IRRB

THE

INTERNATIONAL RED RIVER BOARD

Fourth Annual Progress Report

October 2003

International Joint Commission
Commission mixte internationale

PREFACE

This report documents water quality trends and exceedances of objectives, effluent releases, and control measures for the Red River basin for the 2002 Water Year (October 01, 2001 through September 30, 2002). In addition, this report describes the activities of the International Red River Board during the reporting period October 01, 2002 to September 30, 2003 and identifies several current and future water quality and water quantity issues in the basin.

The units of measure presented in this report are those of the respective agencies contributing to this report.

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1. SUMMARY

1.1 Water Quantity and Water Quality

Persistent rains during the summer of 2001 over parts of the basin contributed to localized agricultural flooding and elevated moisture conditions. This was followed by heavy wet snows over much of the basin in the fall of 2001. However, much of the subsequent winter was mild and dry, and by March 2002, there was little or no snow cover in the basin.

Although early spring snowfalls in 2002 occurred in portions of the basin, flooding was generally not a concern. However, intense rainstorms in June and July, with precipitation amounts ranging from 75 mm-250 mm (3 in.-10 in.) reported, caused enormous damage in southwestern Manitoba and Minnesota. The extreme rainfall generated heavy runoff on both sides of the international boundary with rivers such as the Roseau River and Wild Rice River being particularly hard hit.

The Red River basin experienced a mild and dry winter in 2002-2003, and flooding along the Red River and its tributaries was again not a concern. By late March 2003, there was little or no snow remaining on the ground and concerns began to emerge regarding the average or below soil moisture conditions in much of southern Manitoba and parts of North Dakota. While rains in May and June allayed some of these concerns, July precipitation was less than 25 percent of normal in many areas, which was followed by an extremely dry August. By early September 2003, flows in the Red River and its international tributaries reached the lower decile condition. This is causing some concern about low flows and levels on the Red River for the coming winter in the event of a dry autumn.

The closed Devils Lake sub-basin rose from a low of 46.70 feet in January 2003, to a peak of 47.50 feet in mid-May, which is slightly below the peak of 47.56 feet in 2002. Regular rainfall over the sub-basin through late spring and early summer kept the lake level at near 47.4 feet through mid-July. In late July, the lake levels started a gradual decline and by early October had dropped to 46.4 feet, which is lowest since April 2001. The long-range probabilistic outlook for Devils Lake shows less than a 10% chance of the lake exceeding 46.9 feet between October and end of December.

Based on the established water quality objectives, water quality conditions at the international boundary remained about the same as in the 2001 water year. The dissolved oxygen and total dissolved solids objective was exceeded marginally in one month during the reporting period. The fecal coliform objective was also exceeded once but at an unusually high value in June 2002. This high observed fecal count coincided with the above normal rainfall in the upper basin and is likely associated with agricultural and storm water runoff. There were no observed exceedences of the chloride and sulfate objective. It is noted that a complete series of continuous monitoring data at the international boundary is not available for the 2002 water year. The available continuous data were augmented with instantaneous monthly samples to comprise a generally complete record with some data gaps.

Fourteen of the pesticides and herbicides for which alert levels have been established at the international boundary were detected during the reporting period at low levels and well below the Canadian Aquatic Life Guidelines. Mercury was also detected in two of six observations at levels marginally above the Canadian Aquatic Life Guideline.

Facilities in the United States with current National Pollution Discharge Elimination System (NPDES) discharge permits from North Dakota and Minnesota were generally in compliance with their permits during the 2002 water year. Incidents of spills and releases were associated with localized flooding that inhibited wastewater treatment and interfered with effluent management. None of the spills or releases resulted in enforcement action. Overall, the number of discharges and the volumes discharged declined from previous years.

All treated municipal effluents discharged to the Red River or its tributary streams within the basin in Manitoba are licensed under Manitoba's Environment Act. Three municipalities with populations greater than 1000 (Morris, Selkirk and Winnipeg) discharge treated effluents directly to the Red River, while most

tributary streams also receive treated effluents from nearby communities. During the 2002 water year, the volumes and quality of effluents has not changed significantly from previous years.

On September 16, 2002, a valve failed at the City of Winnipeg's North End Water Pollution Treatment Control Centre allowing untreated sewage to flow to the Red River of a period of about 60 hours. A full report on the water quality impacts from this spill was prepared by Manitoba Conservation and is available on the Manitoba Conservation website. In addition, public hearings to investigate the causes of the spill, its consequences, and other matters related to discharge limits for the City's sewage treatment facilities were conducted by the Manitoba Clean Environment Commission. A final report on the hearings was released in August 2003 with recommendations for action in the short and longer terms to improve the reliability of the treatment facilities and their effectiveness in protecting the water quality of the Red River and Lake Winnipeg.

1.2 Other Activities

The International Red River Board (IRRB) investigates and reports on other activities in the Red River basin that have a potential to affect the waters and aquatic ecosystems of the Red River and its transboundary tributaries and aquifers. This information exchange alerts the International Joint Commission of current and emerging water-related issues and contributes to the prevention and resolution of disputes on an on going basis. The International Red River Board also reports on the Poplar and Big Muddy basins, which were the responsibility of the former International Souris-Red Rivers Engineering Board.

Responsibilities stemming from the November 2000 IJC report to governments *'Living with the Red'*, direct the IRRB to monitor progress made by governments in implementing the IJC recommendations, and to provide encouragement for continued preparedness and mitigation activities in the basin. The IRRB has completed a basin-wide survey and analysis of progress being made and will be reporting these findings to the IJC. Over the coming weeks and months, the IJC and IRRB will be formulating response strategies to the findings.

In addition, and associated with its expanded flood mitigation responsibilities, the IRRB is supporting development of a comprehensive flood mitigation plan for the Red River basin in cooperation with the IJC and Red River Basin Commission.

The IRRB has also engaged in discussion with the IJC regarding the concept of watershed boards as envisioned by the IJC in its report *'The IJC and the 21st Century',* focusing on how to move forward with this vision for the basin. The discussion suggests an incremental approach that builds on the advantages that the merger of the former IJC boards in the Red River basin that created the IRRB provides. A more precise path forward will be delineated in the coming weeks and months.

At the request of Manitoba Conservation, the IRRB has undertaken to explore the possibility of establishing additional water quality objectives for phosphorus and nitrogen at the international boundary. While there are no established objectives for these nutrients at present, the undertaking will determine if the request is consistent with the IRRB Directive, and if it is, make recommendations on how the objectives might be developed and implemented.

One of the top ranking initiatives identified by the IRRB in its work plan is to develop biological and implementation strategies for the basin. In support of this initiative, with funding support from the IJC, Red River Basin Institute (RRBI), and U.S. Bureau of Reclamation, a workshop will be hosted by the RRBI in early 2004 aimed at improving the general knowledge of the principles and technology of biological monitoring and assessment and its application to the Red River basin.

In July 2003, the Pembina River Basin Advisory Board requested assistance from the IRRB to resolve a long standing drainage issue along the international boundary. The IRRB is responding to this request as expeditiously as possible and is establishing a three person team comprising an independent team chairperson and one IRRB member from Manitoba and one IRRB member from North Dakota to work with the Pembina River Basin Advisory Board. The IRRB expects to complete these arrangements, with the team to commence

work in the coming weeks.

Table 1: Current Issues in the Red River Basin

Project	Transboundary Issue	Status	Action
Devils Lake	Potential outlet to the Red River could cause water quality deterioration, biota transfer, and changes in the flow regimes at the boundary.	U.S. Corps of Engineers released final EIS, with Pelican Lake outlet as preferred alternative, in April 2003. In mid-October, theCorps signed a Record of Decision recommending construction of federal project provided that all legal requirements are met and assurance received from Secretary of State that the project does not violate the Boundary Waters Treaty of 1909. North Dakota is proceeding with construction of state outlet. Permits have been obtained and contract awarded for portion of open channel.	Project being monitored by IRRB.
International Boundary	Intensive livestock operations near boundary could be potential water quality concern.	Manitoba, ND, and Minnesota have developed and implemented a notification protocol. A number of proposals have been received resulting in effective exchange of information and review of concerns.	Members will keep the IRRB informed on notifications.
Pembina, Aux Marais, and South Buffalo Drainage	Embankment along boundary in Manitoba prolongs agricultural flooding in North Dakota. --- Embankments along the Pembina increase water volumes flowing toward Manitoba	Manitoba and North Dakota have reached agreement to improve capacity of crossings #2 &#3 --- Non-permitted levees have been removed and set-back levees proposed. Pembina River Basin Advisory Board requests IRRB assistance to resolve long-standing issue.	Manitoba and N.D. will keep the IRRB informed on progress of bilateral discussions. --- IRRB strikes 3-person team to address issue and to respond to Advisory Board request.
Pembina River	Water use/development are increasing, no apportionment agreement. --- Agricultural and tributary flooding in Manitoba.	Manitoba licenses water use from the river. --- Drainage into upper Pembina R. tributaries in North Dakota blamed for flooding.	Monitor total water use upstream of boundary. IRRB Hyd. C'tee to develop natural flow database. --- Manitoba and North Dakota will keep IRRB informed of negotiations.
Poplar River	IJC apportionment formula not ratified. --- Water quality concerns.	Current Bilateral Monitoring Agreement extended to March 31, 2007. Saskatchewan and Montana considering renegotiation of agreement on apportionment and water quality. --- No significant upward trends in parameters sampled over 20 years. Reduced water quality monitoring starting in 2003.	IRRB to maintain watch on negotiations when they resume. --- Bilateral Monitoring Committee will continue to monitor and review water quality conditions at the international boundary.

Project	Transboundary Issue	Status	Action
Garrison Diversion Unit	Potential diversion from Missouri R. to Hudson Bay drainage could transfer non-native biota, change water quality and increase flows.	Dakota Water Resources Act (2000) increased MR&I funds. Feasibility level engineering report on Red River Valley Water Needs and Options underway with final report scheduled for November 2005. Reclamation and Garrison Diversion Conservancy District jointly preparing EIS for three groups of alternatives.	Project being monitored by the IRRB.

2. INTRODUCTION

In April 2000 the International Joint Commission (IJC) formally merged its International Red River Pollution and Souris-Red Rivers Engineering Boards, consolidating the water quality and water quantity responsibilities of the former boards, to form the International Red River Board (IRRB). This consolidation formalized the already emerging cooperative efforts of the former boards towards an integrated approach to transboundary water issues in the basin. Further, in its November 2000 report *'Living with the Red'*, the IJC recommended that the governments assign certain flood-related tasks to the IJC for implementation by its IRRB. In June 2001, Canada and the United States formally approved a new expanded directive for the IRRB as proposed. The approved directive is included in Appendix A.

To achieve a more ecosystem-based approach and capacity to respond to the range of water-related and environmental challenges of the 21st century, the IJC, at its April 2003 semi-annual meeting, indicated that it wished to have further discussions with the IRRB on how to proceed. The IRRB has been engaged in such discussions and the transformation to a watershed board or council is currently under consideration.

For the present, the IRRB is responsible for assisting the IJC in avoiding and resolving transboundary disputes regarding the waters and aquatic ecosystems of the Red River and its tributaries and aquifers. This is accomplished through the application of best available science and knowledge of the aquatic ecosystems of the basin and an awareness of the needs, expectations and capabilities of residents of the basin. The geographic scope of the Board's mandate is the Red River basin, excluding the Assiniboine and Souris Rivers. The mandate presently includes the Poplar and Big Muddy River basins, previously the responsibility of the International Souris-Red Rivers Engineering Board, until such time that another appropriate IJC board can be established. The Red River basin is illustrated in Figure 1.

This report is the fourth IRRB annual report to the IJC.

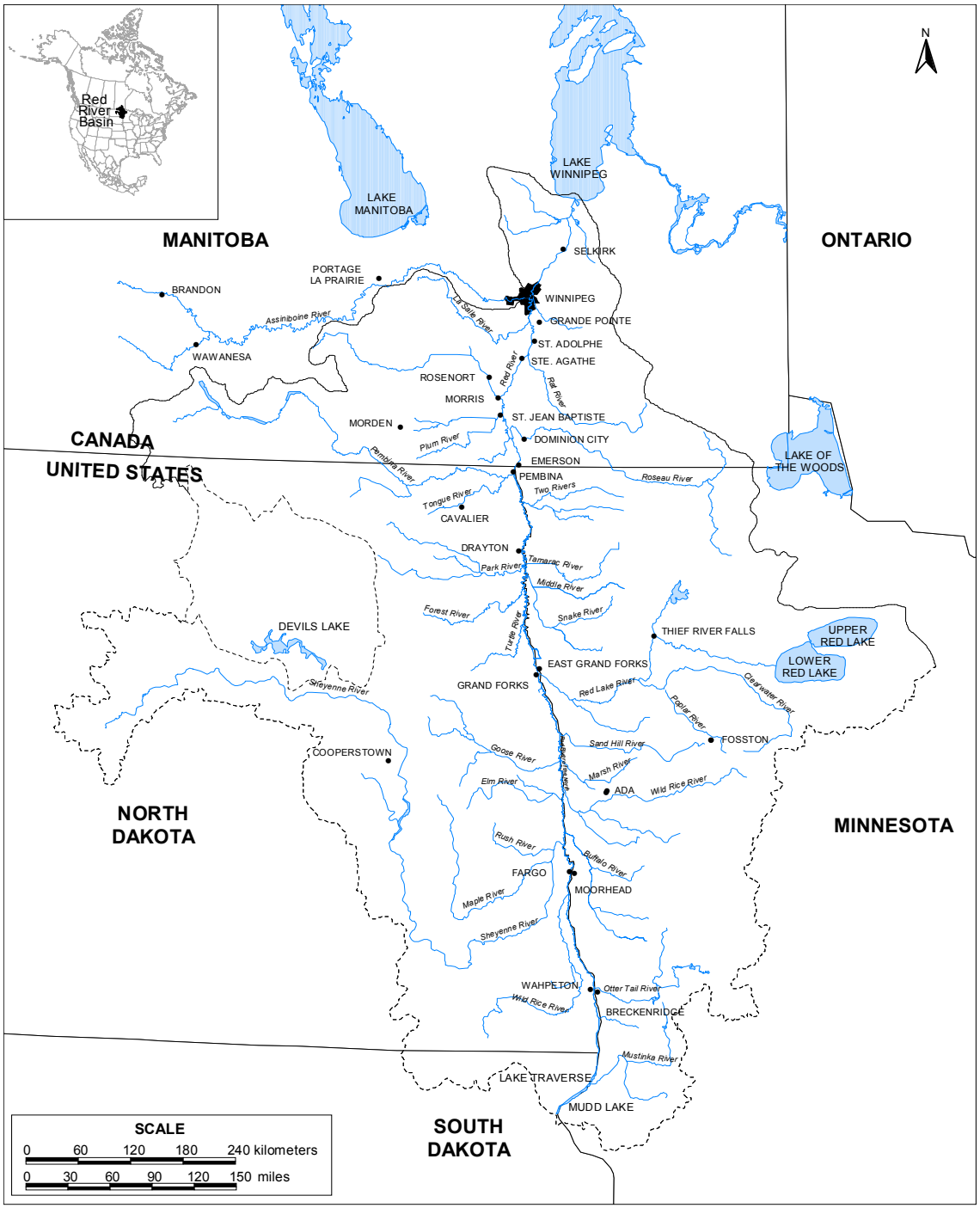


Figure 1. Red River and its Tributaries

3. INTERNATIONAL RED RIVER BOARD MEMBERSHIP

While a comprehensive international watershed approach as proposed in the 1997 IJC report *'The IJC and the 21st Century'* is presently under consideration, many of the goals of this approach are being achieved through the continued integration of the water quality and water quantity responsibilities of the IRRB and through efforts to increase stakeholder involvement. To facilitate these objectives, and with a view to expanding access to expertise, Board membership was expanded in 2000 to include non-government participation. From a full complement of nine members each, there are currently eight members appointed to the Board on the United States side and eight members on the Canada side. This large membership, listed below, reflects the widely distributed water management mandates in the basin. The outstanding appointments are expected to be made in the coming months.

During the reporting period, Mr. Bruce Furness, Mayor, City of Fargo, North Dakota, and former Chair, Red River Basin Commission, withdrew from further participation as member of the IRRB. He was replaced by Mr. Daniel Wilkens, Administrator, Sand Hill River Watershed District, Minnesota, and current Vice-Chair, Red River Basin Commission. Further, during the reporting period, Mr. Kent Heidt, U.S. Co-Secretary, retired from public service with the U.S. Bureau of Reclamation. He is replaced on an interim basis by Ms. Jaralyn Beek, U.S. Bureau of Reclamation.

There were no changes in Canadian membership during the reporting period.

United States

Maryanne C. Bach U.S. Co-Chair Regional Director, Great Plains Region U.S. Bureau of Reclamation	Gregg Wiche District Chief, Bismark Office U.S. Geological Survey
Col. Robert L. Ball District Engineer, St. Paul District U.S. Army Corps of Engineers	Bruce Furness - retired from IRRB Mayor, City of Fargo, North Dakota (Red River Basin Commission)
Jeff Lewis Regional Director, Detroit Lakes Office Minnesota Pollution Control Agency	Daniel Wilkens - new appointee Administrator Sand Hill River Watershed District, Minnesota (Red River Basin Commission)
Dennis Fewless Division of Water North Dakota Department of Health	Jaralyn Beek U.S. Co-Secretary Deputy Regional Director U.S. Bureau of Reclamation
Randy Gjestvang Red River Water Resources Engineer North Dakota State Water Commission	John Giedt U.S. Co-Secretary Office of Ecosystems Protection & Remediation, Region 8 U.S. Environmental Protection Agency
Max. H. Dodson Assistant Regional Administrator Office of Ecosystems Protection & Remediation, Region 8 U.S. Environmental Protection Agency	

Canada

Richard Kellow Canadian Co-Chair Executive Director Transboundary Waters Unit Environment Canada Dwight Williamson Manager, Water Quality Management Section Manitoba Conservation Steven Topping Director, Water Resources Branch Manitoba Conservation Alain Vermette Manager, Regional Water Programs Prairie Farm Rehabilitation Administration Agriculture & Agri-Food Canada	William Gummer Regional Director Environmental Conservation Branch Environment Canada R.S. (Bud) Oliver Chair, Red River Basin Commission Dr. Joseph O'Connor Director, Fisheries Branch Manitoba Conservation Terence Shortt Manager, Environmental Science Division Fisheries & Oceans Canada Michael Kowalchuk Canadian Co-Secretary and Secretariat Hydrologic Issues & Policy Advisor Meteorological Service of Canada Environment Canada

4. INTERNATIONAL RED RIVER BOARD ACTIVITIES

During the reporting period October 01, 2002 - September 30, 2003, the International Red River Board (IRRB) met with the IJC at the 2002 Fall Semi-Annual meeting at which it presented its third annual report as an amalgamated board. In addition, the Board presented and discussed its work plan and funding priorities for the next 2 years.

The IRRB also conducted and participated in a number of meetings and activities to advance implementation of its work plan and to explore watershed concepts as advocated by the IJC. The Board held an interim meeting in January 2003to address progress of its technical committees, and to participate in discussions with the IJC and the Red River Basin Commission towards the development of a comprehensive flood mitigation plan for the basin. The IRRB held its annual meeting in July 2003, and conducted a number of conference calls during the reporting period involving the IRRB Co-chairs, Secretaries, Technical Committee Co-Chairs, and IJC Staff.

Additional details regarding IRRB activities follow.

4.1 Annual Board Meeting

The IRRB held its annual meeting on July 15-16, 2003 in Winnipeg, Manitoba to review the water quality monitoring results and issues of compliance with IJC water quality objectives and alert levels for the 2002 water year. Other key activities discussed included: progress by governments in implementing the recommendations contained in the IJC report *'Living with the Red'* ; formation of international watershed boards/councils; development of a comprehensive flood mitigation strategy for the Red River basin; and establishment of additional water quality objectives for nutrients at the international boundary.

Except for a half-day executive session, the meeting was open to the public in a spirit of information sharing and collaboration. This was undertaken in recognition that there are many local, regional, state/provincial, federal and natural resource management entities operating in the basin with whom connective links would be mutually beneficial.

