three priorities of water quality concern in the St. Croix River. The third priority focuses entirely on the need for long term base line water quality monitoring to assess the condition of the St. Croix River. With the tremendous population increases taking place in the St. Croix Valley (Washington, Chisago, and Pine Counties in Minnesota experienced increases of 39%, 39%, and 16% respectively from 1990 – 1999; in Wisconsin, St. Croix County had a +20% and Hudson Township had a +70% increase. Accompanying these population growths are impacts to water quality.

The St. Croix Basin has been included in several significant studies that provided event and short term monitoring. The United States Geological Survey's NAWQA program monitored from 1995 to 1998. The Basin Team has requested the next phase of the NAWQA program to include the St. Croix Basin. An interagency nutrient subcommittee (Minnesota Pollution Control Agency, Wisconsin Department of Natural Resources, USGS, National Park Service, Metropolitan Council Environmental Services) monitored the tributaries and the St. Croix River during an intensive study of nutrients from 1998 to 1999. Included with the nutrient subcommittee monitoring was the creation of volunteer monitoring on Lake St. Croix (started in 1999 and on going). The MPCA completed a biomonitoring program from 1996-1997. The MCES has been monitoring nutrients in Lake St. Croix since the 1970s from Stillwater to Prescott. At Prescott, they have been monitoring since 1934.

The intensive interagency nutrient study was critical in developing nutrient models for the Basin. These studies have been instrumental in developing goals and funding for water resource protection in the St. Croix Basin.

Related documents

- Sampling Strategies and Nutrient and Sediment Concentrations and Loads in Tributaries to the St. Croix National Scenic Riverway – 1997-99
- St. Croix River Basin Nutrient Monitoring, Modeling, and Management Project Plan
- St. Croix Water Quality Assessment QAPP, Project Description, Sampling Procedure, St. Croix St. Croix Chippewa Indians of Wisconsin
- Volunteer Monitoring: Water Quality and Perceptions, Integrated Watershed Management

- Water Quality in the Upper Mississippi River Basin, Minnesota, Wisconsin, South Dakota, Iowa, and North Dakota, 1995-1998
- <http://scwatershed.org/basinteam>

Interagency cooperation

Assimilating public use with multi-regulatory water quality protection

**ISSUE STATEMENT 5
Public involvement and stewardship**

Outcome

- To create, implement, and coordinate a program that would: 1) integrate existing efforts, 2) support an expanded volunteer monitoring program, 3) develop a permanent organization of public involvement in water resource policies, 4) support watershed management educational activities.
- Coordinate all management efforts in the Basin, including the local level, so that mainstem goals are addressed as well as local water quality goals.

Recommendations

- Target funding opportunities
- Organize a group of participants to develop a program and create goals
- Develop a list of existing activities
- Further website development
- Develop a long term plan for a goal setting process

Accomplished to date

- Expanded interaction with other planning organizations and efforts, state and municipal
- **A Stream Protection Strategy, Guidance for Watershed Stewardship Lower St. Croix River** (see appendix 5)
- Project NEMO program (non point education for municipal officials)
- Volunteer monitoring program
- Challenge Grant for stewardship initiatives
- A few of the activities sponsored by the Minnesota-Wisconsin Boundary Area Commission (the list is too long to include in this statement)
 - St. Croix Watershed Stewardship website in partnership with the National Park Service (<http://scwatershed.org>)
 - An annual St. Croix River Expo
 - *St. Croix River Stewards Journal*, published semi annually
 - *Lower St. Croix Watershed Conservation Assessment* (in process)
 - *Stewardship of the Lower St. Croix River and Its Watershed*
 - *River Stewardship Guide for Landowners, Local Government Officials and Others* (MWBAC 1994)
 - The Riverkeepers Guide, Landowners Volume
 - The Riverkeepers Guide, Local Government Volume

Background

Excerpts from Phase II document

This subcommittee should develop a comprehensive public involvement program for the St. Croix River Basin Water Resources Management Plan effort and implement activities in coordination with the St. Croix Basin Planning Team and other related basin area planning activities of state and federal agencies.

