

**Developing a Water Resources Management Plan
for the St. Croix National Scenic Riverway:
Issues and Priorities**

by

Kerry L. Holmberg¹, James A. Perry¹, and Randy Ferrin²

July 1995

Staff Paper Series No. 105

Department of Forest Resources

**College of Natural Resources
and
Minnesota Agricultural Experiment Station
University of Minnesota
St. Paul, Minnesota**

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The St. Croix National Scenic Riverway, which includes the Namekagon River, was one of the first rivers set aside in the national trust as part of the 1968 National Wild and Scenic Rivers Act. The portion of the River below St. Croix Falls/Taylor's Falls was added in 1972 as The Lower St. Croix National Scenic Riverway. The riverway consists of the St. Croix and Namekagon rivers and their riparian lands. The riverway is administered by the National Park Service (NPS) from the headwaters to Stillwater, Minnesota (known as the federal zone). From Stillwater to the mouth, the riverway is administered by the Minnesota Department of Natural Resources (MDNR) and Wisconsin Department of Natural Resources (WDNR) (known as the state zone). Management responsibilities are diverse and issues are complex; management is mandated at the state and federal level but implemented at the state, federal and local level. Organizations with jurisdiction include two states, several small cities, nine state parks and forests, one National Forest, county forest lands, six scientific and natural areas, six wildlife refuges, numerous private holdings and National Park Service lands. The Minnesota-Wisconsin Boundary Area Commission (MWBAC) has been functioning for years as a facilitator group for state and federal cooperation in managing the St. Croix. With the numerous agencies involved in the St. Croix, it is essential to have opportunity for discussion and agreement on the major issues needing attention in order for a management plan to be effective. Management of the riverway is presently guided by several formal management partnerships: the Lower St. Croix Management Commission (*voting members from the MDNR, WDNR, NPS and a non-voting member from the MWBAC*), the Upper St. Croix Management Commission (*voting members from Northern States Power, NPS, WDNR, MDNR and a non-voting member from the MWBAC*) and the St. Croix River Basin Team (*voting members from the NPS, WDNR, MDNR, Minnesota Pollution Control Agency (MPCA) and non-voting members from the MWBAC, U.S. Geological Survey (USGS), National Biological Service (NBS)*).

The NPS is presently updating their General Resource Management Plans for the St. Croix National Scenic Riverway. Since the St. Croix National Scenic Riverway is a water-based park, the NPS is also developing a Water Resources Management Plan which supplements the Resource Management Plan by identifying water resources issues, needs, and priorities in much greater detail. The major components of this plan are: description of the resource, identification of the water resource issues and priorities, gathering and analysis of existing data and literature, and identification of baseline data needs and mitigation strategies in the form of project statements (Jennings 1994). The NPS has contracted with researchers from the University of Minnesota to develop this Plan. The general approach being taken to develop the Plan is: hold an initial scoping workshop with key St. Croix River stakeholders, take the next 8 months to gather existing data and literature and perform preliminary analyses, hold a second workshop to review data and refine data analyses to be performed, take the next 10 months to conduct analyses and generate project statements addressing data gaps and mitigation strategies, hold a third workshop to ensure the analyses and project statements are complete, finalize the Plan. The second, data and analyses, workshop is scheduled for October 3rd and 4th 1995.

The first workshop was organized by researchers from the University of MN and the NPS in January of 1995. The main objectives of the workshop were to collectively identify data sets and literature sources and to identify the most significant management issues facing the riverway. The 20-25 participants were selected stakeholders in the riverway including management team members and other government agency representatives (NPS, WDNR, MDNR, MPCA, USFWS, MWBAC, NBS, USGS), members from non-government organizations (National Parks and Conservation Association, Northern States Power Co., St. Croix Watershed Network and St. Croix Watershed Research Station) and researchers from educational institutions (University of Minnesota and Macalester college)(For a list of attendees see Appendix A).

The workshop was divided into five subject areas: Water Management, Basin Description, Surface Water Resources, Groundwater Resources, Aquatic and Riparian Resources and Habitats. Each subject area was in turn broken into 2-4 topics. For each topic issues, data sets, contacts and literature sources were identified.

The results of the workshop were collated and a list of issues and data sources for each issue was generated. Along with the issues identified from the workshop, we incorporated an issue list developed by the Liaison Committee from the USGS Upper Mississippi River National Water-Quality Assessment Program. All issues were ascribed as appropriate to various park management goals: I. Protect Biodiversity and Ecosystem Integrity, II. Protect Water Quality from Human Activities, III. Protect the Natural Functioning of Floodplains, Wetlands, and Riparian Areas, IV. Protect Quality of Visitor's Experience, V. Ability to Conduct Management Effectively (Appendix B).