The Board also conducted a public meeting on July 17, 2003 in Emerson, Manitoba to hear the concerns of the residents of the basin regarding existing and potential transboundary water issues, and to encourage active public participation and involvement. The Board invited presentations from the Pembina River Basin Advisory Board, Roseau River International Watershed Board, and Lake Winnipeg Stewardship Board. Utilizing the forum as a communications opportunity, Natural Resources Canada was also invited to make a presentation on 'geo-science research into Red River flooding'.

The July 15-17 meetings were attended by IJC Commissioners J. Blaney and A. Olsen, and IJC Advisors L. Bourget and T. Bailey.

4.2 Living with the Red

In June 2001, as proposed by the IJC, Canada and the United States formally approved a new directive for the IRRB that includes certain flood-related responsibilities. These responsibilities stem from the November 2000 IJC report to governments *'Living with the Red'*, which direct the IJC and its IRRB to monitor progress made by governments in implementing the IJC recommendations, and to provide encouragement for continued preparedness and mitigation activities in the basin. In support of this assigned responsibility, the IRRB Hydrology Committee identified the need to conduct a basin-wide survey of government agencies, water managers and non-government entities, and drafted a possible survey instrument to undertake the task. Further, in January 2003, the IJC requested a written report on actions taken by governments at all levels, for discussion at the July 2003 IRRB annual meeting.

With external Canadian federal funding, a basin-wide survey and analysis of flood preparedness and mitigation activities was conducted by R.Halliday & Associates Ltd in cooperation with the Canadian Water Resources Association. The preliminary survey results were presented to the IRRB annual meeting, and a

draft report was circulated to IRRB members for full review. In addition, a public presentation hosted by the Canadian Water Resources Association on September 29 in Winnipeg, Manitoba, was made by R. Halliday on the preliminary survey results. Audience response provided additional input to the survey. A final report, with recommendations, has now been received by the IRRB Secretariat.

The survey results indicate that expenditures since1997 relating to the IJC recommendations are in the order of hundreds of millions of dollars and that similar amounts will be spent in the next five years. Although considerable progress has been made in increasing preparedness for major floods and in mitigating potential harm from future floods, not all recommendations have been implemented. Further, it is unlikely that a few of the recommendations will be implemented. Recommendations involving construction of structural features, and those aimed at single agencies, have achieved greatest success, while those recommendations involving multiple agencies and multiple objectives, have achieved less success. The results also indicate that it may take considerable effort to achieve the level of interagency and intergovernmental cooperation needed to assure cohesion on flood management and long-term resiliency in the basin.

Over the coming weeks and months, the IRRB will be formulating response strategies to the findings of the survey.

4.3 IJC International Watershed Boards/Councils

A vision for watershed boards, or councils, to provide an improved mechanism for avoiding and resolving transboundary disputes was proposed by the IJC in its 1997 report *'The IJC and the 21st Century*'. In 1998, governments accepted in principle the Commission's proposal and directed the IJC to further define how the watershed boards would operate, provide cost projections and funding sources, and make recommendations for the first binational watershed board. In its December 2000 report *'Transboundary Watersheds'* the IJC recommended the IRRB to be its first pre-pilot international watershed board and recommended sufficient funding be provided by governments. Subsequently, the IJC indicated it wished to engage the IRRB in discussions to determine how the concept could be moved forward and asked that further discussion take place at the July 2003 IRRB annual meeting.

To facilitate this discussion, a paper was prepared by R.Kellow and R.Halliday & Associates Ltd titled *'Discussion Paper on Moving the IRRB to an International Watershed Board, Draft June 23, 2003',* that identifies the questions that may arise in creating a watershed board and provides an initial analysis of how these questions may be addressed. The IJC also prepared a discussion paper outlining more explicitly a 'vision' for the basin, the responsibilities of the international watershed board, stakeholder linkages, and next steps.

The discussion at the IRRB annual meeting indicated that merger of the former IJC boards to create the IRRB with expanded mandate and membership, has greatly contributed to the potential achievement of many of the goals of a watershed board as envisioned by the IJC. However, a number of challenges remain that include sustained interaction with other basin groups to foster consensus building, and pursuit of science-based problem definition and resolution. It is also recognized that the foundation for an IJC basin council has been established and that progress toward more integrated watershed approaches by the IRRB can be achieved through incremental change. Further, the IJC recognized that it needs to work closely with the IRRB to ensure appropriate structure and process for the Board, and to ensure that sufficient resources are available to support the necessary actions. The IJC will be providing further guidance on this matter.

4.4 Comprehensive Flood Mitigation Plan

The IJC in cooperation with the IRRB and Red River Basin Commission (RRBC) organized a meeting of senior officials in Winnipeg on January 15, 2003, to discuss a strategy to move forward with development of a comprehensive plan for flood mitigation in the Red River basin. Development of such a plan follows on the recommendations contained in the IJC report *'Living with the Red'*.

Subsequent to the meeting of officials, the IJC identified a number of specific activities related to the development of a flood mitigation plan. The activities, expected outcomes, lead responsibility, and status

are summarized below.

a. Flood Mitigation Activities Report
The IRRB will undertake studies and prepare a written report on actions taken by governments at all levels to address the recommendations made by the IJC in its November 2000 report 'Living with the Red'. The report will include an assessment of major gains and remaining gaps.

This activity has been completed as described in Section 4.2.

b. Comprehensive Flood Mitigation Plan Framework
The framework, a document to lay out the path for development of a basin-wide comprehensive flood mitigation plan, will set out a common vision and agreed upon approach. The IRRB Flood Mitigation Activities Report will provide useful input to the development of the comprehensive plan but will not delay initiation of discussions leading to the development of the framework. The RRBC will provide the lead for this activity in coordination with the states, province, and IRRB. The framework is expected by late 2003.

The RRBC provided a progress report on this activity to the IRRB annual meeting in July 2003. An outline of the proposed framework document was discussed and the process being followed to develop the framework was described. It was noted that the framework will be set within a broader natural resources context for the basin that will include water supply, water quality, flood damage reduction, hydrology, drainage, water law, conservation, fish, wildlife and recreation, and institutions. Development of the framework by the RRBC is currently in progress.

c. Meeting of Premier and Governors
A meeting of Premier Doer with Governors Pawlenty, Hoven, and possibly Rounds to endorse the vision and framework for a basin-wide comprehensive flood mitigation plan will be arranged when the framework document is completed. The expected outcome is an agreement to work together to further develop a comprehensive flood mitigation plan. The meeting will be arranged by the IJC in coordination with the states, province, and RRBC.

Although initially targeted for the fall of 2003, the meeting with the Premier and Governors may be deferred to the spring of 2004.

d. Comprehensive Flood Mitigation Plan
Following endorsement of the vision and framework, development of the comprehensive flood mitigation plan aimed at coordination of flood mitigation activities on a basin-wide basis will be initiated. In-basin organization(s) will take ownership of this initiative with leadership yet to be determined but to involve federal, state, provincial, and local entities in both Canada and United States. The time frame for this phase of the undertaking is presently undefined.

4.5 Pembina River Basin

The Pembina River originates in the Turtle Mountain area of south central Manitoba and flows easterly, than southerly into North Dakota, entering the Red River about three kilometres south of the international boundary. There is very little gradient in the lower reaches of the system and flooding has been a natural and common occurrence. Breakout flows from the main stem of the Pembina River in the vicinity of Neche, North Dakota, move away from the river and overland into the Tongue River watershed to the south, or north toward Canada and eastward to the Red River. Going back as early as the 1940s, flood control works implemented in this reach, such as dikes and raised roads, have changed the natural patterns of flood flows, reducing flooding in some areas and increasing flooding in others.

In an attempt to manage runoff reaching the international boundary, the International Boundary Drain running parallel to the international boundary from a point about 1.6 km west of Gretna, Manitoba, to the Aux Marais River crossing, was constructed in 1956. Over the intervening years, various negotiations between Manitoba and North Dakota have taken place to improve drainage in the United States and to increase the capacities

of the receiving channels such as the South Buffalo and Aux Marais systems in Manitoba. The IJC investigations in 1962 on measures to develop the water resources of the Pembina River basin, and its studies post 1997, resulted in a number of recommendations regarding flood control for the basin.

In recent months, Manitoba and North Dakota have reached a formal agreement with respect to funding arrangements and responsibility for construction and maintenance of improved drainage works along the South Buffalo system in Manitoba associated with crossings #2 and #3. Improvements on crossing #3 are nearly complete and in 2004, crossing #2 will be completed. These improvements will address increased local flows but will not address overflows from the Pembina River. Similar issues associated with the Aux-Marais system have not been resolved.

With respect to the overall flood mitigation efforts in the Pembina River basin, a North Dakota court order was issued for the removal of 17 non-permitted levees along the Pembina River. The Pembina County Water Resources District extended the order to include removal of additional non-permitted agricultural levees. Since the removal of these levees, and at the request of the Pembina County Water Resources District, the North Dakota State Water Commission completed a study and plan for the establishment of set-back levees along the Pembina River from the City of Niche to near the confluence with the Tongue River. The proposed plan has caused concern that the set-back levees would exacerbate flooding in some areas if provision for the storage of water along the system, or diversion of water across the international boundary was not provided.

On July 17, 2003, at the IRRB public meeting in Emerson, Manitoba, the Pembina River Basin Advisory Board formally requested the assistance of the IRRB to resolve the long-standing transboundary drainage issue. The Advisory Board has appointed four of its members to work with the IRRB or a committee appointed by the IRRB, and federal, state, and provincial agencies to find and implement a resolution to the flooding issue. As demonstrated by this request, there is a sincere interest in resolving the issue at the local level, however, recognizing that a commitment of time and resources from federal, state and provincial governments is required.

In response to this request, and with the concurrence of the IJC, the IRRB will assemble a three-person team comprising an independent team chairperson and one IRRB member from North Dakota and one IRRB member from Manitoba to work with the Pembina River Basin Advisory Board and its appointees. The chairperson has been selected and funding support to retain this expertise is being provided by the IJC, Canadian Section. The IRRB expects to complete these arrangements in the coming weeks and will be advising the Pembina River Basin Advisory Board accordingly.

4.6 Notification Protocol for Intensive Livestock Operations

In 2002, at the direction of the IRRB, a Notification Protocol for Intensive Livestock Operations proposing to locate near the international boundary was developed and approved by the Board. The purpose of the protocol is to share information on issues of mutual concern and to resolve transboundary issues associated with intensive livestock operations prior to operation.

During the reporting period, information on two proposed operations was provided by Manitoba Conservation to adjacent jurisdictions. The first, a cow/calf operation located adjacent to the Pine Creek Diversion that flows south from Manitoba to Minnesota, and a second, a grower/finishing hog operation in the Pembina River watershed upstream of the international boundary. Through this process, some concerns were identified by Minnesota and North Dakota contributing to an improved environmental assessment of the projects, and demonstrating the value of the Protocol from a transboundary perspective.

4.7 Conservation Resource Enhancement Program

In June 2003, Governor Tim Pawlenty outlined a clean water vision for Minnesota that includes an ambitious proposal for the next generation of its Conservation Resource Enhancement Program (CREP). The IRRB believes that the CREP will be effective in protecting and improving water quality in the basin and in providing flood mitigation benefits as well. The IRRB provided a letter of support for CREP to Governor Pawlenty.

Minnesota's clean water vision is described in further detail in Section 9.8.

4.8 Proposed Nutrient Objectives for the Red River

In February 2003, Manitoba announced the Lake Winnipeg Action Plan. Eutrophication of Lake Winnipeg has been a major water quality concern for a number of years. One of the main elements contained in the Action Plan is a commitment to reduced nitrogen and phosphorus levels in the lake to pre 1970s concentrations. The Action Plan follows from Manitoba's Nutrient Management Strategy.

Recent studies conducted as part of the Nutrient Management Strategy indicate that nitrogen loading to Lake Winnipeg has increased by about 13% since the early 1970s and that phosphorus loading has increased by about 10%. Overall, approximately 30% of the nitrogen and approximately 43% of the phosphorus loaded to Lake Winnipeg each year originates from the United States' portion of the Red River basin. Further details are provided in Section 6.3.

At present, there are no established water quality objectives or alert levels for nitrogen or phosphorus as nutrients in the Red River at the international boundary. Manitoba believes that sufficient information is now available to set objectives that would assist in achieving the Action Plan reductions in Lake Winnipeg, and has formally proposed that the objectives be established through the IRRB. Manitoba will similarly implement reductions in nitrogen and phosphorus from municipal, industrial, agricultural, and other sources within Manitoba to meet the commitments in the Action Plan and will be working with upstream jurisdictions in other contributing basins.

The IJC Directive to the IRRB assigns responsibility for recommending appropriate strategies to the Commission concerning water quality, water quantity and aquatic ecosystem health objectives in the basin. To provide the basis for meaningful discussion on how the IRRB might best address these responsibilities, the Aquatic Ecosystem Health Committee (AEHC) was asked to consider the Manitoba proposal with respect to its scope and consistency with the IJC Directive. If the AEHC considers the proposal to be consistent with the IRRB Directive, the Committee is instructed to provide recommendations on how the objectives might be developed and implemented, including the timelines within which this could take place. The analysis has been initiated and recommendations on how to proceed are expected in the coming months.

4.9 Hydrology and Aquatic Ecosystem Health Committees

Natural Flow Data Base

The Hydrology Committee completed its investigation with respect to the development of a natural flow database for the international boundary and Red River basin. Based on consultations with water experts from the relevant agencies in the basin, the Committee concluded that the work presently being undertaken by the USGS for the U.S. Bureau of Reclamation in support of the Red River Valley Water Supply Project can be adapted to serve the IRRB. That is, water-use data have been collected from various agencies and reviewed to provide better estimates of withdrawals and return flows. As well, reservoir evaporation estimates have been improved to update unregulated flow data for select locations in the Red River basin. In the coming months, the Hydrology Committee will be submitting a report to the IRRB on the nature of the proposed database and the underlying assumptions, and will provide recommendations on more precise computational methodologies should the region enter into a period of drought.

Literature Review of Non-Native Species

The Aquatic Ecosystem Health Committee's work plan recognizes the need to be proactive with regard to monitoring non-native species. The Committee's recommendation to the IRRB in response to the original directive to the AEHC to *"develop recommendations and implementation details for monitoring non-native species in the watershed"* contains two actions items:

1. Full cooperation between participating agencies, universities, and others to report presence of all known and documented foreign, exotic, and non-native species to the IRRB at each annual meeting.

2. Establishment of sampling protocols and reporting mechanisms for collection and identification of new non-native species.

Subsequently, in accordance with direction from the IRRB, and as a first step in meeting the recommended course of action, the U.S. Bureau of Reclamation is undertaking work designed to examine invasive species. At the request of the North Dakota Health Department, the Bureau of Reclamation is using internal funds to complete an extensive literature review of exotic, invasive, and non-native species in the basin.

The original intent of this work was to complete the literature survey work for the U.S. portion of the basin. However, during discussion at the July 2003 meeting of the AEHC in Winnipeg the Committee strongly recommended that the review cover both the U.S. and Canadian portions of the basin. Reclamation agreed to expand the scope of the work and increase the budget for the project and include the Canadian portion of the basin. Canadian members of the Committee agreed to provide relevant information from their respective agencies to the Bureau of Reclamation.

The objective of this work is to use existing data sources and literature to determine the spatial distribution of exotic, non-native and invasive species in the basin. The results of this work will be used to develop specific short term and long term monitoring strategies for existing species and for new species known to exist in other watersheds that could impact the Red River basin.

Work on the literature review is underway and is scheduled for completion in the spring of 2004. A report on the results will be provided to the IRRB at the annual meeting in July 2004.

Chapter 8 provides additional information on Aquatic Ecosystem Health Committee work plan activities, particularly from a biological monitoring and longer term perspective.

Biological Monitoring and Assessment Workshop

One of the top ranking initiatives identified by the IRRB in its work plan is to develop biological monitoring implementation strategies for the basin. In April 2003 the AEHC discussed co-sponsorship and sources of funding for undertaking a biological monitoring and assessment workshop in support of this priority initiative. The IRRB annual meeting provided additional opportunity for the Board to discuss the workshop proposal and to explore cooperative opportunities with the Red River Basin Institute (RRBI). The IJC, U.S. Section, indicated that some funds would be available for co-sponsoring the workshop. In September 2003, upon further development of workshop content, timing, and funding needs, the IJC, U.S. Section issued a contract to the RRBI for $5,000 (US). Additional financial commitments for co-sponsoring the workshop have been made by the RRBI and the U.S. Bureau of Reclamation. The workshop will be held in the Fargo/Moorhead vicinity sometime during early months of 2004.

Objectives for the workshop are:

1. Provide a general understanding and technical foundation for the principles of biological monitoring and assessment.

2. Address specific technical issues related to establishing reference reaches and reference conditions for the Red River and its tributaries.

3. Identify potential initial funding for Principle Investigators to subsequently develop proposals/work plans/budgets based on the workshop outcomes, including a proposal to develop and characterize reference conditions in the Red River basin.

Intended products are:

Short Term;
1. Provide opportunity for increased networking between university faculty, state, provincial, and federal agencies staff, and other organizations responsible for, or interested in, biological monitoring.

2.Develop a comprehensive research proposal to characterize reference conditions in the Red River basin.

Long Term;
3. Develop a scientifically defensible characterization of biological reference for various stream morphologies in the Red River basin.

4. Develop a biological monitoring and assessment work plan for implementation in the Red River basin. The work plan would be used by agencies with responsibility for biological monitoring in the basin and by other agencies and organizations wanting to seek additional funding for work in the basin.

4.10 Poplar River Basin

Although not geographically in the Red River basin, the mandate of the IRRB includes the Poplar River, previously the responsibility of the International Souris-Red Rivers Engineering Board (ISRREB). This responsibility originates with the 1975 IJC instructions to the ISRREB to investigate equitable apportionment alternatives on the East Poplar River near Coronach, Saskatchewan in consideration of the thermal power station and cooling reservoir being constructed by the Saskatchewan Power Corporation. In 1976, the ISRREB recommended an apportionment formula to the IJC. Subsequently, in 1978, the IJC recommended an apportionment formula to governments for the East Poplar River.

Further, in 1977 the governments referred the matter of water quality to the IJC. The IJC Water Quality Task Force completed its report in 1981 and was the basis for the flow-weighted objectives of numerous water quality parameters including *total dissolved solids* (TDS) and *boron*. The International Air Pollution Advisory Board provided advice to the Commission about air pollution potential from the power plant.

The Coronach power station began operation in 1981. While Canada and Saskatchewan have not accepted the IJC apportionment formula and water quality objectives, Saskatchewan has been following them.

Bilateral Monitoring Committee

A Poplar River Bilateral Monitoring Committee was established by governments in 1980 to oversee monitoring programs designed to evaluate the potential transboundary impacts from the generating station and ancillary operations. The Committee consists of representatives from the federal governments, the State of Montana, and the Province of Saskatchewan, as well as one public ex-officio member from the United States and one from Canada.

Monitoring data on surface water quantity and quality, groundwater quality, and air quality are collected at or near the international boundary and exchanged annually. The Bilateral Monitoring Agreement, which was extended for another five years by the Department of Foreign Affairs & International Trade and the State Department in April 2002, will expire in March 31, 2007.

Current Issues/Activities

In 2002, apportionment for the Poplar River was met including the minimum flow criteria.

While the long-term objective for TDS was not exceeded in 2002, it remained close to the objective level established by the IJC. The long-term objective for *boron* continued to be well below its objective.

Two of the primary concerns in recent years include: 1. Saskatchewan believes the current apportionment formula is not equitable, and 2. Montana concern about water quality issues, particularly the closeness of total dissolved solids (TDS) to the long-term water quality objective proposed by the IJC.

In regard to the apportionment concerns, Saskatchewan and Montana agree that it would be useful to reopen discussions from a few years ago on this matter but did not feel there was an immediate urgency to do so. In the meantime, Saskatchewan is still committed to following the arrangements as recommended by the IJC.