Identification of stakeholders

The Basin Planning Team should collaborate in identifying the stakeholders who should be informed and/or involved in the formulation of the plan.

Coordination with NAWQA Project Liaison Committee

The Basin Planning Team linked with the Upper Mississippi NAWQA Project Liaison Committee to be established by the USGS for the initial study. Coordination efforts are under way for the 2004 phase.

Plan formulation process

The plan formulation process will include an explicit outline of activities and opportunities for public involvement, including information, media relations and meeting arrangement responsibilities.

Plan implementation process

The effective implementation of the plan will depend, in large part, on the willingness of basin stakeholders to do their part to protect the waters of the basin. This commitment must be cultivated through active involvement in plan formulation, so that those who will need to take some specific action to implement the plan will support it because they helped to write it. The plan should acknowledge and reflect such input and commitments.

Promotion of a citizen-based monitoring and stewardship program

In order to stimulate active early commitment to watershed management concepts and build public stewardship and support for the basin plan, the cooperating agencies will promote involvement by volunteer groups and individuals in organized programs, such as Adopt-a-River and Riverwatch programs, for the St. Croix River and its tributaries throughout the plan formulation process, and incorporate such a program in the basin plan.

Related information

The St. Croix Basin's sense of community developed from the St. Croix River. Native Americans utilized its ecosystem for food and medicine and the water for transportation. Using the river as a highway giant white pines were transported to mills, processed, and distributed to markets all over the country. Beaver trapped on its banks was made into clothing for Europeans. Currently, over 1 million visitors a year visit the St. Croix. Finding a balance that will protect the water resources while supporting its uses is a goal of the Basin Team and the Basin Plan. Public support and stewardship has played a dominant role in water quality protection.

One of the four goals of the St. Croix Basin Team is to increase public participation and knowledge in water quality management. In year 2000, the Basin Team started an annual conference on nutrient and sediment impacts on water quality in the St. Croix Basin. In addition to education and outreach, the conference in 2001 provided an opportunity for input into the goal setting process for nutrient and sediment management. In 1999 the Basin Team hired a coordinator. Part of the responsibilities of the coordinator is to attend the meetings of other water resource groups and adopt a basin wide communication strategy. Project NEMO (Non point Education for Municipal Officials), created by the University of Connecticut Extension, provides education on the importance of natural resource protection in local planning. The Basin Team hopes to use Project NEMO as one of its programs to encourage local input towards water quality protection of the St. Croix Basin. Volunteer monitoring on Lake St. Croix has provided important monitoring data and encouraged stewardship.

Leadership for public involvement and stewardship of the St. Croix Basin has come from the Minnesota Wisconsin Boundary Area Commission. From its inception in 1965 the Commission has facilitated and enhanced agency activities while integrating the public into policy decisions. Several events and documents have been developed by the MWBAC to provide legislative, natural, and cultural insight into the St. Croix River.

- St. Croix Watershed Stewardship website in partnership with the National Park Service (<http://scwatershed.org>)
- Two annual St. Croix River Expos
- *St. Croix River Stewards Journal*, published semi annually
- *Lower St. Croix Watershed Conservation Assessment* (in process)
 - *Stewardship of the Lower St. Croix River and Its Watershed* (MWBAC 1994)
 - *River Stewardship Guide for Landowners, Local Government Officials and Others* (MWBAC 1994)
 - The Riverkeepers Guide, Landowners Volume
 - The Riverkeepers Guide, Local Government Volume

With the closing of the MWBAC, stewardship programs and Basin partnerships are in jeopardy. The St. Croix Basin Team needs to coordinate a program supporting stewardship, within integrative basin management to support, maintain, and continue the efforts of the MWBAC (closed in 2001). This program would integrate

existing efforts, support an expanded volunteer monitoring program, develop a permanent organization of public involvement in water resource policies, and support watershed management educational activities. For example, when an individual wants to address an area of concern, such as stream bank erosion, what are the contacts and processes this person needs to follow? Is there funding available? How can a concerned individual begin a volunteer monitoring program to engage in streambank restoration? A centralized location and staff would provide the information to assist in the answers to these questions.