In order to prioritize the issues identified, we sent the list of 133 issues to the participants of the workshop and asked them to rank each issue with a score of 1-3, three being an issue of greatest importance and one being an issue of least importance. Results were summed among the sixteen respondents. A tabulation of the results is given in Appendix C.

Several common topics emerged out of the top 50-60 issues. These represent the current view of the major issues on the river. They are presented here as a base for discussion in developing further strategic plans for management of the St. Croix.

Human Impacts

- nutrient management
- erosion/sediment management
- toxics
- cumulative effects

Species of Special Concern

- exotic species
- endangered species

Data Management

- coordination of monitoring
- data availability

There was a pronounced concern over the effects of tributaries on the mainstem of the St. Croix, including nutrient and sediment inputs and effects on mussel and invertebrate communities.

We were able to make a cursory comparison of the topics emerging from the issues identified at our workshop with concerns expressed by the public. A list of interests of the St. Croix Watershed Network's members (a non-government organization, Voyageurs Region National Park Association) showed the three by far most common interests (watershed pollution, land preservation/urbanization concern, and wildlife protection (Appendix D)) were also among the common topics identified at our workshop (human impacts and species of special concern).

We welcome any additional comments or insights and will incorporate these into our planning process.

References:

Jennings, S. 1994. Study Plan for Water Resources Management Plan, St. Croix National Scenic Riverway. National Park Service, St. Croix Falls, WI.

Appendix A.

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Appendix A.

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Appendix B.

Each issue identified was ascribed to an appropriate park goal; data sources were ascribed to the appropriate issue in smaller type; names or agencies in bold indicate the workshop participant who identified the data source.

Issues and Data Sources for the St. Croix National Scenic Riverway

I. Protect Biodiversity and Ecosystem Integrity

A. Fishes

- Flow fluctuations effect: spawning, stranding, habitat
- Migration impeded by dams or historic falls (desirable and non-desirables)
 - Fish data - Konrad Schmidt (**Ron Lawrenz**)
- Need to study biology of fish host of rare mussels to ensure protection
- Need to examine why there are changes in fish community, distribution, along the axis of the river and through time (e.g. white bass)
 - Inventory of fish data U of MN (**Charles Huver**)
 - Kettle sturgeon data (**Hinkley DNR, Tribes**)
 - 50 years of WI fishing (**Kurt Fausch**)
 - Fish data WIDNR (**Marty Engle**)
 - Fish and invert. data all along St. Croix (**Gary Montz-Terry Boyle**)
- Assess impacts of management of fish/wildlife target species on other species
 - Papers and files - Fago
- Potential impacts/introductions from bait industry and fish ponds
- Need to determine impacts from use of lead sinkers

B. Invertebrates

1. Mussels

- Flow fluctuations effect: habitat, stranding

- Instream flow requirements (IFIM) - DNR Interstate Park
- Hydropower operation, peaking:
 - Apple and SCR - NSP
 - Clam - Dalbert?
 - Yellow - NW, Dalbert, N. Central

- Need to assess what comes through dams (fish, invertebrates, plankton) and impact on mussel community/habitat

- Fish, macrophytes, biology of Trego, Hayward dams (NSP)
- Information on several dams (Dan Hornbach)
- Biology data - Phipps (Terry Boyle)

- Need closer examination of mussels as indicators of environmental quality
- Unknown or impeded hosts (fish) (e.g. skipjack, *Quadrulla*)
- Construction effects: mitigation, translocation
- Potential impact of changing sediment stability, shifting beds (dam addition, removal, etc.)
- Need closer examination of effects of tributaries
- Need to determine cause of positive impacts of STP's
- Study harvesting of mussels by humans

2. Other Invertebrates

- Limited information, not much known
 - Fish and invert. data all along St. Croix (Gary Montz-Terry Boyle)
- Need to determine impacts of toxic bog return waters
 - Cranberry bog toxicity report (NPS)
- Simplification of communities downstream from tributaries/dams
 - Dam effects on invertebrates (Terry Boyle et. al.)
- Non-target effect from mosquito control spraying