At its annual meeting held in Helena, Montana on June 18, 2003, the Bilateral Monitoring Committee reviewed water quality data from its monitoring program and concluded that there were no immediate water quality issues. In regard to *boron* and TDS, monitoring information since the mid 1970s shows both below the short-term water quality objectives of 3.5 mg/L and 1,500 mg/L, respectively. Further statistical analysis of the data by Montana concluded that the temporal changes in *boron* and TDS are most likely linked to persistent drought conditions and there was no statistical differences between TDS concentrations in the 1976-1985 time frame compared to the 1986-1995 period.

As a result of this review of data, the Bilateral Monitoring Committee agreed that in 2004 it will reduce sampling at the East Poplar River station at the international boundary and that *specific conductance* monitoring, using an insitu auto-monitor, would be sufficient. The USGS will supplement the *specific conductance* information with four per year grab samples. For 2003, Environment Canada and the USGS will collect *boron* and TDS grab samples six per year and four per year, respectively.

The Committee also agreed three major 'red flags' should be established – events that would indicate that increased sampling is again required: 1. Changes in the operation of the power plant; 2. *Specific conductance* values show an apparent increasing trend (this may require five-year reviews of statistical relationships to confirm actual changes vs. flow-related changes); and 3. Increased development in the basin.

Reservoir Levels

Cookson Reservoir water level was at a maximum of 751.29 m (72.0 % of FSL) on January 13, 2003 and remained at 751.30 m (72 % FSL) by October 6, 2003, as well.

4.11 Red River Basin Decision Information Network (RRBDIN)

After the flood of 1997, the IJC recognized the need for a virtual 'network' to link people, information, and the decision-making process, and began development of the Red River Basin Disaster Information Network. Cooperating with the Global Disaster Information Network, the IJC focused on an internet-based decision-making support tool for flood related emergency management in the Red River basin. The aim of the 'network' is to make data and information available to those responsible for solving flood problems, and to foster international cooperation and strengthen inter-organizational ties. In recognition of the need to share and disseminate data of all types, the network is now called the Red River Basin Decision Information Network (RRBDIN).

While the initial phases of the project proved successful, sustained funding for the continued development of the RRBDIN has been a challenge. With funding support from the IJC along with additional support from the U.S. Army Corps of Engineers, the Bureau of Reclamation and other agencies, the project is expected to continue into fiscal year 2004. The IRRB is very supportive of the RRBDIN and the perpetuation of its bi-national character. However, RRBDIN responsibility in the future rests with local basin entities that have not yet been identified.

4.12 Secretariat

Effective October 01, 2001, a secretariat position was formally established to complement and to supplement the traditional functions of the existing Secretaries to the Board. The position is filled by Michael Kowalchuk, Environment Canada, Winnipeg, Manitoba. In total, one half person-year and corresponding salary is currently allocated to this position. A substantial portion of salary costs is provided by the IJC and, subject to the availability of funds, is anticipated to continue through March 31, 2004. These arrangements are reviewed annually.

The duties of the Secretariat include keeping the Board apprised of activities/policies in the basin affecting its mandate, moving action items arising from Board decisions forward to completion, preparing discussion documents and communications products, and developing and maintaining effective relations with key water organizations in the basin.

The Board will continue to be supported by its Secretaries for both the United States and Canadian sides.

5. WATER QUALITY - INTERNATIONAL BOUNDARY

The water quality of the Red River at the international boundary, as described herein, is based on continuous monitoring and instantaneous grab samples obtained during the 2002 water year (October 01, 2001 - September 30, 2002). The data are used to determine compliance with established IJC water quality objectives at the boundary and in meeting the provisions of the Boundary Waters Treaty of 1909. Detection of exceedances of the objectives serves as a triggering mechanism for agencies to take appropriate action to prevent or to mitigate potential problems, and to minimize the potential for reoccurrence. Environment Canada carries the responsibility for providing this monitoring service for the IRRB and maintains a permanent water quality and water quantity data collection site at Emerson, Manitoba.

The five parameters for which the IJC has approved objectives, along with streamflow and pH characteristics for a corresponding time period, are discussed below.

Water quality characteristics at other locations throughout the basin are referenced in subsequent sections of this report to provide a more complete spatial representation of water quality and aquatic ecosystem health conditions in the Red River basin.

5.1 Hydrology, pH and Temperature

Streamflow

During the 2002 water year, the mean discharge of the Red River at the international boundary was approximately 183.0 m^3/s (6 462.6 ft^3/s). (The long term mean discharge is about 108 m^3/s (3 813.9 ft^3/s)). Daily flows ranged from a minimum of 46.0 m^3/s (1 624.5 ft^3/s) on March 10, 2002, followed by a freshet peak of 264.0 m^3/s (9 323.1 ft^3/s) on April 14, 2002, a second peak and maximum flow of 1010.0 m^3/s (35 667.8 ft^3/s) on June 18, 2002, and a subsequent peak of 543.0 m^3/s (19 175.9 ft^3/s) on September 5, 2002. The June and September peaks were the result of rainfall in the upper basin. This variability demonstrates the range of hydrological conditions that can occur in the watershed with implications for widely variable watershed responses and water quality patterns.

The streamflow characteristics of the Red River at the international boundary for the water years 1971 through 2002, are illustrated in Figure 2 of Appendix D.

pH and Temperature

During the reporting period, the observed pH and temperature values for the Red River remained within the normal range. However, inconsistencies were observed between the auto-monitor and grab sample pH values that would suggest calibration and/or reliability problems with the auto-monitor. The latter may be attributed to the maintenance procedures employed, which are presently being re-evaluated.

The operational status of the auto-monitor during the reporting period is described in detail in Section 6.3.

5.2 Water Quality Objectives

As described in Appendix B, in 1969, the IJC established objectives for a limited number of water quality variables for the Red River at the international boundary. These variables are *dissolved oxygen*, *total dissolved solids*, *chloride*, *sulphate*, and *fecal coliform bacteria*. The IRRB is responsible for monitoring and reporting on compliance with these objectives.

Dissolved Oxygen

During the 2002 water year, dissolved oxygen (DO) field measurement values remained well above the IJC objective of 5.0 mg/L except for the July reported value, which was marginally above (5.5 mg/L). DO values were not available for December 2001 and August 2002.

Total Dissolved Solids and Specific Conductance

Total dissolved solids (TDS) were determined from continuous monitoring and from instantaneous samples collected monthly when the auto-monitor at the international boundary was not operational. One exceedance of the objective (500 mg/L) was observed in January 2002 at 523 mg/L. The remaining observed values ranged from 174 mg/L in July 2002 to 446 mg/L in November 2002. No TDS values were available for August 2002.

The observed auto-monitor TDS values exhibited short term diurnal fluctuations that are not normal for the Red River. It is believed that this erratic behavior is equipment-related.

The historical TDS values are illustrated in Figure 3 of Appendix D.

Chloride

The chloride objective (100 mg/L) was not exceeded during the reporting period. The highest value recorded was 49.9 mg/L in November 2001and the lowest was 5.5 mg/L in July 2002. Ground water discharge is the predominant source of chloride in the Red River basin with concentrations at the international boundary tending to be higher during the fall and winter months when surface inflows are reduced. The historical record of observed chloride concentrations is provided in Figure 4 of Appendix D.

Sulfate

The sulfate objective (250 mg/L) was not exceeded during the 2002 water year. Observed dissolved sulfate concentrations ranged from 40.4 mg/L in July 2002 to a high of 119.0 mg/L in January 2002.

Bacteriological Characteristics

The bacteriological characteristics of the Red River are assessed on the basis of observed fecal coliform bacteria for which an IJC objective (200 colonies per 100 ml) has been defined. Coliforms are generally monitored on a monthly basis making short term variability and seasonal trends difficult to discern. During the reporting period, fecal coliform counts were at or below the detection level of 10 colonies per 100 ml in December 2001 and January through May in 2002. An extreme value of 1200 colonies per 100 ml was observed in June 2002 which dropped to 106 colonies in July 2002 declining further to 19 colonies in September 2002. The unusually high fecal count in June coincided with the above normal rainfall in the upper basin and is likely associated with agricultural and storm water runoff.

The IRRB will continue to monitor coliform concentrations and to evaluate the nature and uncertainties inherent in analyzing this biological parameter. Historical fecal and total coliform values are illustrated in Figures 5 and 6 of Appendix D.

5.3 Alert Levels

The concept of alert levels was introduced in November 1984 by the former International Red River Pollution Board to complement the existing IJC water quality objectives. Subsequently, alert levels for the most significant water chemistry variables were developed and approved by the Pollution Board in January 1986. Further, a compendium of the analytical methods used by the member agencies was prepared in 1990 and is included in Appendix B.

A total of 14 pesticides and/or herbicides with a total aggregate of 74 exceedances (>detectable concentrations) were recorded during the October 01, 2001 to September 30, 2002 reporting period. Mercury also exceeded the alert level in 2 of 6 samples. It is noted that low levels of cadmium, copper, lead and zinc are endemic to the Red River.

Exceedance level data for the 2002 water year are summarized in Table 2. The concentration of pesticides/herbicides and heavy metals continues to be closely monitored and will be reported for the 2003 water year in the Board's next annual report in 2004.

Table 2. Exceedances of Alert Levels, Red River at International Boundary (Emerson, Manitoba)

Parameter	Units	Alert Level	Number of Exceedences	Exceedance Values		Canadian Aquatic Life Guidelines
				Min	Max	
Alpha-HCH	ng/L	DL*	3 of 8 (no values for Jan., Feb., March, and Sept.2002)	0.20	0.34	10
Gamma-HCH	ng/L	DL*	8 of 9 (no values for Jan., Feb., and March 2002)	0.16	9.31	10
Dieldrin	ng/L	DL*	1 of 6 (no values for Jan., Feb., March, April, May and Sept. 2002)	0.35	0.58	4
Clopyralid	ng/L	DL*	11 of 12	0.59	148.00	NG
Dicamba	ng/L	DL*	11 of 12	0.73	31.90	10 000
MCPA	ng/L	DL*	9 of 12	0.58	1560.00	2 600
2,4-DB	ng/L	DL*	1 of 12	0.42	0.91	4 000
2,4-D	ng/L	DL*	12 of 12	1.55	76.40	4 000
Bromoxynil	ng/L	DL*	3 of 12	0.99	947.00	5 000
Silvex	ng/L	DL*	1 of 12	0.40	0.62	NG
2,4,5-T	ng/L	DL*	1 of 12	0.39	1.15	NG
Desethylatrazine	ng/L	DL*	7 of 12	26.80	125.00	1 800
Trifluralin	ng/L	DL*	1 of 12	5.15	13.10	200
Metolachlor	ng/L	DL*	5 of 12	23.70	123.00	7 800
Mercury (Total)	ng/L	DL*	2 of 6 (no values for April through Sept. 2002)	5.00	7.00	0.1

*DL = Detection Level
NG = No Guideline

5.4 Summary of Water Quality Conditions

Concentrations of chloride and sulfate were well below the object level throughout the reporting period. TDS concentrations were also below the objective level with one marginal exceedance reported in January 2002. Reduced TDS and chloride concentrations are attributed to the dilution capacity from higher flows that occurred in the Red River during the 2002 water year. The latter trend has been observed in all of the recent higher flow years.

The observed fecal coliform bacteria counts were well below the objective level throughout the reporting period except for one very high exceedance in June 2002. As noted above, this is attributed to agricultural and storm runoff from heavy rainfall experienced in the upper basin.

Given that the Red River basin is an agriculturally dominated region, detection of pesticides and herbicides in the Red River at low concentrations is expected. Fourteen of the pesticides and herbicides for which alert levels have been established by the former International Red River Pollution Board were detected during the reporting period at low levels and well below the Canadian Aquatic Life Guidelines. The IRRB recognizes that there is very little scientific information available to assess the implications of long-term exposure to low concentrations of pesticides and herbicides by aquatic organisms and humans. The IRRB continues to closely monitor trends in these concentrations and their frequency of detection with a view to updating its assessment as new scientific information becomes available.

6. WATER QUALITY SURVEILLANCE PROGRAM

Data obtained by IRRB member agencies that monitor water quality within the Red River basin are assembled for preparation of annual reports to the IJC. US-supplied data are entered into STORET, the computer storage and retrieval system of the EPA. All Environment Canada data are entered into ENVIRODAT, Canada's data management and retrieval system. Discussions are currently underway by the Board's Aquatic Ecosystem Health Committee toward a goal of gaining enhanced online access and sharing of relevant Red River water quality data from Environment Canada, Manitoba Conservation, and STORET. More detail on the Committee's efforts toward achieving this goal will be provided in future progress reports. A brief description of the monitoring activities of each agency, including the monitoring that is peripheral to the IRRB's direct interest, is described below.

For the purpose of annual reporting by the IRRB, data collected by the continuous auto-monitor and monthly grab samples at Emerson, Manitoba, have been the primary focus. Environment Canada is responsible for the collection of these data. The continuous auto-monitor and/or monthly grab samples are analyzed for physical parameters, pH, chloride, sulfate, major ion chemistry, nutrients, metals and pesticides. Environment Canada mobile field laboratories, and laboratories located in Saskatoon, Saskatchewan and Burlington, Ontario perform the analyses.

Other data are collected by the United States Geological Survey (USGS), Minnesota Pollution Control Agency (MPCA), North Dakota Health Department (NDHD), and Manitoba Conservation. Resulting individual annual reports of these agencies provide a summary of water quality highlights, a synthesis of monitoring data, and laboratory results for the 2002 water year (October 1, 2001 to September 30, 2002). These reports were distributed to all IRRB members for review and discussion during July 2003 semi-annual meeting, and are summarized in the following sections.

U.S. Water Quality Standards Program

In the United States, the statutory basis for the current Water Quality Standards (WQS) program is the Clean Water Act. Under Section 303 of this Act, the Environmental Protection Agency (EPA) issued a Water Quality Standards Regulation (40 CFR Part 131). This regulation specifies the requirements and procedures for developing, reviewing, revising, and approving WQS by the States and Tribal Nations. EPA has approved WQS programs for the States of North Dakota, South Dakota, and Minnesota. No tribal programs in the Red River basin have yet been approved.

WQS define the water quality goals for a water body or portion thereof, by designating the use or uses to be made of the water, and implementation criteria for protecting each of those uses or areas. Additionally, a WQS program must include an anti-degradation policy to protect water quality that is already better than state standards. Designated uses for water bodies may include:

- Aquatic life - protection of fish and other aquatic organisms;
- Recreation - swimming, wading, boating, and incidental contact;
- Drinking water - protection for downstream public water supply intakes;
- Miscellaneous - industrial or agricultural uses, tribal religious use, etc.

Water quality standards are designed to protect the beneficial uses associated with the standards. Based on the assessment of the water quality data and other relevant information compared to the standards for a given pollutant or water quality characteristic, the use may be:

- Fully supported
- Partially supported
- Threatened
- Not supported

6.1 Minnesota

Ambient Water Quality Monitoring Program

The following Minnesota standards have been established for the waters sampled at the listed stations, and compared with IJC objectives as shown in Table 3.

Table 3. Minnesota Water Quality Standards and IJC Water Quality Objectives

Parameter	MN Standard	IJC Objective
Dissolved Oxygen	5 mg/l minimum	5 mg/L minimum
pH	6.5 – 8.5 allowable range	n/a
Conductivity	1,000 mg/l maximum	n/a
Chloride	100 mg/l maximum	100 mg/L
Total Suspended Solids	25 mg/l maximum	n/a
Total Dissolved Solids	500mg/L	500 mg/L
Sulfate	N/a	250 mg/L
Fecal Coliform	200 colonies/100 ml	200 colonies/100 ml

MPCA Water Quality Milestone Sites are sampled monthly for ten months of two years in a five-year period for each major basin in the state. Sites located in the Red River Basin were sampled in 2002. The station locations are shown in Table 4.

The parameters measured at the Minnesota Milestone Sites include ammonia, dissolved oxygen, turbidity, pH, fecal coliform, e-coliform, chloride and specific conductance. In addition, where stream flow records are available, chlorophyll-*a*, total suspended solids, total volatile solids, total phosphorus and BOD were also sampled. Data from water quality sampling at these sites are entered into the US EPA's STORET database.

Table 4. Minnesota Milestone Sites in the Red River Basin

SITE	DESCRIPTION
OT-1	Otter Tail R bridge on 4th St. N at Breckenridge
OT-49	Otter Tail R bridge on CSAH-15 West Of Fergus Falls
RE-300	*Red River at Almonte Ave S in Grand Forks, ND
RE-403	Red River at bridge on Csah-39, 1 mi. W of Perley
RE-452	Red River bridge on Main Ave at 3rd St., In Moorhead
RE-536	Red River at bridge on Csah-18 0.5 mi. W of Brushvale
RL-0.2	Red Lake R downstream of MN-220 bridge in E Grand Forks
RL-23	Red Lake River at bridge on Csah-15 at Fisher
SK-1.8	Snake River at bridge on MN-220 N of Big Woods
TMB-19	Two Rivers middle bridge on US-75, 1 mi. N of Hallock

** Sampling is now performed at RE-298 to improve access to the river channel; the record is considered continuous with RE-300.*

Sixty-eight reaches were assessed for conventional measures of water quality (dissolved oxygen, pH, turbidity); nonpoint source pollution (fecal coliform bacteria, phosphorus, nitrite nitrate, total suspended solids) and toxics (chloride, ammonia and total hardness).

Under the Minnesota Milestone program, 1,508 stream miles of the 17,838 miles in the basin, were assessed in the current cycle. Of these, about 900 miles, or 60 percent, met water quality standards and were assessed as supporting aquatic life. About 235 miles of streams, or 16 percent, were fair, or threatened for aquatic life. Another 360 miles of streams, or about 24 percent of streams assessed, were poor, or did not support aquatic life. For the Red River basin, about 8.5 percent of the streams were assessed, which is slightly higher than the statewide average of 5 percent of the streams assessed for water quality purposes.

Monitoring results are used to evaluate attainment of state and federal water quality standards. Following the monitoring season, the MPCA holds a best professional judgment meeting to assess the attainment of water quality standards. The MPCA convened a meeting in July 2003 to assess the attainment of water quality standards in the Red River basin for the 2002 water year. The results of this meeting will be reported in the 2004 biennial 305B report to the U.S. Congress. Forty seven reaches were analyzed for chemical parameters of water quality, and most reaches were found to be partially supporting of aquatic life. Preliminary results are shown below in Table 5.

Table 5. Minnesota Pollution Control Agency Water Quality Support Uses (305B) 2004 Preliminary Results (2002 Water Year Data)

Watershed	Reach	Support	Exceedances
Bois de Sioux - 4 reaches assessed – not supporting aquatic life			
Bois de Sioux	RR to OT 15.31 mi	Not supporting aquatic life (exceeded ecoregion norm 13 of 26 observations)	Phosphorus
Rabbit River	Wilkin Co to mouth 22 mi	Not supporting aquatic life	Dissolved oxygen, turbidity, phosphorus
Mustinka River	2 reaches	Not supporting aquatic life	Turbidity
Otter Tail – 11 reaches assessed, supporting aquatic life			
Otter Tail	Mouth (Breck Lake to BdS) 8.2 mi	Not supporting aquatic life	Turbidity
Otter Tail	10 additional reaches	Supporting aquatic life	
Buffalo Red - 2 reaches assessed – partially supporting aquatic life			
Whiskey Creek	20.6 mi	Partially supporting aquatic life	Turbidity, phosphorus, nitrite nitrate
Red River	Breckenridge to Whiskey Creek	Partially supporting aquatic life	Turbidity
Red River – Whiskey Creek to Buffalo River – 4 reaches assessed – partially supporting aquatic life			
Red River	Whiskey Creek to Moorhead	Partially supporting aquatic life Not supporting swimming	Turbidity, phosphorus, nitrite nitrate, Fecal Coliform
Red River	Buffalo R to Elm R (ND)	Partially supporting aquatic life	Turbidity, phosphorus, nitrite nitrate, total suspended solids
Wild Rice-Marsh - 2 reaches assessed – partially supporting aquatic life			
Wild Rice	South Branch	Partially supporting aquatic life	Turbidity
Marsh Creek	44.58 mi	Fully supporting aquatic life	
Red River – Wild Rice to Grand Forks Dam – 3 reaches – partially supporting aquatic life			
Red River	Cole Cr (ND) to Red Lake R	Partially supporting aquatic life	Turbidity; phosphorus; nitrite nitrate; total suspended solids
Grand Marais Creek		Fully supporting aquatic life	
Red Lake River – 17 reaches assessed – partially supporting aquatic life and swimming			
Red Lake	3 reaches	Partially supporting aquatic life	Turbidity
Clearwater River	8 reaches	Partially supporting aquatic life and swimming	Turbidity, low oxygen, fecal coliform
Poplar-Lost-Hill Rivers	6 reaches	Partially supporting aquatic life and swimming	Phosphorus, fecal coliform
Snake-Middle-Tamarac – 2 reaches – partially supporting aquatic life			
Snake	2	Partially supporting aquatic life	Turbidity, total suspended solids; nitrite nitrate;

Watershed	Reach	Support	Exceedences
Two – Joe – 1 reach – partially supporting aquatic life and swimming			
Two Rivers	Middle Br to N Br	Partially supporting 1 reach;	Nitrite nitrate, turbidity, fecal coliform
Roseau River – 1 reach – partially supporting aquatic life			
Roseau	Hay Cr to Canada 49.5 mi	Partially supporting aquatic life	Phosphorus

6.2 North Dakota

Ambient Water Quality Monitoring Program

During the reporting period October 1, 2001 to September 30, 2002, the North Dakota Department of Health conducted ambient chemical monitoring at 17 sites in the Red River basin (Table 6).