Related documents

- Final Cooperative Management Plan Environmental Impact Statement Lower St. Croix National Scenic Riverway (2001)
- Lower St. Croix Watershed Conservation Assessment
- River Stewardship Guide for Landowners, Local Government Officials and Others (MWBAC 1994)
 - a. The Riverkeepers Guide, Landowners Volume
 - b. The Riverkeepers Guide, Local Government Volume
- Guidance for Watershed Stewardship Lower St. Croix River A Stream Protection Strategy
- St. Croix Basin Water Resources Planning Team, brochure
- St. Croix River Stewards Journal, published semi annually
- St. Croix Watershed Stewardship (<http://scwatershed.org>)
- Stewardship of the Lower St. Croix River and Its Watershed (MWBAC 1994)
- Volunteer Monitoring: Water Quality and Perceptions, Integrated Watershed Management (2001)
- <http://scwatershed.org/basinteam>
- Project NEMO: <http://www.lib.uconn.edu/CAN/ces/nemo>

St. Croix Basin Water Resources Planning Team

Issue statement 6: Difference in standards between Minnesota and Wisconsin
St. Croix Basin Water Resources Planning Status Report

Interagency cooperation

Assimilating public use with multi-regulatory water quality protection

ISSUE STATEMENT 6 **Resolve differences in water quality standards between the two states**

Outcome

- A common protection strategy between states which results in equal protection of the St. Croix mainstem

Recommendations

- Identify the differences in classification description
- Review all St. Croix River plans including local watershed regulations
- List differences in plans, potential conflicts in regards to WQ standards and antidegradation policies
- Develop a plan to address these differences
- Develop a strategy between states which results in equal protection of the St. Croix.

Accomplishments to date

- Meeting among management of Wisconsin and Minnesota on June 21, 2001; issues not resolved.

Background

Excerpt from Phase II document

This subcommittee should review current standards and how they are set by each state, and recommend ways to resolve differences for consistent protection of the resources.

Stream classification systems used by Minnesota and Wisconsin use the federal Clean Water Act for overall guidance. Both states use these classifications in their application of water quality standards and antidegradation policies. Minnesota lists the St. Croix River as an Outstanding Resource Value Water. Wisconsin classifies most of the St. Croix River and all of the Namekagon River as Outstanding Resource Waters. Two segments of the St. Croix River have less restrictive Exceptional Resource Water classification in Wisconsin: St. Croix Falls to Osceola, and Hudson to the confluence with the Mississippi River. In addition to some differences in classification, the two states may use different criteria for maintaining "antidegradation." These differences could lead to inconsistencies between the two states in protection of the St. Croix River.

Recommendation: The interstate water quality planning process should include a review of how Minnesota and Wisconsin apply water quality standards and antidegradation policies on the St. Croix River. Individuals familiar with water quality standards development from the two states are needed for this review. The states should resolve differences which result in inconsistent protection of the St. Croix River.

Related documents

Amended from the Water Resources Management Plan written in 1997 for the National Park Service:

Both Wisconsin and Minnesota, using the federal Clean Water Act for overall guidance, recognize the quality of the water of the St. Croix Riverway and give most of it the highest level of protection allowed in each state. Although each state defines their designations differently, the goals and objectives are essentially the same - to prevent any degradation in water quality of the Riverway. With different designations and definitions of the designations, inconsistencies between the two states in protection of the Riverway occur.

Wisconsin classifies the Namekagon River from the outlet at Lake Namekagon to its confluence with the St. Croix, and the St. Croix from the St. Croix Flowage dam in Douglas County to the northern boundary of the St. Croix Falls city limits, as Outstanding Resource Water (ORW). Wisconsin classifies the St. Croix as Exceptional Resource Water (ERW) from the northern city limit of St. Croix Falls to one mile below the State Highway 243 bridge at Osceola. The ORW classification resumes from this point to the northern boundary of the Hudson city limits. From Hudson to the confluence with the Mississippi River, the St. Croix is classified as an ERW.