3. Vertebrates

- Need to determine if St. Croix is following global trend towards amphibian and reptile decline
 - Amphibian/herp. (turtle sand habitat) data (John Probst-Rhineland)er)
 - Deahn DonnerWright is leading a series of studies about the distribution patterns of reptiles and amphibians including turtles in the St. Croix. (Rhineland)er NCF exp. Sta.)
- Potential impacts/use of birds (wading, waterfowl, predator)
- Blue heron rookeries potentially affected by water pollution
- Need to examine impacts of beaver (dams, tree harvesting)

4. Macrophytes/Phytoplankton

- Potential increase in algal populations (e.g. blue green Taylors Falls to LSCNSR)
- Lack of information on periphyton
- Determine if macrophytes are reaching nuisance proportions (impacting navigation)
 - Navigation effects - COE

5. Microbiological

- *Blastomycosis* killing dogs
- Status of lyme disease, *Haunta* virus, *Giardia*, *Cryptosporidium*

C. Exotics Management

- Invasion of milfoil, loosestrife, zebra mussels, ruffe, Asiatic clam (*Corbicula*), rusty crayfish, *P. crispus*, *Bathyterpes*
 - Ca levels wrt zebra mussels (Mary Balzer)
 - Loosestrife report (Sue Jennings)
 - *P. crispus* in Trego flowage (Ted Smith)

- Lakes with artificial drains to St. Croix potential seed sources for exotics

D. Species of Special Concern

- Sections of special concern containing many different endangered species
- Thriving populations of otherwise endangered species (potential use as nursery)
- Inadequate understanding of biology
- Unknown fish host of *Quadrulla fragosa*
 - Draft recovery plan for *Q. fragosa* - Dolittle (Ron Lawrenz, Sue Jennings)
 - Fish host-mussel larvae review (Dan Hornbach)
- Lack of information on genetic variability

E. Ecosystem Integrity

- Habitat (woody debris, diversity, HSI)
- Monitoring diversity, integrity
- Examine impacts of logging along the upper river on channel morphology, sedimentation, etc.
 - 1920 navigation charts, width and depth of channel - Karr Griffith
 - Data from dredging 3 ft. channel - COE
- Non-target impacts of fish/wildlife management (e.g. trapping, stocking, promotion of cold water species)

II. Protect Water Quality from Human Activities

A. Point Sources

- Frequency of violations, magnitude, impact
- Need for status report on all dischargers on each tributary
 - MPCA, WI DNR

- Examine relationship between change in demographics and change in discharges (potential impact on rapidly growing areas)
- Need for a phosphorus (nutrient) effluent standard
- Potential impacts from proposed Danbury fish rearing facility
- Potential impacts from runoff from Anderson plant in Bayport

B. Non Point Sources

- Backwaters potentially becoming eutrophic (e.g. Apple R.)
- Impacts of tributary nutrient loads on river
- Potential leaking of septic tanks, LUST's into ground water and river
- Potential impacts of dumps, landfills, waste disposal sites
- Lack of information about storm water inputs of toxics and sediment
 - Storm water models/data - DNRs, MPCA
- Impacts of water withdrawal/toxic runoff from recreational facilities (golf courses, ski areas)
- Increasing impacts from increasing populations
- Need to assess impact potential based on tilled acres
- Need to examine animal waste practices
 - data from regulated feed lots (MPCA)
- Need to identify atmospheric deposition of nutrients/toxics
 - data for precipitation deposition (Pat Brezonik, Cliff Twoarski-MPCA)
- Spill/catastrophic events (accidents, pipeline breaks, destructive rains)
- Potential biological impacts of soluble pesticides
- Need to assess relationship of soil fertility and N/P load to geology

- Need to assess relationship of land use to main stem N and P loads
- Need to determine levels and causes of PCB and Hg in fish
 - Voyageurs NPA, PCBs and heavy metals in eagles
 - Atmospheric deposition of Hg - WIDNR (Buzz), MPCA (Ed Swain-Hg report, task force), NPS (Cliff Wetmore - Lichen accumulation)
 - Hg, PCB in fish tissue (LCMR study database, fish consumption advisories, caged fish PCE study (WIDNR, Buzz))
- Impacts of pipe, bridge replacements
 - Grantsburg bridge, Hwy 70 - WI DOT (sediment info?)
- Potential impacts from fuel and blacktop use at gravel pits
- Possible fuel leakage from river boats