Sites were sampled during the open water period at six week intervals beginning in April of each year and concluding in November. In addition, one sample was collected in February under ice. This schedule resulted in a maximum of seven samples collected at each site during the reporting period. Stations which were inaccessible due to flooding or road construction, or sites with no flow were not sampled.

Samples collected by the Department were analyzed for major cations, anions, trace elements (total recoverable), nutrients, and suspended solids (Table 7). In addition, each site was sampled and analyzed for fecal coliform, E.coli, and Enterococcus sp. bacteria.

The Department enters all of its water quality results in the Surface Water Quality Management Program's Sample Identification Database (SID). Each year data are then exported to EPA Region 8 into EPA's recently released STORET database (STORET Version 1.1).

Table 6. North Dakota Ambient Stream Monitoring Sites Within Red River Basin

Station I.D.	Description
385055	Bois de Sioux River near Doran, MN [1]
380083	Red River near Brushville, MN
380031	Wild Rice River near Abercrombie, ND [1]
385040	Red River near Harwood
380010	Sheyenne River near Warwick[1]
380009	Sheyenne River near Cooperstown[1]
380153	Sheyenne River below Baldhill Dam[1]
380007	Sheyenne River at Lisbon
385001	Sheyenne River near Kindred[1]
384155	Maple River at Mapleton[1]
380156	Goose River at Hillsboro[1]
384156	Red River at Grand Forks [1]
380037	Turtle River at Manvel
380039	Forest River at Minto[1]
380157	Park River at Grafton[1]
380158	Pembina River at Neche[1]
384157	Red River at Pembina[1]

[1] *Department site co-located with USGS flow gauging station.*
[1] *Department site co-located with USGS flow gauging station.*

Table 7. North Dakota Water Quality Variables Analyzed

Field Measurements	Laboratory Analysis			
	Trace Element	General Chemistry	Nutrients	Biological
Temperature pH Dissolved Oxygen	Aluminum Antimony Arsenic Barium Beryllium Boron Cadmium Chromium Copper Lead Nickel Silver Selenium Thallium Zinc	Sodium Magnesium Potassium Calcium Manganese Iron Chloride Sulfate Carbonate Bicarbonate Hydroxide Alkalinity Hardness Total Dissolved Solids Total Suspended Solids	Ammonia Nitrate-nitrite Total Phosphorus Total Kjeldahl Nitrogen	Fecal Coliform bacteria Fecal Streptococcus

6.3 Manitoba

Ambient Water Quality Monitoring

Water quality continues to be monitored monthly at two sites on the Red River within Manitoba by Manitoba Conservation. These sites are located upstream and downstream of the City of Winnipeg (Floodway control structure and Selkirk, respectively). Variables measured include physical, general chemistry, suspended sediment, bacteria, industrial organics, trace elements, plant nutrients, and agricultural chemicals. The City of Winnipeg normally monitors six sites on a bi-weekly basis. These sites are located upstream, within, and downstream of the City of Winnipeg. Variables monitored by the City of Winnipeg include general chemistry, plant nutrients, suspended sediment, bacteria, and chlorophyll-*a*. Variables and frequency are shown in Table 8.

Routine monitoring is also conducted on six tributary streams to the Red River by Manitoba Conservation. Samples are collected four times per year and analyzed for a wide range of variables including physical, general chemistry, suspended sediment, bacteria, industrial organics, trace elements, plant nutrients, and agricultural chemicals. Locations and variables monitored are shown in Table 9. In addition, beginning in 1995, benthic macroinvertebrates have been collected at each routine monitoring site on the tributary streams once each year. Macroinvertebrate data have been assessed as indicators of ecosystem health. Results have been reported by Hughes (2001). Beginning in 2002, macroinvertebrate samples were also collected from the Red River at Emerson and from the Red River at Selkirk.

Manitoba Conservation has developed a Nutrient Management Strategy. The Strategy includes an initial scientific phase in which available water quality data are being assessed for trends, nutrient loadings are being calculated, and new information is being collected to fill data gaps, with the goal being to develop better water quality objectives for both streams and lakes. Considerable focus is being placed on Lake Winnipeg. An implementation phase will follow the scientific phase.

Water Quality Status of Red River in Manitoba

During this reporting period, water quality in the Manitoba reach of the Red River main stem remained relatively comparable to past years. Dissolved oxygen levels were relatively good with the average level being 9.8 mg/L downstream of the City of Winnipeg and 9.3 mg/L upstream of Winnipeg. The lowest value recorded of 5.6 mg/L occurred in July 2002 downstream of the City of Winnipeg.

Densities of *Escherichia coli* bacteria continued to remain elevated downstream of the City of Winnipeg. Average density downstream of the City of Winnipeg was 189 organisms / 100 mL, similar to the previous reporting period, while densities in the upstream reach was 17 organisms / 100 mL. The exceedance rate of the Manitoba Water Quality Standards, Objectives, and Guidelines for the protection of recreation was 66 % downstream of the City of Winnipeg, while no exceedances were observed immediately upstream of Winnipeg.

During this reporting period, three pesticides were detected out of 51 monitored. The herbicides bromoxynil and atrazine were detected in samples collected from both upstream and downstream of the City of Winnipeg on July 4, 2002. Simazine was detected on one occasion upstream of the City of Winnipeg on April 10, 2002. Unlike previous reporting periods, the herbicide 2,4-D was not detected. None of the detections exceeded water quality guidelines for the protection of surface water used as sources of drinking water supply, habitat for aquatic life and wildlife, or agricultural uses except for bromoxynil. In the case of bromoxynil, concentrations were at and slightly exceeded the guideline developed by the Canadian Council of Ministers of the Environment for protection of irrigation uses.

As part of work being undertaken on Manitoba's Nutrient Management Strategy, long-term nitrogen and phosphorus data were assessed for trends (Jones and Armstrong 2001) then sources of nutrients were identified (Bourne *et al.* 2002). Figures 7 through 10 show general contributions of nitrogen and phosphorus to Lake Winnipeg from the Red River basin.

In accordance with recommendations of the IJC to governments following the 1997 flood in the Red River basin, Manitoba Conservation in partnership with Fisheries and Oceans Canada have been monitoring toxaphene concentrations in Lake Winnipeg fish. Data for 2002 have been obtained and are presently being adjusted for lipid content to account for differing lipid densities among fish. Following this, an assessment will be made to indicate that toxaphene concentrations have not increased since 1999 but have still not yet returned to pre-1997 concentrations.

Table 8. Surface water quality monitoring activities on the Red River (main stem) within Manitoba, Canada during the period October 1, 2001 to September 30, 2002.

Variables	Floodway Control (Manitoba Conservation)	Floodway Control (City of Winnipeg)	Fort Garry Bridge (City of Winnipeg)	Norwood Bridge (City of Winnipeg)	Redwood Bridge (City of Winnipeg)	Chief Peguis Bridge (City of Winnipeg)	Lockport (City of Winnipeg)	Selkirk (Manitoba Conservation)
Temperature	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Turbidity	Monthly	2 times / month				2 times / month	2 times / month	Monthly
Colour	Monthly							Monthly
Dissolved Solids	Monthly							Monthly
Suspended Solids	Monthly	2 times / month				2 times / month	2 times / month	Monthly
Total Solids	Monthly	2 times / month				2 times / month	2 times / month	Monthly
Total Coliform		2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	
Fecal Coliform	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Enterococcus		2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	
pH	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Conductivity	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Dissolved Oxygen	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Alkalinity	Monthly							Monthly
Calcium	4 times / annum							Monthly
Magnesium	4 times / annum							Monthly
Hardness	4 times / annum							Monthly
Sodium	4 times / annum							Monthly
Potassium	4 times / annum							Monthly
Chloride	4 times / annum							Monthly
Sulphate	4 times / annum							Monthly
Total Phosphorus	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Dissolved Phosphorus	Monthly							Monthly
Suspended Phosphorus	Monthly							Monthly
Nitrate – Nitrite Nitrogen	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Total Kjeldahl Nitrogen	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Ammonia Nitrogen	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Chlorophyll – *a*		2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	
Total Organic Carbon	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Total Inorganic Carbon	Monthly	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	2 times / month	Monthly
Boron	4 times / annum							Monthly
Arsenic	4 times / annum							Monthly
Aluminum	4 times / annum							Monthly

Table 8. Continued.

Variables	Floodway Control (Manitoba Conservation)	Floodway Control (City of Winnipeg)	Fort Garry Bridge (City of Winnipeg)	Norwood Bridge (City of Winnipeg)	Redwood Bridge (City of Winnipeg)	North Perimeter (City of Winnipeg)	Lockport (City of Winnipeg)	Selkirk (Manitoba Conservation)
Manganese	4 times / annum							Monthly
Iron	4 times / annum							Monthly
Hexavalent Chromium	4 times / annum							Monthly
Nickel	4 times / annum							Monthly
Copper	4 times / annum							Monthly
Zinc	4 times / annum							Monthly
Lead	4 times / annum							Monthly
Cadmium	4 times / annum							Monthly
Antimony	4 times / annum							Monthly
Barium	4 times / annum							Monthly
Beryllium	4 times / annum							Monthly
Bismuth	4 times / annum							Monthly
Cobalt	4 times / annum							Monthly
Cesium	4 times / annum							Monthly
Lithium	4 times / annum							Monthly
Molybdenum	4 times / annum							Monthly
Rubidium	4 times / annum							Monthly
Selenium	4 times / annum							Monthly
Strontium	4 times / annum							Monthly
Thallium	4 times / annum							Monthly
Tin	4 times / annum							Monthly
Tellurium	4 times / annum							Monthly
Titanium	4 times / annum							Monthly
Uranium	4 times / annum							Monthly
Vanadium	4 times / annum							Monthly
Tungsten	4 times / annum							Monthly
Zirconium	4 times / annum							Monthly
Pentachlorophenol	4 times / annum							Monthly
2,4-D	4 times / annum							Monthly
2,4-DB	4 times / annum							Monthly
2,4-DP	4 times / annum							Monthly
2,4,5-TP	4 times / annum							Monthly
Bromoxynil	4 times / annum							Monthly
Dicamba	4 times / annum							Monthly
Dinoseb	4 times / annum							Monthly
Fenoxaprop	4 times / annum							Monthly
MCPA	4 times / annum							Monthly
MCPP	4 times / annum							Monthly
Picloram	4 times / annum							Monthly
Quizalofop	4 times / annum							Monthly
Trichlopyr	4 times / annum							Monthly

Table 8. Continued.

Variables	Floodway Control (Manitoba Conservation)	Floodway Control (City of Winnipeg)	Fort Garry Bridge (City of Winnipeg)	Norwood Bridge (City of Winnipeg)	Redwood Bridge (City of Winnipeg)	North Perimeter (City of Winnipeg)	Lockport (City of Winnipeg)	Selkirk (Manitoba Conservation)
Azinphosmethyl	4 times / annum							Monthly
Chlorpyrifos	4 times / annum							Monthly
Diazinon	4 times / annum							Monthly
Dimethoate	4 times / annum							Monthly
Malathion	4 times / annum							Monthly
Methyl Parathion	4 times / annum							Monthly
Parathion	4 times / annum							Monthly
Terbufos	4 times / annum							Monthly
Deltamethrin	4 times / annum							Monthly
Diclofop	4 times / annum							Monthly
Diclofop-methyl	4 times / annum							Monthly
Eptam	4 times / annum							Monthly
Ethafluralin	4 times / annum							Monthly
Propachlor	4 times / annum							Monthly
Propanil	4 times / annum							Monthly
Triallate	4 times / annum							Monthly
Trifluralin	4 times / annum							Monthly
Chlorthalonil	4 times / annum							Monthly
gamma-BHC (Lindane)	4 times / annum							Monthly
alpha-Chlordane	4 times / annum							Monthly
gamma-Chlordane	4 times / annum							Monthly
Methoxychlor	4 times / annum							Monthly
Carbofuran	4 times / annum							Monthly
Propoxur	4 times / annum							Monthly
Alachlor	4 times / annum							Monthly
Atrazine	4 times / annum							Monthly
Bromacil	4 times / annum							Monthly
Metribuzin	4 times / annum							Monthly
Simazine	4 times / annum							Monthly
Glyphosate	4 times / annum							Monthly
AMPA	4 times / annum							Monthly
Mecoprop	4 times / annum							
Imazethabenz	4 times / annum							
Metsulfuron-me	4 times / annum							
Tifensulfuron	4 times / annum							
Tribenuron	4 times / annum							

Table 9. Surface water quality monitoring activities on tributaries to the Red River within Manitoba, Canada during the period October 1, 2001 to September 30, 2002.

Variables	Boyne River PTH 13, Carman	La Salle River St. Norbert, PTH 75	Marsh River PR 303 near Otterborne	Rat River PR 303 near Otterborne	Roseau River PR 200, near Dominion City	Seine River PTH 100 (Perimeter Highway)
Macroinvertebrate community structure	1 time / annum	1 time / annum	1 time / annum	1 time / annum	1 time / annum	1 time / annum
Temperature	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Turbidity	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Colour	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Dissolved Solids	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Suspended Solids	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Total Solids	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Fecal Coliform	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
pH	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Conductivity	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Dissolved Oxygen	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Alkalinity	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Calcium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Magnesium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Hardness	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Sodium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Potassium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Chloride	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Sulphate	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Total Phosphorus	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Dissolved Phosphorus	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Suspended Phosphorus	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Nitrate – Nitrite Nitrogen	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Total Kjeldahl Nitrogen	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Ammonia Nitrogen	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Total Organic Carbon	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Total Inorganic Carbon	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Boron	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Arsenic	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Aluminum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Manganese	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Iron	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Hexavalent Chromium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Nickel	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Copper	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Zinc	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Lead	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Cadmium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Antimony	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Barium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum

Table 9. Continued.

Variables	Boyne River PTH 13, Carman	La Salle River St. Norbert, PTH 75	Marsh River PR 303 near Otterborne	Rat River PR 303 near Otterborne	Roseau River PR 200, near Dominion City	Seine River PTH 100 (Perimeter Highway)
Beryllium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Bismuth	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Cobalt	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Cesium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Lithium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Molybdenum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Rubidium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Selenium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Strontium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Thallium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Tin	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Tellurium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Titanium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Uranium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Vanadium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Tungsten	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Zirconium	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Pentachlorophenol	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
2,4-D	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
2,4-DB	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
2,4-DP	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
2,4,5-TP	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Bromoxynil	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Dicamba	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Dinoseb	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Fenoxaprop	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
MCPA	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
MCPP	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Picloram	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Quizalofop	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Trichlopyr	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Azinphosmethyl	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Chlorpyrifos	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Diazinon	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Dimethoate	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Malathion	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Methyl Parathion	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Parathion	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Terbufos	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Deltamethrin	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Diclofop	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Diclofop-methyl	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Eptam	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum

Table 9. Continued.

Variables	Boyne River PTH 13, Carman	La Salle River St. Norbert, PTH 75	Marsh River PR 303 near Otterborne	Rat River PR 303 near Otterborne	Roseau River PR 200, near Dominion City	Seine River PTH 100 (Perimeter Highway)
Ethafluralin	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Propachlor	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Propanil	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Triallate	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Trifluralin	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Chlorthalonil	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
gamma-BHC (Lindane)	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
alpha-Chlordane	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
gamma-Chlordane	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Methoxychlor	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Carbofuran	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Propoxur	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Alachlor	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Atrazine	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Bromacil	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Metribuzin	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Simazine	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Glyphosate	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
AMPA	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Mecoprop	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Imazethabenz	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Metsulfuron-me	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Tifensulfuron	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum
Tribenuron	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum	4 times / annum

Figure 7. Loading of total nitrogen to Lake Winnipeg for the period 1994 to 2001.

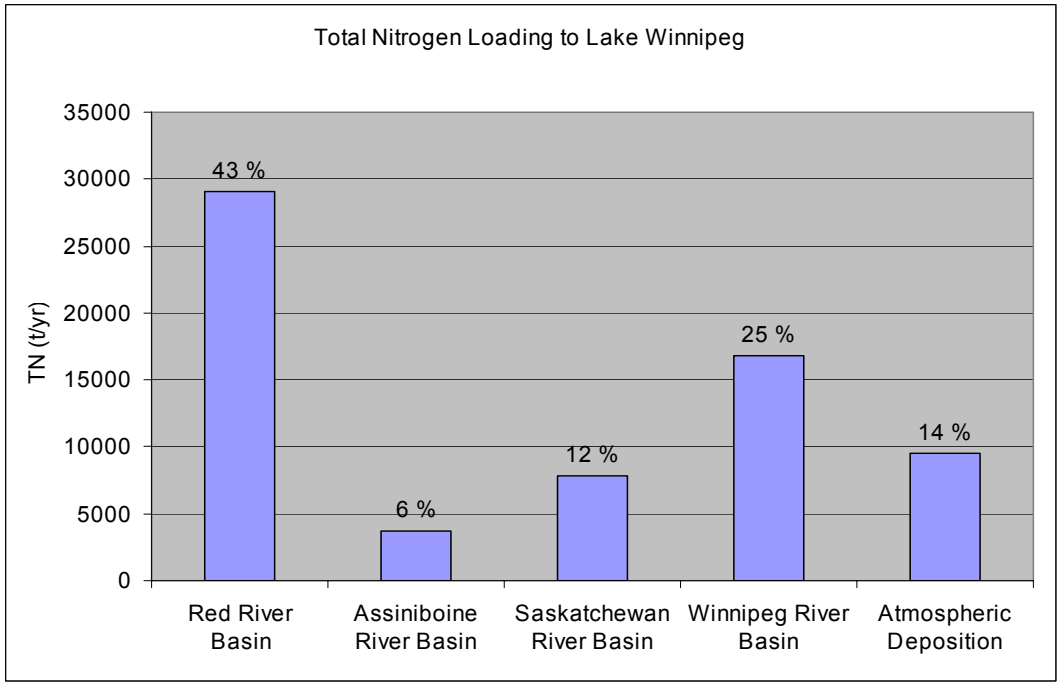


Figure 8. Loading of total nitrogen to the Red River basin for the period 1994 to 2001.