As stated in the Water Quality Management Plan, Wisconsin Department of Natural Resources, 1994: "In Wisconsin, Outstanding Resource Waters have the highest value as a resource, excellent water quality and high quality fisheries. They do not receive wastewater discharges and point source discharges will not be allowed in the future unless the quality of such a discharge meets or exceeds the quality in the receiving water. This classification includes national and state wild and scenic rivers and the highest quality Class I trout streams in the state. Exceptional resource waters have excellent water quality and valued fisheries but already receive wastewater discharges or may receive future discharges necessary to correct environmental or public health problems. This classification includes about 1400 trout stream segments (in Wisconsin) not classified as outstanding resource waters."

Amended from the draft St. Croix River Basin Information Document, 1999, Minnesota Pollution Control Agency:

In Minnesota, the entire reach of the St. Croix River, as well as its Kettle River tributary, is designated as Outstanding Resource Value Waters (ORVW). Under Minnesota Law, a water body designated as an Outstanding Resource Value Water means that it falls into the category of water bodies which are recognized as exceptional recreational, cultural, aesthetic, or scientific resources and are thus deserving of special protection. ORVW states that no new or expanded discharge of any sewage, industrial waste, or other waste is allowed unless there is no prudent and feasible alternative to the discharge. If allowed, the discharge shall be restricted to the extent necessary to preserve the existing high quality, or to preserve the wilderness, scientific, recreational, or other special characteristics that make the water an ORVW. In addition, new or expanded discharges to waters that flow into ORVW are to be controlled so as to assure no deterioration in the quality of the downstream ORV Water. The classification allowed existing dischargers at the level permitted at the time of the ORVW rule (1984; in addition, the MPCA has assigned a mass cap for point sources that discharge directly into the St. Croix River).

St. Croix Basin Water Resources Planning Team

Issue statement 7: Forecast future changes in land use, impact on water quality
St. Croix Basin Water Resources Planning Status Report

Interagency cooperation

Assimilating public use with multi-regulatory water quality protection

ISSUE STATEMENT 7

Forecast future land use changes and the impact on water quality

Outcome

- f* To be able to make decisions and develop management strategies now to protect water resources in the future
- f* Compare current water resource conditions to predicted conditions in the future

Recommendations

- f* Define and map ecoregions (Obernirk); divide into subwatershed units or geomorphic divisions (used by Washington County)
- f* Compare pre-european settlement conditions to current conditions
- f* Compare the impact current settlement has had on natural conditions
- f* Geographical assessment; assess future changes impact on WQ
- f* Geological assessment; assess future changes impact on WQ
- f* Hydrologic assessment; assess future changes impact on WQ
- f* Define acceptable future water resource conditions
- f* Determine management goals and strategies to protect for future water resource conditions

Accomplishments to date

- f* Support the Metropolitan Council's and Wisconsin Department of Natural Resources Natural Resources Inventory and Smart Growth programs
- f* Implementing Project NEMO (Non point education for municipal officials)

Back ground

Excerpt from Phase II booklet

A general geographical, geological and land use assessment of the St. Croix River Basin and its tributary watersheds is needed to understand the basic existing conditions.

The ecoregion conditions, including geology, geography and hydrology, will determine any natural limitations to management strategies that could be developed to protect and improve water resource conditions in the St. Croix River Basin. Ecoregion boundaries as identified by Omernik (1988) should be utilized within each tributary watershed.

The Ecoregions concept is a tool that will assist in determining the optimum potential for streams and lakes within the tributary watersheds. Presettlement vegetation communities within each tributary watershed should be utilized to develop a sense of how man has impacted land use conditions in the river basin. An assessment of current land use should be included in the basin plan. A comparison of the presettlement and current land use conditions will be critical in assessing the potential to protect and improve water resource conditions through the implementation of management strategies. Presettlement vegetation communities, current land use information and ecoregion boundaries are available for all tributary watersheds through land use information systems in each state.

Related documents

- f* National Water-Quality Assessment Program by the United States Geological Society
- f* <http://scwatershed.org/basinteam>

St. Croix Basin Water Resources Planning Status Report, Issue statement 7:
Forecast future changes in land use, impact on water quality