C. Erosion/Sedimentation

1. Erosion

- Need to assess recreational use impacts on erosion (boat wakes, shoreline/island use)
 - Analysis of overflights for erosion/use (Dave Lime)
 - Campsite impacts on erosion, Jeff Marion (Dave Lime)
 - Visitor use - Kg waste, erosion (Dick Weisbrod)
 - Data on recreational impacts on dunes-extrapolate to islands (Ron Lawrenz)
 - Erosion from barges (Scott Johnson)
- Erosion from wind, ice, high water
- Riprapping vs. bioengineering for shoreline erosion management
- Need to determine/map erodibility of shoreline soils along river

2. Sedimentation

- Inputs from urban construction
- Potential of a deposition gradient along the river
 - Sediment grain size data (Dan Hornbach)

- Need to determine if impoundments are filling in
 - visual determination of sedimentation-airphotos (NSP, SCS, NPS)
 - Trego, Hayward dams, Namakogen flowage (NSP)
 - use sediment cores to determine natural rates vs. present day
 - History of dams:
 - Hayward, Trego, Nevers (NSP Lloyd Everhart)
 - Hayward - local historical society
 - SCF NPS - Historical Society
 - Gordon - Douglas Co.
 - Information on unlicensed dams - WI DNR FERC licensing, Water Reg. & Zoning (Ted Smith)

- Gravel extraction impacts on sediment load
 - Matrious gravel pit (NPS, MN DNR report)

- Need to determine the contribution to sediment load from tributaries and land use practices
 - Balsam Branch, Apple R. sediment transport off Ag lands - Polk Co. Land Conservation, WI DNR (Ted Smith)
 - Sediment bed load - Trego (WIDNR)
 - Alluvial fans, deltas - SCS photos
 - Land use - U of M Landscape Arch. Dept. 1970 study (Dave Pitt)
 - Land use change to date (Buzz Sorge, Ted Smith)

- Need to investigate prop wash/paddle boat sediment resuspension
 - prop wash resuspension papers (Mark Tomasek)

- Possibility of toxic resuspension along with the sediment
 - Sediment chemistry NSP, Sediment chemistry riparian wetland - King Plant (NSP-Dan Orr)
 - Sediment chemistry in flowages (Ted Smith)

D. Nutrients

- Backwaters potentially becoming eutrophic (e.g. Apple R.)

- Impacts of tributary nutrient loads on river
 - Proceedings of BOWSR-Snake River Watershed district (Greg Larson)
 - Watershed districts, local watershed plans
 - Willow River State Park studies - Hudson (Buzz Sorge)

- Potential leaking of septic tanks, LUST's into ground water and river
- Need to assess relationship of soil fertility and N/P load to geology
- Need to assess relationship of land use to main stem N and P loads
 - Nutrient gradient along river, north to south (Terry Boyle)
- Waste/nutrient (inorganic carbon) load allocation modeling
 - General data Namakagon flowages (NSP)
 - Nutrient monitoring - fish hatcheries, dischargers, STORET, MPCA, LCMR reports, WATSTORE
 - Phosphorous monitoring - WI DNR (Ted Smith, Buzz Sorge)
 - Ideas for waste load calculations (Mark Tomasek)
 - Storm water models/data - DNRs, MPCA
- Need to look at agricultural lands vs. non-agricultural lands to determine nutrient loading
- New lake drainages as potential nutrient sources
 - Rush Lake - Blue water science, Twin cities
- Cranberry bogs as potential nutrient sources
- Need to examine potential impacts from CRP/RIM lands going out of contract
 - Northern Prairie Science Center - Ron, Cohen (Mark Tomasek)
 - Information on what farmers will do with CRP land (Nels Troelstrup)
- Need to determine extent of internal nutrient loading

E. Cumulative Effects

- Serious lack of information on cumulative effects from human impacts

III. Protect the Natural Functioning of Floodplains, Wetlands, and Riparian Areas

A. Ground Water

- Gas contaminated ground water contaminating river - SCF, Osceola (Ted Smith)
- Ground water data from fish hatcheries - SCF, Osceola
- Monitoring data - Wild River, St. Croix Parks
- Phosphorus in ground water (Fred Madison)