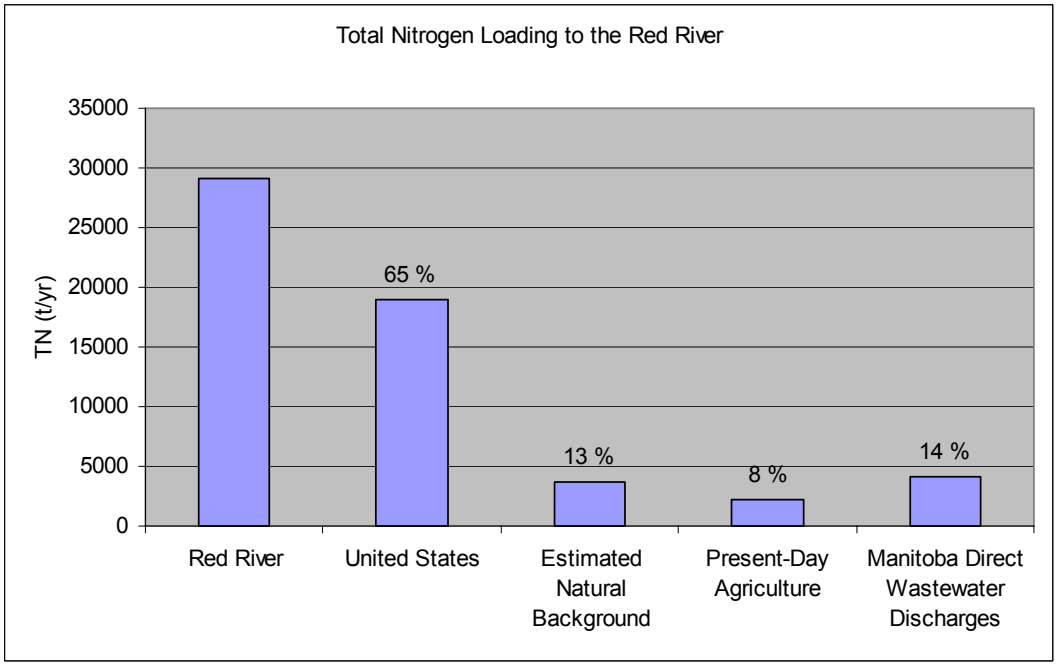


Figure 9. Loading of total phosphorus to Lake Winnipeg for the period 1994 to 2001.

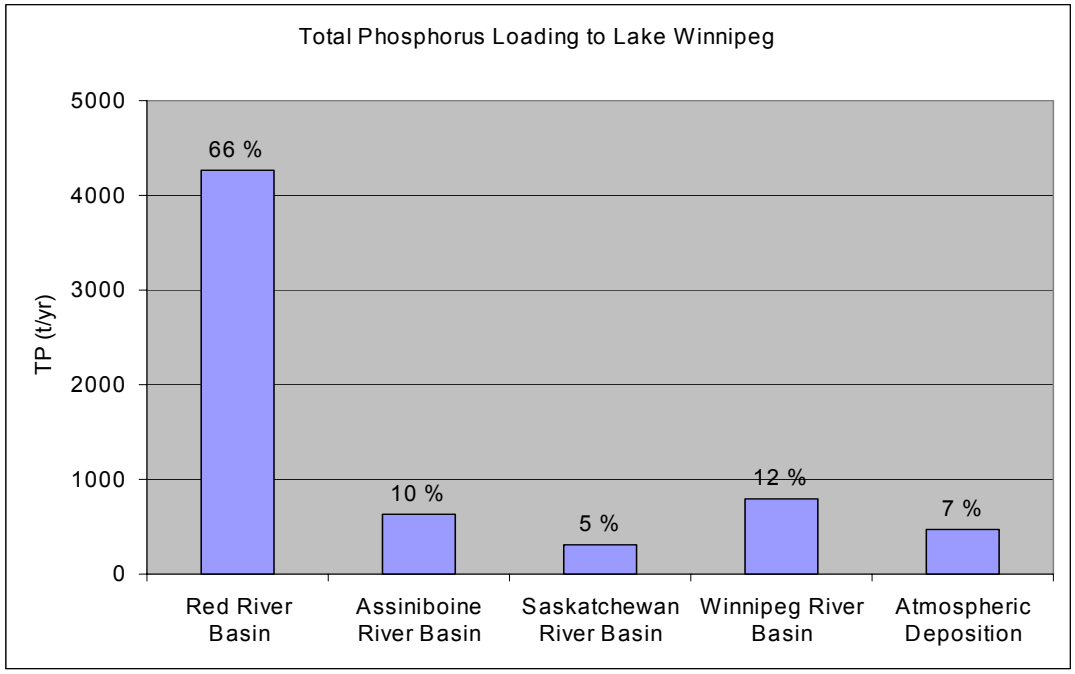
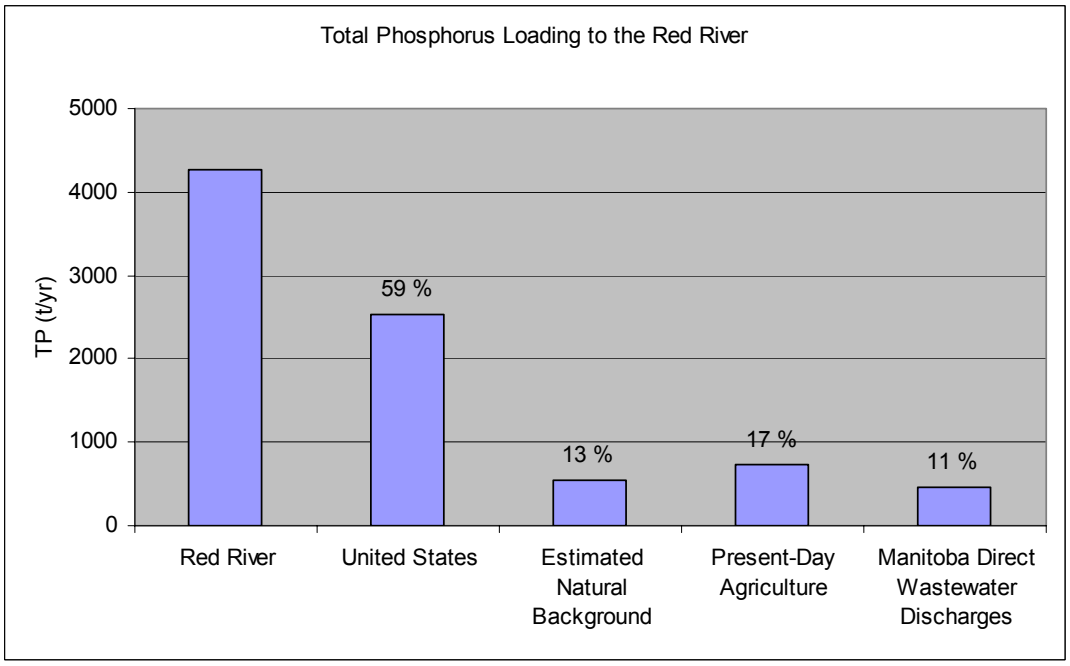


Figure 10. Loading of total phosphorus to the Red River basin for the period 1994 to 2001.



6.4 Environment Canada

Auto-Monitor at Emerson, Manitoba

The automatic water quality monitor started collecting data for *chloride*, *pH*, *conductivity*, *temperature* and *dissolved oxygen* on May 8, 2002 and has been working continuously except for two instances of shut down during this period. The monitor was down from April 7-16, 2003 due to the pump screen being plugged with sediment, and on August 19, 2003, the pump failed due to abrasion of the impellers. Because a replacement pump was not readily available in North America, a larger pump was installed and data collection was resumed on September 19, 2003.

During this down time, the intake lines were flushed and the sediment trap below the submersible pump was cleaned. It is recommended that this type of flushing and cleaning be performed twice a year and that the pump be replaced once a year regardless of its' condition. Further, due to the extremely low water levels in the river, the new pump was lowered an additional two to three feet to prevent damage from air intake. Should the water level stay low during freeze-up and throughout winter and break-up, the intakes could be damaged or taken out completely by ice.

Discussions were held with the USGS to arrange for the Emerson auto-monitor data to be available real-time on the USGS website. The USGS assisted with the data screening protocols and system testing, and on August 11, 2003 , the Emerson data was made available on the USGS website. Minor problems have since appeared with some of the sensors to disrupt availability of the full suite of data. These problems are currently being resolved.

Monthly water quality sampling continued on a monthly basis according to established sampling schedules.

7. WATER POLLUTION CONTROL

7.1 Contingency Plan

The contingency plan was adopted by the former International Red River Pollution Board on January 1, 1981. Contacts and telephone numbers have been updated for 2003, and are included in Appendix C.

The purpose of the contingency plan is to ensure that positive coordinated action is taken to minimize public health hazards and environmental damage in the event of a spill. This plan does not supersede any local or national contingency plans in existence but rather serves to coordinate these activities. The plan becomes effective whenever the discharge of a pollutant within the Red River basin has the potential to adversely impact the Red River. The plan also becomes effective at any time when exceedances of either water quality objectives or alert levels as described in Chapter 5 are observed at the international boundary.

The contingency plan is available from the IRRB.

7.2 Spills and Releases

Minnesota

Compliance with the technical review criteria of MPCA's NPDES water quality permits is monitored monthly by the permittees. MPCA staff review the reported exceedances, and enforcement actions are required in some cases.

During the 2002 water year, municipal and industrial facilities in Minnesota discharging directly to the Red River were generally in compliance with their NPDES permits. The MPCA received 22 reports of spills and bypasses during the reporting period. Nineteen of the basin's permitted municipal wastewater treatment plants reported wastewater bypasses during the water year, and an industrial facility reported three storm water bypasses. All of the bypasses were attributed to weather conditions, and the wastewater bypasses were associated with extreme rain events that occurred during the summer of 2002. None of the bypasses resulted in enforcement actions.

North Dakota

During this reporting period, most of the state returned to near normal conditions relating to precipitation events. Select areas, mostly in the western and south-central part of the state, received minimal precipitation in the form of snow/rain. Fewer bypasses and lagoon overflows were reported compared to the past several years. In addition, the number of discharges and total volume of water discharged for this reporting period continued the downward trend and resembled near normal conditions.

Manitoba

Three municipalities with populations greater than 1000 discharge treated effluents directly to the Red River within Manitoba. The Town of Morris discharges for a short period of time each spring and fall, while the City of Winnipeg's South End Water Pollution Control Centre, the North End Water Pollution Control Centre, and the Town of Selkirk discharge continuously. Volumes and quality of effluent has not changed significantly from previous years. In addition to the two major wastewater treatment facilities within the City of Winnipeg, discharges also occur from 21 private wastewater treatment plants, 41 combined sewer outfalls, and 75 major land drainage outfalls.

Most tributary streams also receive treated wastewater effluents from nearby communities.

On September 16, 2002, a valve failed at the City of Winnipeg's North End Water Pollution Control Centre allowing untreated sewage to flow to the Red River. During a period of approximately 60 hours, about 462,500 cubic metres of untreated sewage entered the Red River from a number of combined sewer

overflow locations. A full report on the water quality impacts arising from this spill was prepared and is available on the Manitoba Conservation website.

As a result of this incident, the Honourable Steve Ashton, Minister of Conservation, asked the Manitoba Clean Environment Commission to hold public hearings and to investigate the causes of the spill, its consequences, and other matters related to discharge limits for the City of Winnipeg's sewage treatment facilities. Public hearings were held in January and April, 2003. The Clean Environment Commission released its final report in August 2003 with recommendations for action in the short and longer terms to improve the reliability of the City's waste treatment systems and their effectiveness in protecting water quality in the Red River and Lake Winnipeg. The City of Winnipeg has undertaken timely implementation of these recommendations.

7.3 Pollution Abatement and Advisories

Minnesota

Point Source Control Program

The Minnesota National Pollutant Discharge Elimination System (NDPDES) permit program regulates the release of wastewater and stormwater from point sources into waters of the state. All point source dischargers, both municipal and industrial, are required to obtain a permit. These permits outline technology based and water quality based limits for wastewater discharges.

The Minnesota Pollution Control Agency has permitted 107 facilities to discharge wastewater into the Red River or its tributaries. Of these facilities, 85 are municipal permits, and 22 are industrial permits. There are 13 major permits (average design flow over 1 million gallons per day) in the Minnesota portion of the Red River basin. Of the major permits, 6 are municipal and 7 are industrial.

In the 2002 water year, 32 water quality permit actions occurred as follows:

- 20 municipal wastewater treatment facilities were reissued permits to discharge;
- Three regular wastewater treatment facilities, and three regular industrial wastewater treatment facilities, were reissued general permits to discharge;
- Three regular wastewater treatments facilities were issued general permits to discharge;
- Two regular facilities, one municipal and one industrial, received administrative modification to permits,
- One major industrial facility received a minor permit modification, and
- One major industrial wastewater treatment plan (discharging more than 1 million gallons daily) was reissued a permit.

Stormwater Permits

Construction projects disturbing five acres or more of land require a General NPDES Storm Water Permit. The objective of this permitting program, which is a part of the National Pollutant Discharge Elimination System (NPDES), is to reduce the amount of sediment/pollution entering surface waters both during and after construction projects.

The program requires that any project disturbing more than five acres of total land area be covered under the storm water permit for construction activity. Construction activities requiring a permit include landscape clearing, grading, excavation, road building, and construction of homes, office buildings, industrial parks, landfills and airports.

Customers of this program include anyone involved in construction in Minnesota. This includes developers, builders, architects, design engineers, surveyors, city/county highway departments, and the Minnesota Department of Transportation. During this reporting period, 93 construction stormwater permits were issued in the Red River basin.

Feedlots

The MPCA is the principal agency for regulating feedlots in Minnesota. In addition, 55 counties (as of February 2003) administer the program for feedlots under 1,000 animal units. A revised feedlot rule went into effect in October 2000. MPCA has dedicated considerable resources to identifying, managing and regulating feedlots since then. There are 1,570 registered feedlots in thirteen Red River basin counties in Minnesota. MPCA-Northwest Office staff have worked with landowners to provide permits in a timely fashion, inspect feedlots as necessary and to implement measures to reduce water quality impacts of feedlots.

Fish Consumption Advisory

The Minnesota fish contaminant program is a multi-agency program for which the MPCA, the Department of Natural Resources (DNR), the Department of Agriculture, and the Minnesota Department of Health (MDH) each have a role. It is the MDH, however, that establishes the threshold concentrations of contaminants in fish that trigger the various levels of advice, which range from "unlimited consumption" to "do not eat". Also, it is the MDH that each year issues the 'Minnesota Fish Consumption Advisory' (MFCA) to anglers suggesting that they limit their consumption of certain fish species of certain sizes from certain bodies of water. The MFCA is strictly advisory, with the goal being to help anglers make intelligent decisions on which fish to keep for eating. There is nothing mandatory or regulatory about the advice itself. However, the MPCA uses the MFCA for assessment of potentially impaired waters for the 303(d) list, as well as to provide information in the 305(b) biannual water quality report. Fish contaminant data are also used by the MPCA to determine if additional studies are needed to identify sources of pollutants and determine pollutant trends.

The Minnesota Department of Health updated its MFCA in May 2000. The Department simplified its reporting procedure to emphasize the fish consumed. The advisory is available electronically at <www.health.state.mn.us >. Fish from each lake or river reach are aggregated by species and size class: 0-5, 5-10, 10-15 inches, etc. Water bodies will be considered impaired if the arithmetic average concentration of the fish in any size class exceed 0.2 parts per million for both mercury and PCBs. Only water bodies with measured data in excess of this threshold are listed.

The Department of Natural Resources (DNR), the Minnesota Pollution Control Agency (MPCA), and the Minnesota Department of Health (MDH) collaborate in producing this advisory. Each year, the DNR collects fish from lakes and rivers for testing. Fish from 856 lakes and 51 streams in Minnesota have been tested for contaminants. Minnesota has over 6000 fishable lakes, so it is too expensive to test fish from every lake and stream. Waters are selected for sampling where angling is popular, where there is a known or suspected pollution source, or where fish contaminant trends are being tracked.

MDH has issued guidelines for the general population and women who may be pregnant. Red River basin waters with fish consumption advisories are listed in Table 10.

Table 10. Minnesota Fish Consumption Guidelines For Red River Basin

River	Species	General population consumption	Vulnerable population consumption
Clearwater	Northern Pike	1 meal per week 15-25 inches in length	1 meal per month 15-25 inches in length
	White Sucker		1 meal per week under 15 inches in length
Red Lake River	Black Crappie *Above Thief River Falls Dam*	Unlimited	1 meal per week under 15 inches in length
	Walleye *Above Thief River Falls Dam*	1 meal per week under 20 inches in length	1 meal per month under 20 inches in length
	White Sucker *Above Thief River Falls Dam*	Unlimited under 15 inches; 1 meal per week 15-20 inches in length	1 meal per week under 20 inches in length
	Black Crappie *Below Thief River Falls Dam*	1 meal per week under 15 inches in length	1 meal per week under 15 inches in length

River	Species	General population consumption	Vulnerable population consumption
	Carp *Below Thief River Falls Dam*	1 meal per week 15- 20 inches in length	1 meal per month 15- 20 inches in length
	Smallmouth Bass *Below Thief River Falls Dam*	1 meal per week under 20 inches in length	1 meal per month under 20 inches in length
	Walleye *Below Thief River Falls Dam*	1 meal per week under 20 inches in length	1 meal per month under 25 inches in length
Red River	Black Bullhead	Unlimited	1 meal per week under 15 inches in length
	Black Crappie	Unlimited	1 meal per week under 15 inches in length
	Burbot	1 meal per week 15- 20 inches in length	1 meal per week 15- 20 inches in length
	Carp	1 meal per week under 30 inches in length	1 meal per week 30 inches in length
	Channel Catfish	1 meal per week under 30 inches in length	1 meal per week under 15 inches in length; 1 meal per month 15-30 inches in length
	Freshwater Drum	1 meal per week 15-25 inches in length	1 meal per week under 15 inches in length; 1 meal per month 15-30 inches in length
	Golden Redhorse	1 meal per week 15-20 inches in length	1 meal per month15-20 inches in length
	Northern Pike	1 meal per week 15-30 inches in length	1 meal per week under 15 inches in length; 1 meal per month 15-30 inches in length
	Quillback	1 meal per week under 20 inches in length	1 meal per month under 20 inches in length
	Redhorse Sucker	1 meal per week under 20 inches in length	1 meal per month under 20 inches in length
	River Carpsucker	1 meal per week under 20 inches in length	1 meal per month under 15 inches in length; 1 meal per month 15-20 inches in length
	Sauger	1 meal per month under 20 inches in length	1 meal per month under 20 inches in length
	Silver Redhorse	1 meal per week 15- 20 inches in length	1 meal per month 15- 20 inches in length
	Walleye	1 meal per week under 30 inches in length	1 meal per week under 15 inches in length; 1 meal per month 15-20 inches in length; do not eat 20-30 inches in length
	White Sucker	1 meal per week under 20 inches in length	1 meal per month under 20 inches in length
Roseau	Carp	1 meal per week 15-20 inches in length	1 meal per week 15-20 inches in length; 1 meal per month 20-25 inches in length
	Walleye	1 meal per week under 20 inches in length	1 meal per month under 20 inches in length

Mercury is a classic example of a bioaccumulative chemical: it never degrades, it can bioaccumulate through the food chain to toxic levels from benign water concentrations, and it can cause serious health effects. To make the situation worse, it is unusually mobile in the environment and it readily moves from one medium to another. Mercury can volatilize and be deposited elsewhere time after time. Atmospheric transport can be short (metres) or long (around the world). Mercury numerical water quality standards are based on total concentrations and thus, total mercury will be used in the assessment. Minnesota's statewide chronic water quality standards for total mercury is 6.9 ng/L, which is based on human health.

With regard to the exposure element, the MPCA has departed from EPA policy based on local information and the importance of fishing in this state. Minnesota human health-based water quality standards are calculated assuming people eat 30 grams of fish per day. EPA uses 17.5 grams per day (prior to 2000, EPA used 6.5 g/d). The MPCA arrived at a value of 30 grams per day in 1989, based on several surveys of the fish eating habits of anglers. Thirty grams per day equals about one half-pound meal per week. Because the one-meal-per-week consumption rate (~ 30 g/d) is the basis for all Minnesota human health-based water quality standards, the MPCA position is that eating one fish meal per week (over a life time) is fully supporting the use. In other words, advice to limit consumption to "no more than one meal per week" (or any advise that is less restrictive) is not considered an exceedance of the mercury or PCB water quality standards. But, advice to limit consumption to less than one meal per week, such as one meal per month, for any member of the population, is an indication of impairment. Less than 20 percent of anglers and less than 95 percent of the whole population in the upper Midwest eat more sport-caught fish than one meal per week over a lifetime.

The new EPA mercury fish tissue criterion of 0.3 ppm was calculated assuming people eat 17.5 grams of fish per day. If the EPA criterion is re-calculated using 30 g/day, the criterion becomes 0.17 ppm. The difference between the MDH threshold value of 0.2 ppm and the re-calculated EPA criterion of 0.17 ppm is the fact that the EPA criterion accounts for people eating some ocean fish in addition to freshwater fish, whereas the MDH advice is based on exposure from freshwater sport-caught fish only. Given the closeness of 0.17 and 0.2 ppm, the more protective MPCA fish consumption assumption, (and the uncertainties inherent in criteria development and use of built in safety factors), the MPCA believes that the use of the 0.2 value as the threshold for impairment decisions is appropriate.

MPCA reports that mercury is the leading cause of water quality impairment in the State of Minnesota. The agency is participating in a multi-agency research project to determine the effects of mercury exposure on fish. Preliminary results were presented at the Red River Basin Institute's April 2003 International Water Conference. Figure 11 indicates the relative significance of methylmercury as a leading cause of surface water impairment in Minnesota, and Figure 12 indicates the regional significance of fish consumption advisories for mercury.

Figure 11. Methylmercury Surface Water Impairment in Minnesota

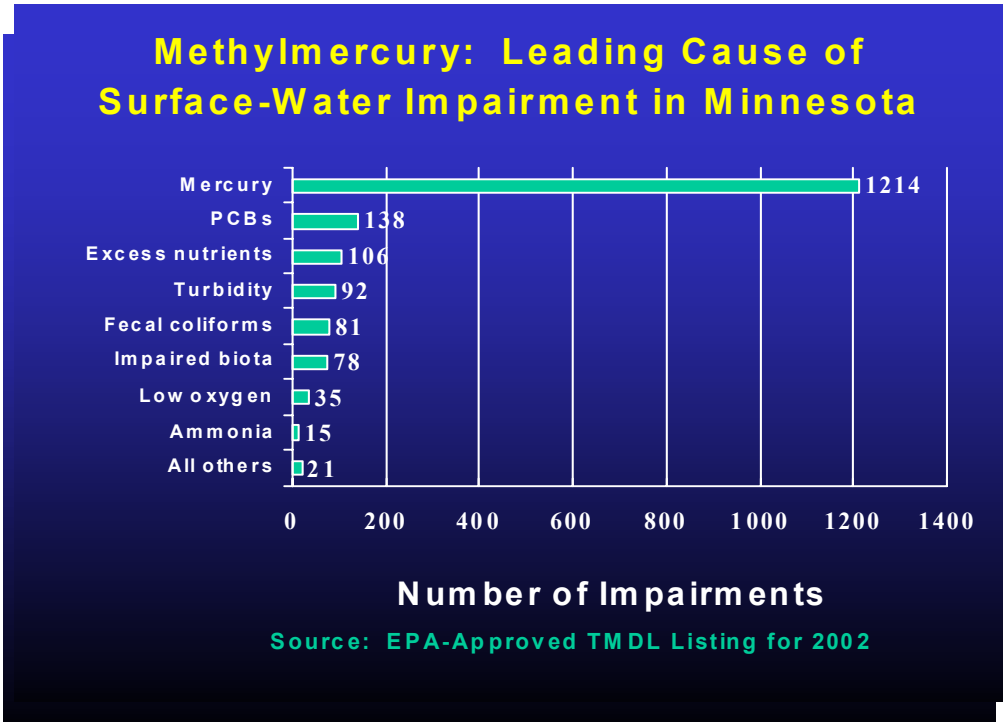
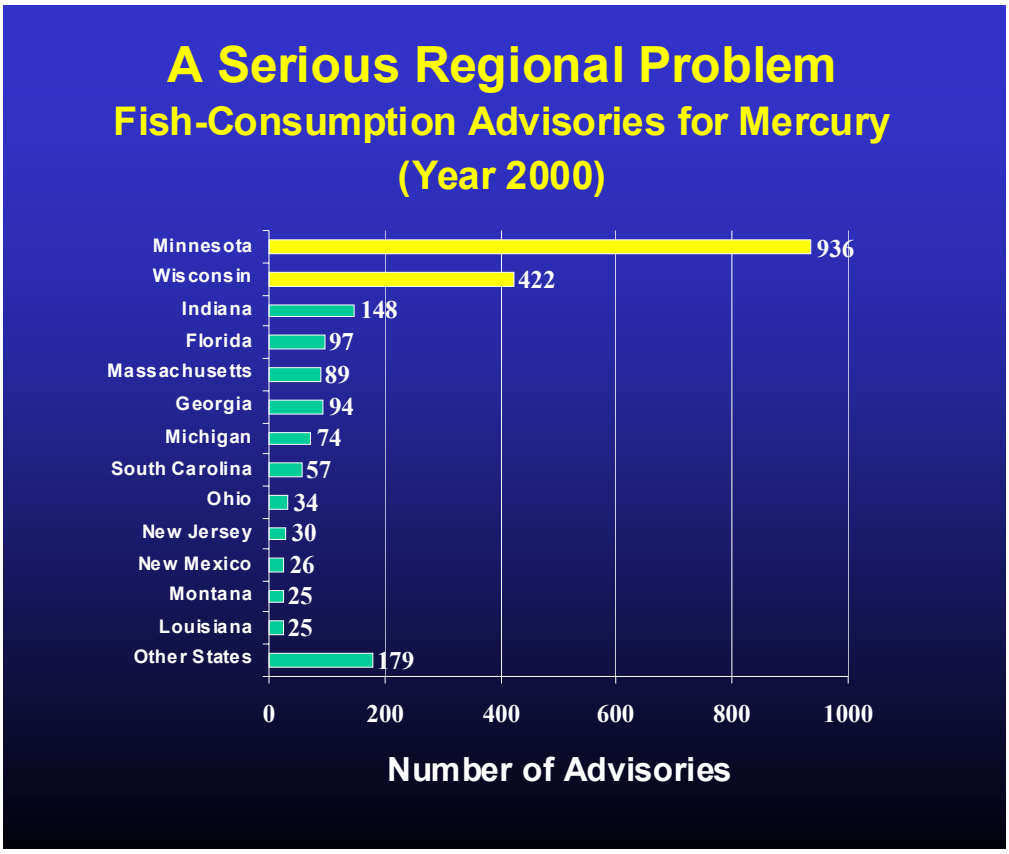


Figure 12. Regional Fish Consumption Advisories for Mercury



North Dakota

Point Source Control Program

The North Dakota Pollutant Discharge Elimination System (NDPDES) program regulates the release of wastewater and storm water from point sources into waters of the state. Permitted municipal and industrial point source dischargers must meet technology and water quality-based limits.

Toxic pollutants in wastewater discharges are an important concern, particularly for the larger cities and industries in North Dakota. They are regulated through the industrial pretreatment program which is administered by US EPA Region VIII. The cities of Grand Forks, Fargo, and West Fargo have approved pretreatment programs in the eastern part of the state. The department is in the final stages of seeking delegation for the pretreatment program. The department had expected final approval by US EPA during calendar year 2002. However, the time needed for legal reviews has delayed submittal of the final program package to EPA for approval.

All waters of the state shall be free from substances attributable to municipal, industrial, or other discharges in concentrations or combinations which are toxic or harmful to humans, animals, plants, or resident biota. This standard is enforced in part through appropriate Whole Effluent Toxicity (WET) requirements. All major municipal and industrial permittees must monitor their discharge for WET on a regular basis. Should the results from these tests indicate the effluent is toxic to aquatic organisms, a toxicity identification evaluation (TIE) may be required. TIEs have resulted in minor and major wastewater upgrades to select municipalities and industries.

Wastewater discharge data during the reporting period October 1, 2001 to September 30, 2002 are presented in Table 11. In addition, the average BOD_5 and TSS values from facilities discharging to the Red River for the years 1985 to 2002 are presented in Figure 13.

The City of Fargo's wastewater treatment plant provides a quality effluent on a continual basis to the Red River. Wastewater treatment consists of pretreatment/odor control, primary clarification, trickling filters, nitrification filters, final clarification and disinfection. Improvements to the residuals management (additional digesters, sludge drying beds and belt presses) has given the City more flexibility in addressing the sludge and wastewater treatment. Although the City presently uses the processed solids as cover at the municipal landfill, they are exploring several different options to address the biosolids issue. Fargo still maintains their six, 90-acre wastewater stabilization ponds which can be used for storage during times of flooding or an upset in treatment plant.

Cargill Corn Milling (ProGold) produces high fructose corn syrup at their facility near Wahpeton. The plant discharges to the Red River on a continuous basis with storage ponds available to store wastewater when treatment is inadequate or when the river would be adversely affected. Wastewater high in total dissolved solids is stored in two ponds on site. The discharges from these ponds must be coordinated with the conditions in the Red River, downstream users and discharges from Minn-Dak Farmer's Cooperative in order to meet the requirements of their permit. The background water quality in the Red River continues to be the most limiting factor for coordinating discharges from the ponds, particularly when flows are predominantly from Lake Traverse. The department re-issued Cargill's NDPDES permit in July 2000. Like the original permit, the requirements in the new permit protect water quality standards and reflect comments and concerns expressed by federal, state, municipal and citizen entities in North Dakota and Minnesota.

American Crystal Sugar uses a combination of lagoons and constructed wetlands for wastewater treatment at their facilities in Hillsboro and Drayton. The final effluent from these facilities surpasses the federal effluent criteria for suspended solids and oxygen demand. The 1.5 million gallons per day (MGD) anaerobic digester and clarifier at the Hillsboro plant maximizes the performance of the existing aerobic digester resulting in a reduction of the feed water strength while maintaining a constant temperature throughout the season. This water is of better quality and is routed to the wetland earlier in the season, maximizing the wetland's ability to provide additional treatment/polishing prior to discharge.

The Minn-Dak Farmer's Cooperative sugar beet processing plant uses both mechanical and facultative lagoons for wastewater treatment at the Wahpeton facility. The wastewater receives additional treatment/polishing in the large discharge reservoir from which the final effluent is discharged through an in-stream diffuser to the Red River. The addition of the nitrification/de-nitrification system has significantly decreased ammonia levels in the discharge. Minn-Dak continues to coordinate its discharges with Cargill, since both facility permits contain receiving stream quality requirements for sulfate, chloride, and total dissolved solids.

The City of Grand Forks has moved the start-up date of their new wastewater treatment plant to midsummer 2003. The treatment facility consists of a high level activated sludge plant using a European technology of Micro-Bubble Flotation. The plant is designed for 15 MGD and 40,000 pounds of BOD_5. The operation of the new treatment facility has also been modified to include the continual use of the stabilization ponds for treatment/storage and biosolids management. Treatment and operational practices have also been adjusted in the water treatment plant residuals handling facility in an effort to reduce the likely hood of residuals being discharged to the Red River. The proposed flood protection dike alignment runs through the water treatment plant facility. Based on this and the age of the plant, the long range plans are to relocate the water plant further away from the river which is subject to flooding. The City continues to move forward on activities associated with the new water treatment plant. The new plant will be built east of Interstate 29 in the SW part of the new industrial park. The raw water intake and transmission line from the river to the proposed treatment plant location has been completed and a large clearwell/reservoir is in the process of being constructed.

The Cities of Fargo, West Fargo and Grand Forks were notified in the fall of 2002 that discharge permits would be required for their storm sewer systems in response to EPA's storm water phase II rule. The goal of the permitting effort is to restore and maintain the quality in water bodies through the management and treatment of urban storm water runoff. To accomplish this goal the Cities will be developing a Storm Water Pollution Prevention Program designed to reduce the discharge of pollutants from their storm sewer systems. Permit applications and program outlines were due to be submitted to the department in the spring of 2003.

Fish Consumption Advisory

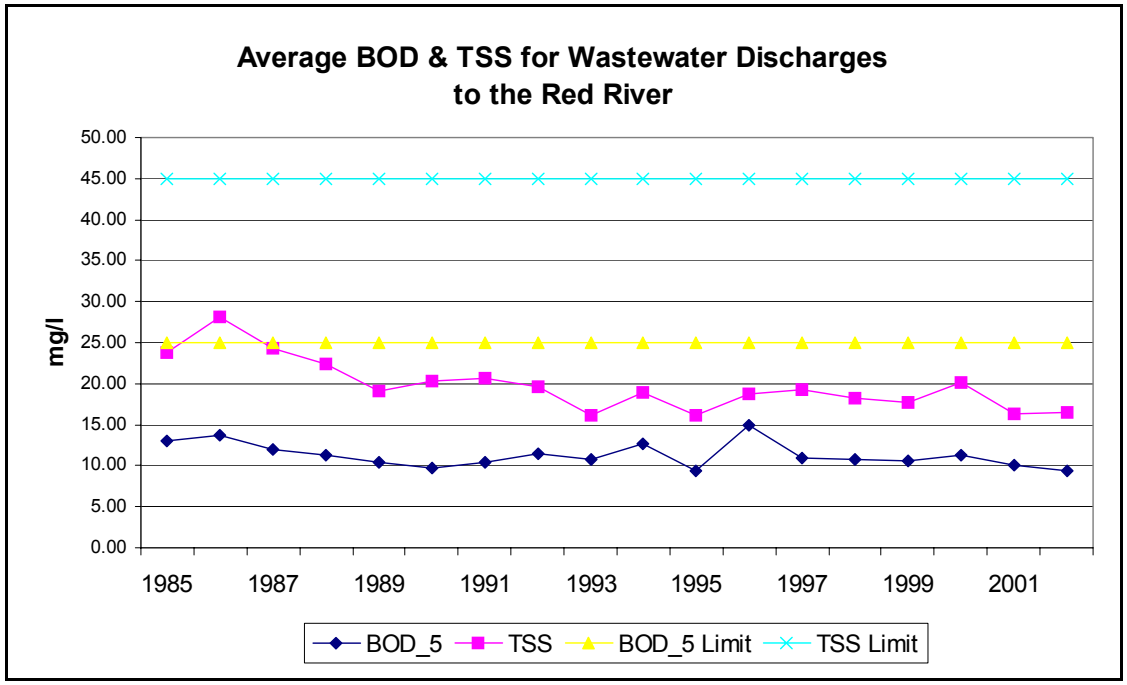
The North Dakota Fish Consumption Advisory was updated in January 2001 as a statewide advisory. Mercury data from fish tissue samples collected from rivers, lakes and reservoirs throughout the state were combined resulting in a statewide advisory for walleye, northern pike, yellow perch, largemouth bass, smallmouth bass, white bass, channel catfish, and chinnook salmon.

Table 11. Waste Discharge Data for North Dakota during the Reporting Period October 1, 2001 to September 30, 2002

Source*	Length of Discharge Days	Total Flow M^3	Discharge Quality - mg/l						Discharge Rate Avg. M^3/day	BOD-5 Loading Avg. kg/day	TSS Loading Avg. kg/day	Time in Permit Compliance Percent
			BOD-5			TSS						
			High	Low	Avg.	High	Low	Avg.				
Drayton	7	83467.766	6	6	6	5	5	5	11923.967	71.5438	59.61983	100
Fargo	342	14232054	14.2	2.5	8.2538	19.6	5.7	10.9923	41614.194	343.477	457.436	100
Grafton	15	598408.49	6.6	6	6.1	24	5.5	11.465	39893.9	243.353	457.3836	100
Grand Forks	63	7708909.4	45	6	10.397	45	12	21.65	122363.64	1272.17	2649.173	100
Grand Forks AFB	10	352459.21	6	6	6	9.7	5	5.78333	35245.921	211.476	203.8389	100
Wahpeton	28	1072290.5	21	6.3	10.528	60	10.5	22.375	38296.089	403.162	856.875	98.1
West Fargo	73	1621039.8	14.45	5.7	9.0257	83.3	5.7	22.7914	22206.025	200.425	506.107	97.3
ACS-Drayton	119	876303.21	29	7	11.2	41.5	18.5	13.16	7363.8925	82.4756	96.90883	100
ACS-Hillsboro	214	507420.9	8	4	4.6667	40.8	8.5	12.1	2371.1257	11.0653	28.69062	100
Minn Dak	37	1053516.9	18.5	8.5	14.4	27.7	7.5	20.3333	28473.43	410.017	578.9597	100
Cargill Inc	363	1915058.6	28.1	2	11.309	50	3	22.95	5275.6435	59.6631	121.076	98.1

* Source -- Population greater than 1,000 or P.E. greater than 1,000

Figure 13. Average BOD & TSS for Wastewater Discharges to the Red River, 1985 to 2002



Manitoba

Pollution Abatement

Manitoba Water Quality Standards, Objectives, and Guidelines are applicable to streams within the Red River basin. In addition, site-specific water quality objectives have been established for the Red River within and downstream of the City of Winnipeg. Water uses protected in the Red River include domestic water supply source, habitat for aquatic life and wildlife, industrial uses, irrigation, livestock watering, and water-related recreation.

All treated municipal effluents discharged to tributary streams within the Red River basin in Manitoba are licenced under Manitoba's Environment Act. Approximately nine private facilities located within the City of Winnipeg boundary are not yet licenced (out of the original 21 facilities un-licenced when the Environment Act came into effect in 1988). The nine facilities will receive licences within the next couple of years. Disinfection using ultra-violet light technology has been installed and is operational at the South End Water Pollution Control Centre. Disinfection works have been developed for the North End Water Pollution Control Centre and construction will occur in 2002. Disinfection likely is not required at the West End Water Pollution Control Centre. At the West End Centre, lagoons are utilized to polish the effluent. Data indicate that effluents from the polishing lagoons contain acceptable densities of bacteria during the open water season. The City of Winnipeg, with input from an advisory committee including Manitoba Conservation, has completed a major study on combined sewer overflows. A study into the impacts of un-ionized ammonia on the Red River began in late 1998 and was completed in mid-2001. The purpose of the study is to develop a site-specific water quality objective for ammonia and to identify applicable technologies to reduce ammonia levels in the wastewater prior to discharge. Discussions are underway to incorporate the findings of these studies into Environment Act Licences for the City of Winnipeg.

8. BIOLOGICAL MONITORING IN THE RED RIVER BASIN

The International Red River Board (IRRB) and its predecessor, the International Red River Pollution Board, have been monitoring aquatic environmental conditions in the Red River basin for more than three decades. This long-term environmental monitoring has focused primarily on the chemical characteristics of the mainstem Red River, its tributaries, and Lake Winnipeg. The current Directive to the IRRB indicates the need for a more holistic, ecosystem-based, monitoring approach. To initially meet the requirements of the Directive, Chapter 8 presents a report on some aspects of aquatic biological conditions in the Red River basin. The data for this report have been obtained from a number of agencies and have been collected for a variety of reasons. In the future, other monitoring programs that are more relevant to the mandate of the IRRB need to be implemented to supplement the monitoring activities and available data identified in this report.

The aquatic monitoring report herein includes:

1. an initial and preliminary list of the exotic fish species in the Red River basin,
2. time trends for the Lake Winnipeg commercial fishery (1880s to present),
3. algal blooms in Lake Winnipeg (2003),
4. fish species composition at the international boundary on the Red River for 2003, and
5. benthic invertebrate monitoring in tributaries to the Red River in Manitoba (1995 – 2001).

8.1 Exotic Species in the Red River Basin

The intent of the IRRB is to provide for each year a complete list of the exotic species that have been found in the Red River basin and Lake Winnipeg. A number of activities have been undertaken in the past year to begin this task.

The IRRB Aquatic Ecosystem Health Committee work plan recognizes the need to be proactive with regard to monitoring non-native species. The Committee's recommendation to the IRRB in response to the original directive to the AEHC to *"develop recommendations and implementation details for monitoring non-native species in the watershed"* contains two actions items:

1. Full cooperation between participating agencies, universities, and others to report presence of all known and documented foreign, exotic, and non-native species to the IRRB at each annual meeting, and

2. Establishment of sampling protocols and reporting mechanisms for collection and identification of new non-native species.

In accordance with the direction given to the Committee by the IRRB, and as a first step in meeting the recommended course of action, the U.S. Bureau of Reclamation is undertaking work designed to examine invasive species. At the request of the North Dakota Health Department, the Bureau of Reclamation is using internal funds to complete an extensive literature review of exotic, invasive, and non-native species in the basin.