- Lack of information on ground water recharge areas, seeps
- Influence of geology on local ground water
- Need to determine cause of local Na increases (e.g. snow removal)
 - Spring box monitoring (Ron Lawrenz, counties)
- Need to determine local land management/use impacts on ground water
 - Agricultural, dairy inputs to ground water, database (WIDNR)
- Predict impacts of global change
- Potential contamination through abandoned wells
 - well data (NPS, WI land conservation dept., MPCA/Dept. of Health (Mark Tomasek, WIDNR- well log data)
- Potential impacts from fuel and blacktop use at gravel pits
 - Gravel pit contamination, Washington Co.
- Possibility for contamination via sinkholes
 - MGS Co. atlas - Ground water susceptibility
- Contamination from leaking tanks, dumps
 - St. Croix Co. - St. Croix Basin Plan
 - Map outlining problems, landfills (Buzz Sorge)
 - Superfund sites (MPCA)
- Examine effects of potential water withdrawals and sewer line construction on spring habitats and what those springs contribute to the ecology of the riverway
 - Spring flow data - MNDOT, Science museum (Ron Lawrenz)
- Potential for wells, mining or de-watering to connect or drain aquifers
 - Ground water flow data - MN DNR (Dale Homuth)
 - Ground water flow maps - WI Geological Survey & Natural History
- Examine impacts of proposed peat mining

- Need to assess impacts of tiling, draining for agriculture

B. Wetlands

- Need to assess effects of drainage on water storage capacity
- Need to determine extent of drained wetlands
 - Drained and restored wetlands (WIDOT, Kara Dunning U of MN)
 - Farmed wetland maps (ASCA maps)
- Potential mitigation candidates
- Identify external threats
 - Issue of 404 permits (COE)
- Need to assess as habitat for species of special concern (e.g. bog bluegrass)
- Possibility that stained waters (bog) promotes Hg methylation
- Need for more detailed classification of wetlands beyond NWI
 - Mapped wetlands (USFW, MNDNR)
- Assess impacts from fragmentation of wetlands
- Cranberry bog construction, harvest, irrigation, chemigation
 - WI DNR (Ted Smith)
- Potential type conversions from development impacts
 - Study of sedimentation of a wetland (DOT, Jan Janssen - Ron Lawrenz)

C. Backwaters, floodplains

- Backwaters potentially filling in
 - Change in island sedimentation (Nels Troelstrup, Dave Pitt)
- Pressure to restore migrating channels back to original course

- Need to assess the effects of impounding the Mississippi on sediment transport
 - Air photos, change over backwater area (NSP, SCS, NPS)
- Need to determine 100, 500 year floods
 - NSP, MN DNR, NPS (Sue)
 - Tree ring analyses of floods (Wayne Wedland)
 - WI/MN flood studies 1973, FEMA flood insurance (Dale Homuth)
 - Interstate park flooding (Sean Johnson, MNDNR)

IV. Protect Quality of Visitor's Experience

A. Perceived Quality/Aesthetics

- Public perception (Dave Lime)
- Eutrophication
- Turbidity and suspended sediment
- Crowding/Use conflicts
 - Use statistics (NPS)
 - USFS literature review 1980
 - Trego flowage use data (NSP)
 - Water rights examination, discussion (Dave Sharrow, LSCNR 1972 paper)
 - Data on transient vs. resident impacts
- Floods, withdrawals impact experience/use
 - Current surface and groundwater appropriations (Dale Homuth)
- Riparian litter

B. Management Limitations

- Need to determine impacts of fluctuating flows on recreational water use
 - Boating use and flow data - aerial photos, marinas, DNR boat launches

V. Ability to Conduct Management Effectively

A. Data Availability and Management

- Need to determine if available data are sufficient to ensure non-degradation of the riverway
- Need to assess if data management capabilities are adequate to ensure non-degradation standards
- Need recommendation for parks to initiate more efficient and consistent data sharing with other agencies (collection management)
- Data sets are short term and site specific
- Need for long term, comprehensive and cooperative monitoring (island coliforms, boat wakes, endangered species)
- Need recommendation for interagency ecosystem monitoring design

B. Adequate Goals and Objectives

- Need to assess if clean water goals are being met (where, when, variables)
- Need to determine if use classifications are being supported
- Need to review parks goals to ensure they reflect the agencies and public's desires
- Need to review parks goals to ensure they reflect the parks capabilities (e.g. educational resource)
- Need to determine parks role in education (educate public that use management helps achieve users goals)
- Explore expanding "MAB" approach to parks core areas, sustainable use (e.g. Alagash wilderness canoe area)

Climate data

- 1 1/2 year weather data (Ron Lawrenz)
- NWS data (Zanklo, Seeley)
- Fire station weather data (USFS, WI, MNDNR's)
- Soil temperature data (extension services? Pam Knox (state climatologist) UW ext. Madison)
- Frost depth, local cemeteries
- Snow depth - NWS weekly snow depth maps, ski industry
- Ice out dates (Jim Gilbertson, Marshland Hwy 70 - NPS, Marine Landing - John Burrell)

Appendix C.

Water Resource Related Issues - Results of Prioritization Survey			
St. Croix National Scenic Riverway			
Total Number Surveyed = 16 Resource Management Professionals			
Total points are the sum of all individual ratings, where High = 3, Mod = 2, and Low = 1			
Rank = Placement out of 133 issue statements			
		TOTAL	RANK
Subject	Issue	POINTS	
Non Point Sources	Impacts of tributary nutrient loads on river	47	NO. 1
Nutrients	Impacts of tributary nutrient loads on river	46	NO. 2
Point Sources	Need for a phosphorus (nutrient) effluent standard	44	TIE 3
Data Availability and Management	Need recommendation for interagency ecosystem monitoring design	44	TIE 3
Mussels	Flow fluctuations effect: habitat, stranding	44	TIE 3
Cumulative Effects	Serious lack of information on cumulative effects from human impacts	43	TIE 4
Sedimentation	Need to determine the contribution to sediment load from tributaries and land use	43	TIE 4
Exotics Management	Invasion of milfoil, loosestrife, zebra mussels, ruffe, Asiatic clam (Corbicula), rusty crayfish, P. crispus, Bathyterpes	42	TIE 5
Data Availability and Management	Need to determine if available data are sufficient to ensure non-degradation of the Riverway	42	TIE 5
Non Point Sources	Lack of information about storm water inputs of toxics and sediment	42	TIE 5
Perceived Quality/Aesthetics	Crowding/Use conflicts	42	TIE 5
Non Point Sources	Increasing impacts from increasing populations	42	TIE 5
Adequate Goals and Objectives	Need to assess if clean water goals are being met (where, when, variables)	41	TIE 6
Species of Special Concern	Sections of special concern containing many different endangered species	41	TIE 6
Erosion	Need to assess recreational use impacts on erosion (boat wakes, shoreline/island use)	41	TIE 6
Data Availability and Management	Need for long term, comprehensive and cooperative monitoring (island coliforms, boat wakes, endangered species)	40	TIE 7
Fish	Need to study biology of fish host of rare mussels to ensure protection	40	TIE 7
Sedimentation	Inputs from urban construction	40	TIE 7
Data Availability and Management	Need to assess if data management capabilities are adequate to ensure non-degradation standards	39	TIE 8
Mussels	Need closer examination of mussels as indicators of environmental quality	39	TIE 8
Point Sources	Frequency of violations, magnitude, impact	39	TIE 8
Point Sources	Examine relationship between change in demographics and change in discharges (potential impact on rapidly growing areas)	38	TIE 9
Perceived Quality/Aesthetics	Turbidity and suspended sediment	38	TIE 9
Ecosystem Integrity	Monitoring diversity, integrity	38	TIE 9
Nutrients	Need to assess relationship of land use to main stem N and P loads	38	TIE 9
Point Sources	Need for status report on all dischargers on each tributary	38	TIE 9
Ecosystem Integrity	Habitat (woody debris, diversity, HSI)	38	TIE 9
Species of Special Concern	Thriving populations of otherwise endangered species (potential use as nursery)	38	TIE 9
Mussels	Potential impact of changing sediment stability, shifting beds (dam addition, removal, etc)	38	TIE 9
Adequate Goals and Objectives	Need to review parks goals to ensure they reflect the parks capabilities (e.g. educational resource)	37	TIE 10
	Need to determine levels and causes of PCB and Hg in fish	37	TIE 10
Mussels	Construction effects: mitigation, translocation	37	TIE 10
Other Invertebrates	Need to determine impacts of toxic bog return waters	37	TIE 10
Mussels	Need closer examination of effects of tributaries	37	TIE 10
Perceived Quality/Aesthetics	Eutrophication	37	TIE 10