As noted in Section 4.9, the original intent of this work was to complete the literature survey for the U.S. portion of the basin. However, during discussion at the July 2003 meeting of the AEHC in Winnipeg the Committee strongly recommended that the review cover both the U.S. and Canadian portions of the basin. The Bureau of Reclamation agreed to expand the scope of the work and increase the budget for the project and include the Canadian portion of the basin. Canadian members of the Committee agreed to provide relevant information from their respective agencies to the Bureau.

The objective of this work is to use existing data sources and literature to determine the spatial distribution of exotic, non-native and invasive species in the basin. The results of this work will be used to develop specific short term and long term monitoring strategies for existing species and for new species known to exist in other watersheds that could impact the Red River basin.

Work on the literature review is underway and is scheduled for completion in the spring of 2004. A report on the results will be provided to the IRRB at the annual meeting in July 2004.

A number of exotic fish species have been recorded from the Red River and its tributaries in Manitoba and from Lake Winnipeg. Some of these fish species may not reproduce and therefore will or have become extinct. Two species, brook trout and lake trout, are native to the Nelson River and its tributaries in northern Manitoba. The list of exotic species include:

Goldfish (*Carassius auratus*)
Carp (*Cyprinus carpio*)
Rainbow smelt (*Osmerus mordax*)
Rainbow trout *(Oncorhynchus clarki*)
Brown trout (*Salmo trutta*)
Brook trout (*Salvelinus fontinalis*)
Lake trout (*Salvelinus namaycush*)
Arctic char (*Salvelinus alpinus*)
White bass (*Morone chrysops*)
Pumpkinseed (*Lepomis gibbosus*)
Bluegill (*Lepomis macrochirus*)
Smallmouth bass (*Micropterus dolomieui*)
Largemouth bass (*Micropterus salmoides*)
White crappie (*Pomoxis annularis*)

8.2 Lake Winnipeg Commercial Fishery

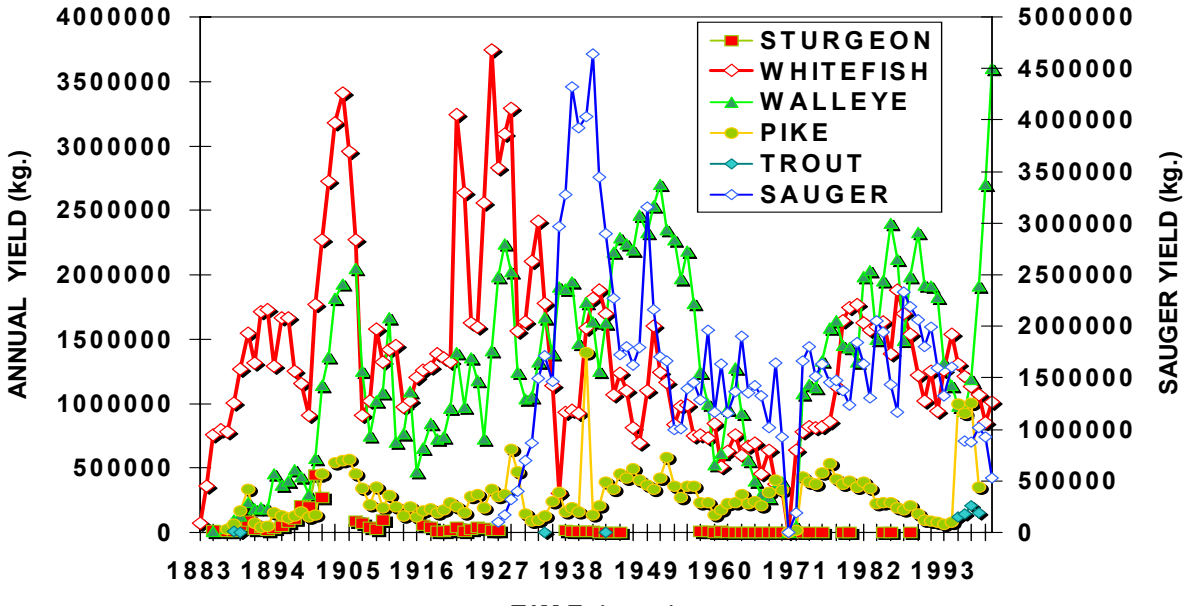
Records for the commercial fishery in Lake Winnipeg have been collected from the 1880s to the present by the Freshwater Fish Marketing Corporation (FFMC) and other agencies in the past. These data were collected primarily for economic assessments and requirements; however, they are also of value in providing long-term, general indications of fish community composition and change over time.

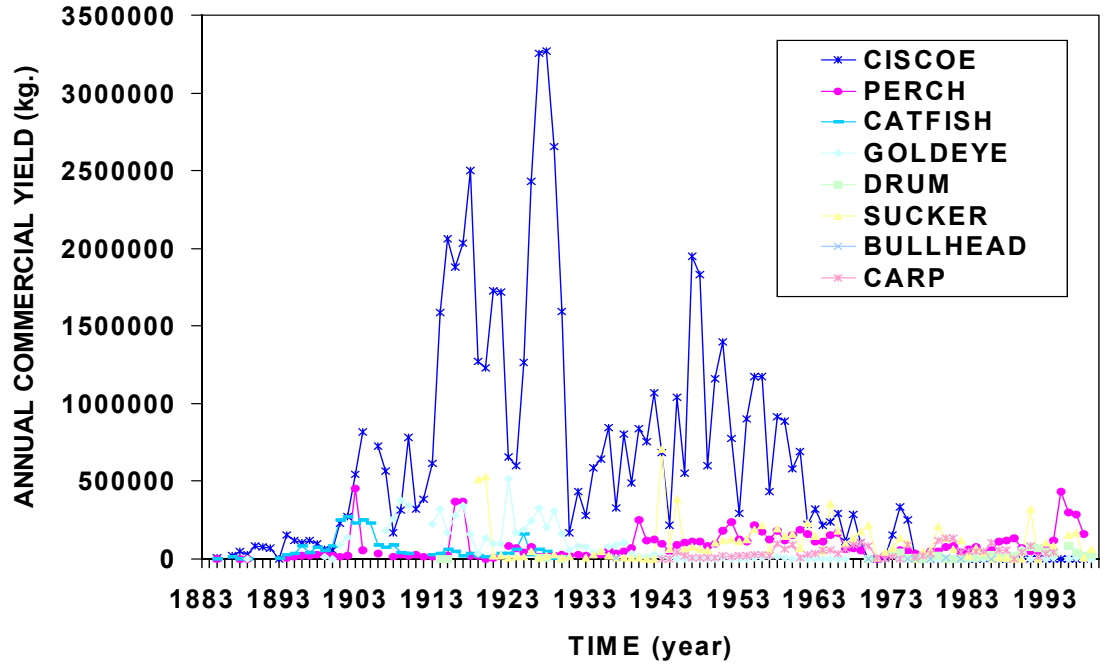
The assessment of commercial fish data for environmental monitoring requires caution because of a number of serious biases that could be introduced relating to the way the data are assembled. For example, fishing effort and mesh sizes change from year to year. Further, while the data indicate catch sold to the FFMC, some fish species, such as suckers, burbot, and lake whitefish, may be culled from the catch depending on the available mixed species quotas and prices. There are numerous examples in the catch data that are indicative of "fishing up", fishery closure, changes in management, and price fluctuation. Sustainability in most of the inland fisheries seems to be driven by cost-benefit decisions by fishers; that is, if price is high they fish hard if it falls they fish less, and, if the catch falls off, some fishers leave the business. A better and more scientific monitoring program would require experimental fishing gear and consistent sampling methods. Nevertheless, the data from the commercial catch records provide valuable insight into the long-term ecological status of the fish assemblage of Lake Winnipeg.

It can be concluded from the long-term catch records that the commercial fishery of Lake Winnipeg has and continues to be an economically important and valued component of the Red River ecosystem. This fishery remains dominated by indigenous freshwater fish species. In 2003, walleye, sauger, and lake whitefish were the dominant and most valued component of the fishery. In general, strategies for managing the commercial catch during the past century (closures, quotas, etc.) have successfully maintained a viable fishery of indigenous species although the pristine fish community has not been maintained.

A number of important changes have occurred to the Lake Winnipeg fish assemblage. Lake Winnipeg has about the same species richness that it did in the late 1800s but there have been huge changes in the abundance of several fish species (Figures 14A and B).

Figures 14A and B. Annual yields of Lake Winnipeg commercial fishery.

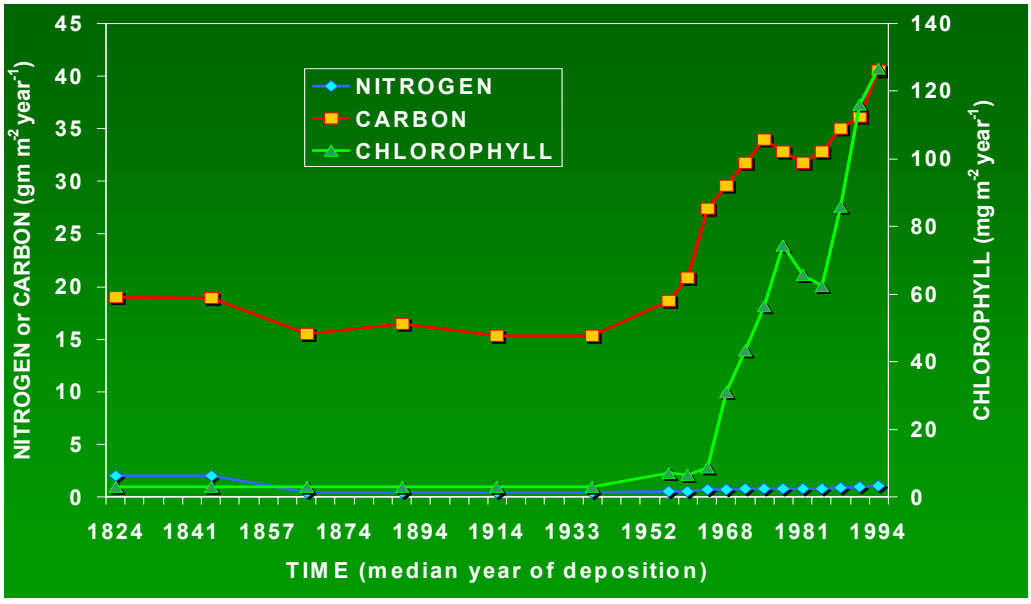




Sturgeon and trout were the first to collapse during the early 1900s. They were replaced with whitefish whose commercial abundance peaked in the 1920s and then slowly declined. Carp invaded in the 1940s. As whitefish declined, percid (walleye and sauger) abundance increased and then declined. Whitefish and percid catches first collapsed in the late 1960s. After a 2-year closure due to excessive mercury, fishing for percids and whitefish started again. Yields increased until the mid-1980s and declined until the mid-1990s. Meanwhile, four exotic species (carp– early 1900s, white bass-1964, black crappies-198? and rainbow smelt-1990) had invaded. It took walleye about five years to "catch on" to eating smelt. Now walleye feed exclusively on smelt in the northern basin whose less turbid waters are preferred by smelt. A standardized annual monitoring program began in 1979, and recording of the numbers and sometimes weights of "non-quota" species caught in index gillnets began in 1984. Since the second collapse in the mid-1990s, walleye yields have attained a record maximum but are beginning to decline in 2003. Sauger and whitefish abundance has declined slowly since the late 1970s. Generally, the fish community has and is replacing fish that grow slowly, mature slowly, have low fecundity and attain a large maximum size, with fish that grow and mature faster, have higher fecundity and a smaller maximum body size. These traits provide the adaptive advantage when faced with continuous selectivity by gillnets which have provided "artificial selective pressure" for 120 years. Additionally, the continuous removal of the primary piscivorous predators (pike and percids) has allowed increases in the abundance of forage fish (mullet, ciscoe, emerald shiners, etc.).

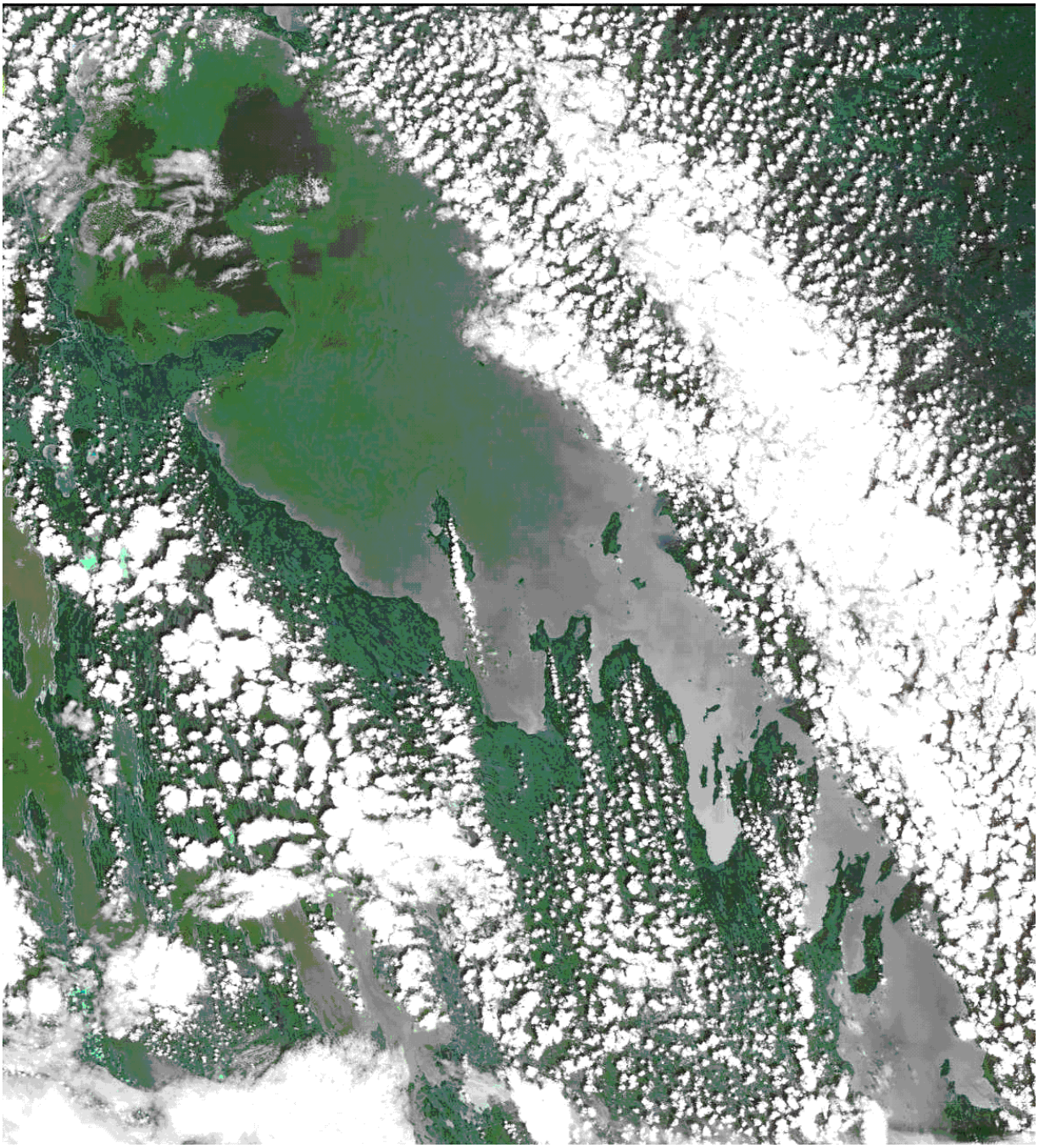
The stock-recruitment curves of walleye, sauger and whitefish represent fishery effects. The correlation coefficient of the 1979-2000 whitefish stock-recruitment curve was greatly improved from 0.2371 to 0.9529 by adding concentrations of chlorophyll, nitrogen and carbon, growing degree-days >10°C, rate of fall water cooling and length of cooling season (Figure 15). Forward and backward stepwise regression eliminated all of these variables except *abundance of mature females* (affected by the fishery) and *chlorophyll* (affected by nutrient loading). Suspended sediment in the Lake Winnipeg southern basin prevents algal blooms which prevail in the clearer waters of the northern basin preferred by whitefish. The walleye stock-recruitment curve is also "improved" by adding growing degree-days and length of warming season.

Figure 15. Nitrogen, carbon and chlorophyll from Lake Winnipeg sediment cores.



The extent of algal blooms in Lake Winnipeg can be monitored from satellite imagery. Figure 16 provides an example of a MODIS image taken on July 21, 2003 showing the algal blooms (dark) in the northern basin and the suspended sediment (light) in the southern basin.

Figure 16. MODIS Image of Lake Winnipeg - July 21, 2003



8.3 Fish Species Composition - Red River at Emerson, Manitoba

In 2003, the Department of Fisheries and Oceans collected a large sample of fish from the Emerson reach of the Red River using an electro fishing boat. Sixteen species of fish were caught with emerald shiner and goldeye being the most abundant. Sex distribution was relatively normal for the large species that were sampled for tissues. Size distributions of the various species were distributed normally as would be expected for healthy populations sampled with electro fishing gear. Channel catfish was the largest predatory species in the reach. White suckers were extremely rare compared to quillbacks and shorthead redhorse. Saugers and shorthead redhorse were tied as the third most abundant species in this part of the river. Only two walleye were caught in a total catch of 661 fish. One well established exotic species, carp, was present in the catch. This survey catch suggests that the fish community in the Emerson reach is robust and abundant. These catches varied with season but sampling design and effort were not consistent for the different dates. The catch results are summarized in Table 12.

Table 12. 2003 Fish Catches from the Red River near Emerson, Manitoba

		May	July	October		
Fish Species		**3km**	**2km**	**2km**	**Total**	**Percent**
Emerald Shiner	*Notropis atherinoides*	0	0	292	292	44.2
River Shiner	*Notropis blennius*	0	0	1	1	0.2
Goldeye	*Hiodon alosoides*	84	14	28	126	19.1
Mooneye	*Hiodon tergisus*	1	0	1	2	0.3
Carp	*Cyprinus carpio*	2	3	16	21	3.2
Silver Chub	*Hybopsis storeriana*	1	1	0	2	0.3
Quillback	*Carpiodes cyprinus*	0	0	21	21	3.2
White Sucker	*Catostomus commersonii*	0	1	2	3	0.5
Golden Redhorse	*Moxostoma erythrurum*	0	0	1	1	0.2
Shorthead Redhorse	*Moxostoma*	2	9	61	72	10.9
Silver Redhorse	*Moxostoma anisurum*	0	0	2	2	0.3
Channel Catfish	*Ictalurus punctatus*	3	0	22	25	3.8
Northern Pike	*Esox Lucius*	4	0	1	5	0.8
Sauger	*Stizostedion canadense*	50	6	16	72	10.9
Walleye	*Stizostedion stizostedion*	1	0	0	1	0.2
Freshwater Drum	*Aplodinotus grunniens*	4	1	10	15	2.3
TOTAL		152	35	474	661	100

8.4 Benthic Invertebrate Monitoring in Manitoba

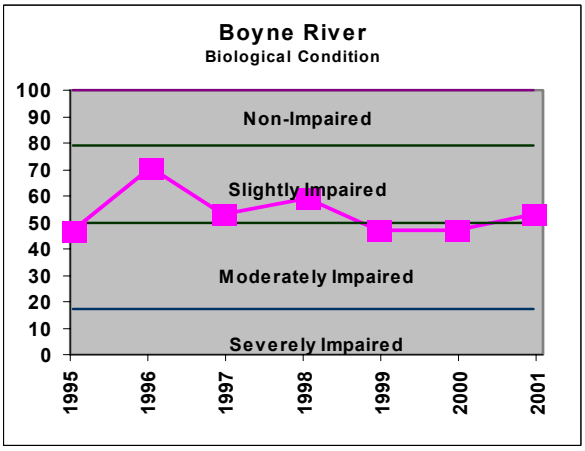
Table13 and the figures that follow provide information on the biological condition and Canadian Council of Ministers of the Environment's Water Quality Index for Manitoba tributary streams to the Red River from 1995 to 2001. Ecological quality of the tributaries ranged from marginal to good depending on the tributary and year. The macrocinvertebrate communities of the tributaries are dominated by midges (Diptera) and an unusual high diversity of mayflies (Ephemeroptera). Table 14 describes the biodiversity of macroinvertebrates for the international Roseau River.