Non Point Sources	Need to assess relationship of land use to main stem N and P loads	37	TIE 10
Data Availability and Management	Need recommendation for parks to initiate more efficient and consistent data sharing with other agencies (collection management)	36	TIE 11
Nutrients	Cranberry bogs as potential nutrient sources	36	TIE 11
Other Invertebrates	Limited information, not much known	36	TIE 11
Wetlands	Potential type conversions from development impacts	36	TIE 11
Wetlands	Assess impacts from fragmentation of wetlands	36	TIE 11
Non Point Sources	Potential impacts of dumps, landfills, waste disposal sites	36	TIE 11
Erosion	Riprapping vs. bioengineering for shoreline erosion management	36	TIE 11
Macrophytes/Phytoplankton	Potential increase in algal populations (e.g. blue green Taylors Falls to LSCNSR)	36	TIE 11
Mussels	Unknown or impeded hosts (fish) (e.g. skipjack, Quadrulla)	35	TIE 12
Adequate Goals and Objectives	Need to determine if use classifications are being supported	35	TIE 12
Backwaters, floodplains	Backwaters potentially filling in	35	TIE 12
Non Point Sources	Backwaters potentially becoming eutrophic (e.g. Apple R.)	35	TIE 12
Wetlands	Need to determine extent of drained wetlands	35	TIE 12
Fish	Flow fluctuations effect: spawning, stranding, habitat	35	TIE 12
Non Point Sources	Spill/catastrophic events (accidents, pipeline breaks, destructive rains)	35	TIE 12
Wetlands	Need to assess as habitat for species of special concern (e.g. bog bluegrass)	35	TIE 12
Wetlands	Cranberry bog construction, harvest, irrigation, chemigation	35	TIE 12
Wetlands	Identify external threats	35	TIE 12
Nutrients	Need to look at agricultural lands vs. non-agricultural lands to determine nutrient loading	34	TIE 13
Nutrients	Need to determine extent of internal nutrient loading	34	TIE 13
Adequate Goals and Objectives	Need to determine parks role in education (educate public that use management helps achieve users goals)	33	TIE 14
Species of Special Concern	Inadequate understanding of biology	33	TIE 14
Erosion	Need to determine/map erodibility of shoreline soils along river	33	TIE 14
Non Point Sources	Potential leaking of septic tanks, LUST's into ground water and river	33	TIE 14
Sedimentation	Need to investigate prop wash/paddle boat sediment resuspension	33	TIE 14
Adequate Goals and Objectives	Need to review parks goals to ensure they reflect the agencies and public's desires	33	TIE 14
Wetlands	Potential mitigation candidates	33	TIE 14
Fish	Migration impeded by dams or historic falls (desirable and non-desirables)	33	TIE 14
Non Point Sources	Potential biological impacts of soluble pesticides	33	TIE 14
Vertebrates	Need to determine if St. Croix is following global trend towards amphibian and reptile decline	32	TIE 15
Erosion	Erosion from wind, ice, high water	32	TIE 15
Fish	Assess impacts of management of fish/wildlife target species on other species	32	TIE 15
Other Invertebrates	Simplification of communities downstream from tributaries/dams	32	TIE 15
Vertebrates	Blue heron rookeries potentially affected by water pollution	32	TIE 15
Non Point Sources	Need to examine animal waste practices	32	TIE 15
Ground Water	Lack of information on ground water recharge areas, seeps	32	TIE 15
Wetlands	Need for more detailed classification of wetlands beyond NWI	32	TIE 15
Nutrients	Backwaters potentially becoming eutrophic (e.g. Apple R.)	32	TIE 15
Perceived Quality/Aesthetics	Riparian litter	32	TIE 15
Wetlands	Need to assess effects of drainage on water storage capacity	32	TIE 15
Fish	Need to examine why there are changes in fish community, distribution, along the axis of the river and through time (e.g. white bass)	31	TIE 16
Non Point Sources	Need to assess impact potential based on tilled acres	31	TIE 16
Non Point Sources	Need to assess relationship of soil fertility and N/P load to geology	31	TIE 16
Sedimentation	Gravel extraction impacts on sediment load	31	TIE 16
Ecosystem Integrity	Non-target impacts of fish/wildlife management (e.g. trapping, stocking, promotion of	31	TIE 16
Data Availability and Management	Data sets are short term and site specific	31	TIE 16

Exotics Management	Lakes with artificial drains to St. Croix potential seed sources for exotics	31	TIE 16
Species of Special Concern	Unknown fish host of <i>Quadrulla fragosa</i>	31	TIE 16
Adequate Goals and Objectives	Explore expanding MAB approach to parks core areas, sustainable use (e.g. Alagash wilderness canoe area)	30	TIE 17
Nutrients	Potential leaking of septic tanks, LUST's into ground water and river	30	TIE 17
Ground Water	Influence of geology on local ground water	30	TIE 17
Ground Water	Need to determine cause of local Na increases (e.g. snow removal)	30	TIE 17
Management Limitations	Need to determine impacts of fluctuating flows on recreational water use	30	TIE 17
Nutrients	Need to examine potential impacts from CRP/RIM lands going out of contract	30	TIE 17
Ground Water	Contamination from leaking tanks, dumps	30	TIE 17
Backwaters, floodplains	Need to determine 100, 500 year floods	30	TIE 17
Ground Water	Examine effects of potential water withdrawals and sewer line construction on spring habitats and what those springs contribute to the ecology of the riverway	29	TIE 18
Sedimentation	Potential of a deposition gradient along the river	29	TIE 18
Backwaters, floodplains	Pressure to restore migrating channels back to original course	29	TIE 18
Non Point Sources	Impacts of pipe, bridge replacements	29	TIE 18
Nutrients	New lake drainages as potential nutrient sources	29	TIE 18
Backwaters, floodplains	Need to assess the effects of impounding the Mississippi on sediment transport	29	TIE 18
Ecosystem Integrity	Examine impacts of logging along the upper river on channel morphology, sedimentation, etc.	28	TIE 19
Non Point Sources	Need to identify atmospheric deposition of nutrients/toxics	28	TIE 19
Ground Water	Potential contamination through abandoned wells	28	TIE 19
Sedimentation	Need to determine if impoundments are filling in	28	TIE 19
Ground Water	Need to determine local land management/use impacts on ground water	28	TIE 19
Mussels	Need to assess what comes through dams (fish, invertebrates, plankton) and impact on mussel community/habitat	27	TIE 20
Vertebrates	Need to examine impacts of beaver (dams, tree harvesting)	27	TIE 20
Mussels	Need to determine cause of positive impacts of STP's	27	TIE 20
Perceived Quality/Aesthetics	Floods, withdrawals impact experience/use	27	TIE 20
Microbiological	Status of lyme disease, Haunta virus, Giardia, Cryptosporidium	27	TIE 20
Point Sources	Potential impacts from proposed Danbury fish rearing facility	27	TIE 20
Other Invertebrates	Non-target effect from mosquito control spraying	27	TIE 20
Sedimentation	Possibility of toxic resuspension along with the sediment	27	TIE 20
Ground Water	Need to assess impacts of tiling, draining for agriculture	27	TIE 20
Fish	Potential impacts/introductions from bait industry and fish ponds	27	TIE 20
Nutrients	Need to assess relationship of soil fertility and N/P load to geology	26	TIE 21
Wetlands	Possibility that stained waters (bog) promotes Hg methylation	26	TIE 21
Vertebrates	Potential impacts/use of birds (wading, waterfowl, predator)	26	TIE 21
Ground Water	Examine impacts of proposed peat mining	26	TIE 21
Ground Water	Potential for wells, mining or de-watering to connect or drain aquifers	26	TIE 21
Non Point Sources	Impacts of water withdrawal/toxic runoff from recreational facilities (golf courses, ski areas)	25	TIE 22
Nutrients	Waste/nutrient (inorganic carbon) load allocation modeling	25	TIE 22
Non Point Sources	Possible fuel leakage from river boats	25	TIE 22
Species of Special Concern	Lack of information on genetic variability	25	TIE 22
Non Point Sources	Potential impacts from fuel and blacktop use at gravel pits	24	TIE 23
Ground Water	Potential impacts from fuel and blacktop use at gravel pits	24	TIE 23
Macrophytes/Phytoplankton	Lack of information on periphyton	24	TIE 23
Adequate Goals and Objectives	Climate data	23	TIE 24
Macrophytes/Phytoplankton	Determine if macrophytes are reaching nuisance proportions (impacting navigation)	23	TIE 24
Ground Water	Possibility for contamination via sinkholes	22	TIE 25
Point Sources	Potential impacts from runoff from Anderson plant in Bayport	22	TIE 25

Mussels	Study harvesting of mussels by humans	21	TIE 26
Fish	Need to determine impacts from use of lead sinkers	21	TIE 26
Microbiological	Blastomycosis killing dogs	19	TIE 27
Ground Water	Predict impacts of global change	19	TIE 27

Appendix D

Interests of St. Croix Valley Watershed Network Members

(Interests are ordered from the most commonly mentioned interest to the least commonly mentioned interest.)

- Watershed Pollution
- Land Preservation/Urbanization Concern
- Wildlife Protection
- Farming (community farming and effects of farming)
- Cabin Owner/Camping
- Zoning/Environmental Design
- Commerce/Tourism
- Forestry
- Culture/Native American
- Tribal Rights
- Want to Decrease Motorized Tourism
- History
- Concern over Population Growth

n=298