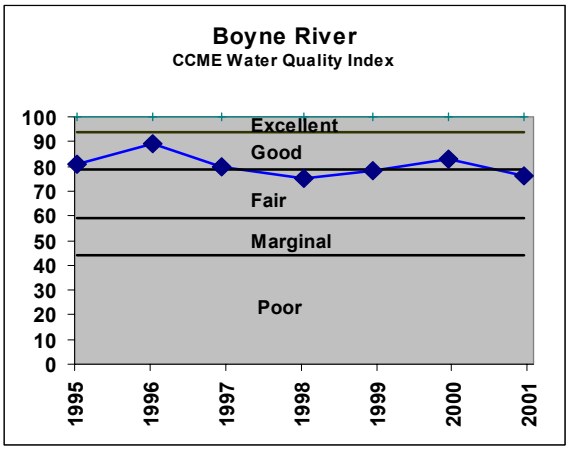
Table 13. Biological Conditions on Manitoba Tributary Streams to the Red River

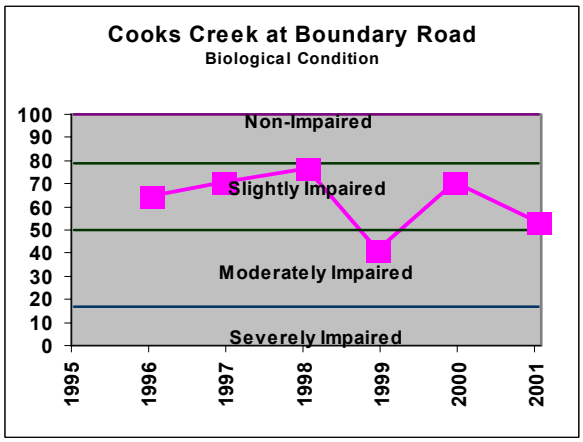
Stream	Year	Biological Condition Score	Biological Condition Category (Relative Impairment)	CCME Water Quality Index[1]	CCME Water Quality Index Rank	Overall Assessment Water Quality and Invertebrate Biota[2]
Boyne River at Carman	1995	47.1%	Moderate	81	Fair-Good	Fair to good water quality with moderate environmental impacts on biota.
	1996	70.7%	Slight	89	Good	Good water quality with slight environmental impacts on biota.
	1997	53.0%	Slight-Moderate	80	Fair-Good	Fair to good water quality with slight environmental impacts on biota.
	1998	58.9%	Slight	75	Fair	Fair water quality with slight environmental impacts on biota.
	1999	47.1%	Moderate	78	Fair	Fair water quality with moderate environmental impacts on biota.
	2000	47.1%	Moderate	83	Good	Good water quality with moderate environmental impacts on biota.
	2001	53.0%	Slight-Moderate	76	Fair	Fair water quality with moderate environmental impacts on biota.
Cooks Creek at Springfield and St. Clements boundary	1996	64.8%	Slight	66	Fair	Fair water quality with slight environmental impacts on biota.
	1997	70.7%	Slight	74	Fair	Fair water quality with slight environmental impacts on biota.
	1998	76.6%	Slight	85	Fair-Good	Good tending to fair water quality with slight environmental impacts on biota.
	1999	41.2%	Moderate	74	Fair	Fair water quality with moderate environmental impacts on biota.
	2000	70.7%	Slight	67	Fair	Fair water quality with slight environmental impacts on biota.
	2001	53.0%	Slight-Moderate	81	Good	Good water quality with slight to moderate environmental impacts on biota.
La Salle River in St. Norbert	1995	42.1%	Moderate	68	Fair	Fair water quality with moderate environmental impacts on biota.
	1996	53.0%	Slight-Moderate	67	Fair	Fair water quality with moderate environmental impacts on biota.
	1997	53.0%	Slight-Moderate	66	Fair near Marginal	Fair near marginal water quality with moderate environmental impacts on biota.
	1998	17.7%	Severe-Moderate	68	Fair	Fair water quality with severe environmental impacts on biota.
	1999			76	Fair	See below.
La Salle River downstream of La Barrier Park dam	1999	47.1%	Moderate			Fair water quality with moderate environmental impacts on biota.
	2000	53.0%	Slight-Moderate	77	Fair	Fair water quality with moderate environmental impacts on biota.
	2001	41.2%	Moderate	69	Fair	Fair water quality with moderate environmental impacts on biota.
Marsh River near Otterburne	1995	47.1%	Moderate	66	Marginal-Fair	Marginal to fair water quality with moderate environmental impacts on biota.
	1996	53.0%	Slight-Moderate	51	Marginal	Marginal water quality with slight to moderate environmental impacts on biota.
	1997	58.9%	Slight	52	Marginal	Marginal water quality with slight environmental impacts on biota.
	1998	41.2%	Moderate	74	Marginal-Fair	Fair tending to marginal water quality with moderate environmental impacts on biota.
Rat River at Otterburne	1995	82.5%	Slight-Nonimpaired	83	Good	Good water quality with slight to virtually no environmental impacts on biota.
	1996	76.6%	Slight	81	Good	Good water quality with slight environmental impacts on biota.
	1997	82.5%	Slight-Nonimpaired	78	Fair	Fair water quality with slight environmental impacts on biota.
	1998	70.7%	Slight	82	Good	Good water quality with slight environmental impacts on biota.
	1999	70.7%	Slight	88	Good	Good water quality with slight environmental impacts on biota.
	2000	70.7%	Slight	83	Good	Good water quality with slight environmental impacts on biota.
	2001	94.3%	Nonimpaired	83	Good	Good water quality with virtually no environmental impacts on biota.
Roseau River near Dominion City	1995	70.7%	Slight	88	Good	Good water quality with slight environmental impacts on biota.
	1996	94.3%	Nonimpaired	89	Fair-Good	Good tending to fair water quality with little to no environmental impacts on biota.
	1997	117.9%	Nonimpaired	82	Fair-Good	Good tending to fair water quality with virtually no environmental impacts on biota.
	1998	94.3%	Nonimpaired	83	Fair-Good	Good tending to fair water quality with virtually no environmental impacts on biota.
	1999	100.2%	Nonimpaired	82	Good	Good water quality with virtually no environmental impacts on biota.
	2000	47.1%	Moderate	85	Good	Good water quality with moderate environmental impacts on biota.
	2001	88.4%	Nonimpaired	84	Good	Good water quality with little to no environmental impacts on biota.

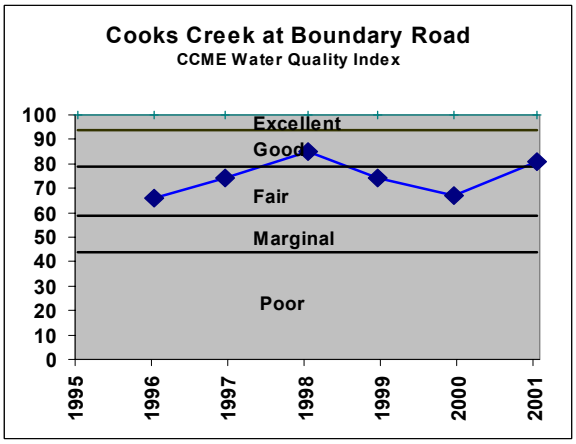
Table 13 Continued

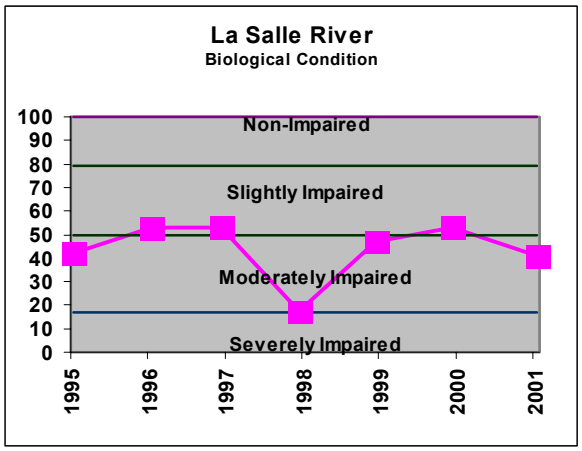
Stream	Year	Biological Condition Score	Biological Condition Category (Relative Impairment)	CCME Water Quality Index[1]	CCME Water Quality Index Rank	Overall Assessment Water Quality and Invertebrate Biota[2]
Seine River south of Winnipeg	1995	53.0%	Slight-Moderate	71	Poor-Fair	Fair tending to poor water quality with slight to moderate environmental impacts on biota.
	1996	41.2%	Moderate	74	Fair	Fair water quality with moderate environmental impacts on biota.
	1997	29.5%	Moderate	82	Fair-Good	Good tending to fair water quality with moderate environmental impacts on biota.
	1998	23.6%	Moderate	80	Fair-Good	Fair to good water quality with moderate environmental impacts on biota.
	1999	47.1%	Moderate	80	Fair-Good	Fair to potentially good water quality with moderate environmental impacts on biota.
	2000	41.2%	Moderate	83	Good	Good tending to fair water quality with moderate environmental impacts on biota.
	2001	58.9%	Slight	84	Fair-Good	Good water quality with slight environmental impacts on biota.

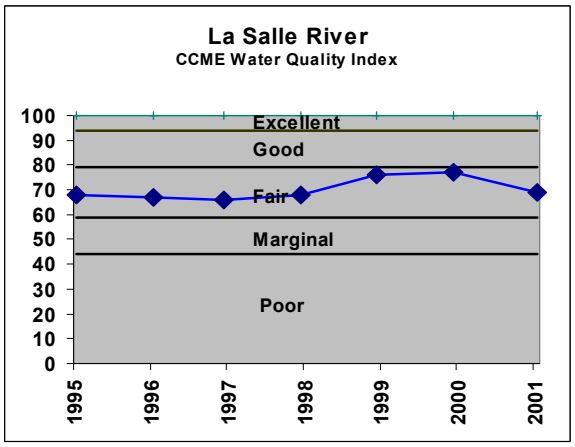


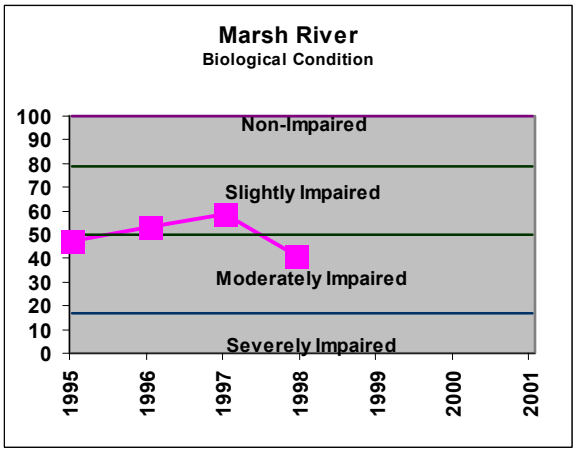







La Salle River
Biological Condition
Non-Impaired
Slightly Impaired
Moderately Impaired
Severely Impaired
100
90
80
70
60
50
40
30
20
10
0
1995
1996
1997
1998
1999
2000
2001


La Salle River
CCME Water Quality Index
Excellent
Good
Fair
Marginal
Poor
100
90
80
70
60
50
40
30
20
10
0
1995
1996
1997
1998
1999
2000
2001


Marsh River
Biological Condition
Non-Impaired
Slightly Impaired
Moderately Impaired
Severely Impaired
100
90
80
70
60
50
40
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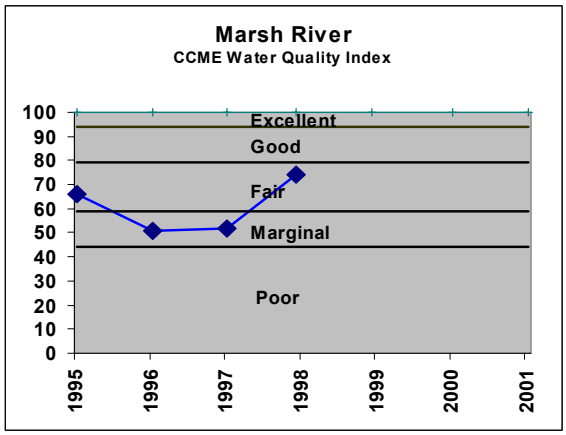
20
10
0
1995
1996
1997
1998
1999
2000
2001


Marsh River
CCME Water Quality Index
Excellent
Good
Fair
Marginal
Poor
100
90
80
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30
20
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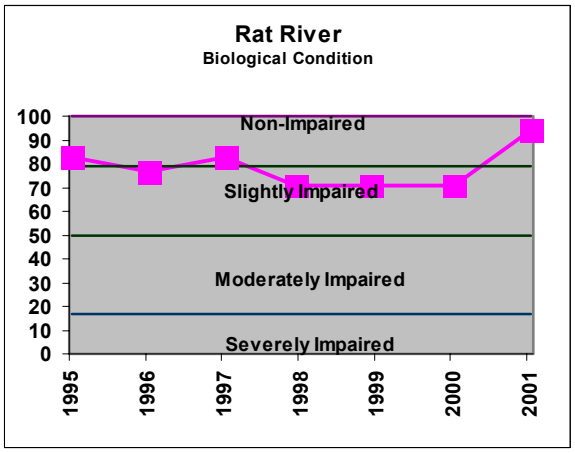
0
1995
1996
1997
1998
1999
2000
2001


Rat River
Biological Condition
Non-Impaired
Slightly Impaired
Moderately Impaired
Severely Impaired
100
90
80
70
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10
0
1995
1996
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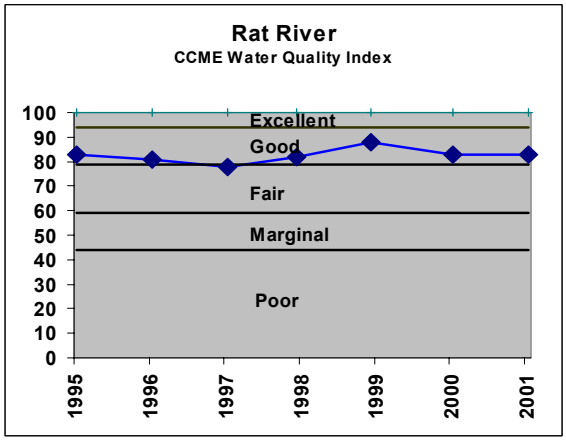
1998
1999
2000
2001


Rat River
CCME Water Quality Index
Excellent
Good
Fair
Marginal
Poor
100
90
80
70
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1995
1996
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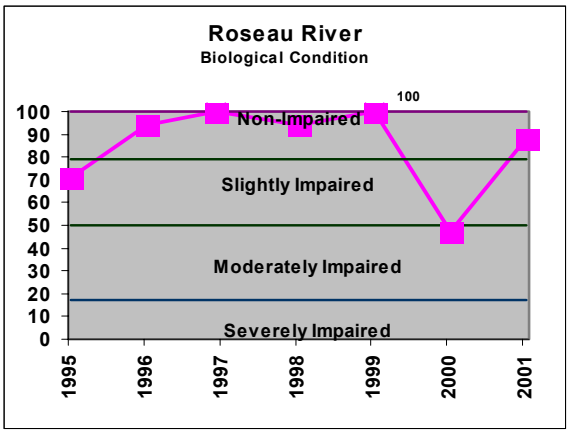
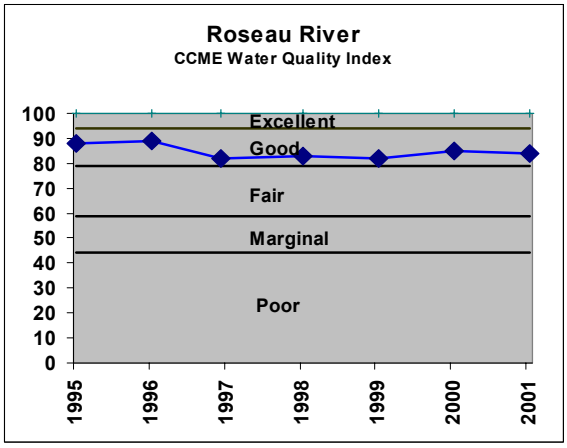
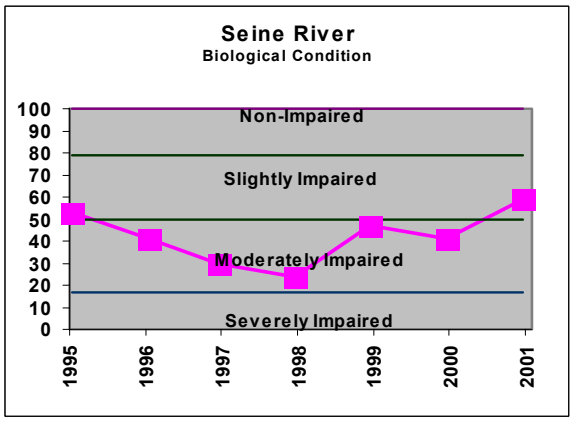
1999
2000
2001







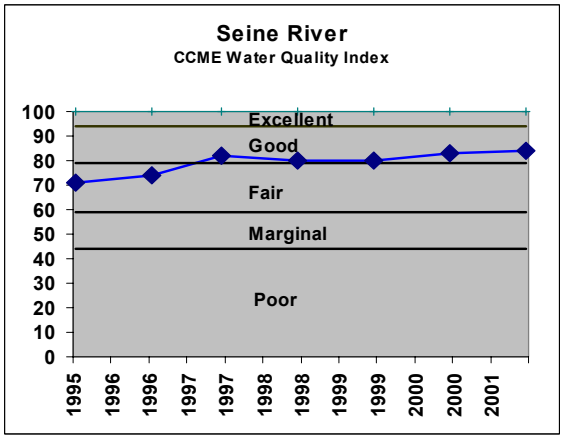


Table 14. Biodiversity of macroinvertebrates for the Roseau River.

DateSamp	Class or	Order or Class	Family	Genus
20/09/1995	ANNELIDA	OLIGOCHAETA	OLIGOCHAETA	Aeolosoma sp.
20/09/1995	ANNELIDA	OLIGOCHAETA	OLIGOCHAETA	Cambarincola sp.
22/08/1997	ANNELIDA	OLIGOCHAETA	OLIGOCHAETA	Limnodrilus sp.
22/08/1997	CRUSTACEA	AMPHIPODA	TALITRIDAE	Hyalella azteca
04/09/1998	CRUSTACEA	DECAPODA	ASTACIDAE (CAMBARINAE)	Orconectes sp.
22/08/1997	GASTROPODA	PULMONATA	ANCYLIDAE	Ferrissia sp.
22/08/1997	INSECTA	COLEOPTERA	DYTISCIDAE	Liodessus affinis
22/08/1997	INSECTA	COLEOPTERA	ELMIDAE	Dubiraphia sp.
12/09/2000	INSECTA	COLEOPTERA	ELMIDAE	Stenelmis sp.
04/09/1998	INSECTA	DIPTERA	CERATOPOGONIDAE	Palpomyia sp.
20/09/1995	INSECTA	DIPTERA	CHIRONOMIDAE	Ablabesmyia sp.
09/09/1996	INSECTA	DIPTERA	CHIRONOMIDAE	Chironomidae
09/09/1996	INSECTA	DIPTERA	CHIRONOMIDAE	Chironomus sp.
09/09/1996	INSECTA	DIPTERA	CHIRONOMIDAE	Chironomus thummi
09/09/1996	INSECTA	DIPTERA	CHIRONOMIDAE	Cricotopus sp.
09/09/1996	INSECTA	DIPTERA	CHIRONOMIDAE	Cryptotendipes sp.
09/09/1996	INSECTA	DIPTERA	CHIRONOMIDAE	Demicryptochironomus
22/08/1997	INSECTA	DIPTERA	CHIRONOMIDAE	Krenosmittia sp.
22/08/1997	INSECTA	DIPTERA	CHIRONOMIDAE	Labrundinia sp.
04/09/1998	INSECTA	DIPTERA	CHIRONOMIDAE	Paralauterborniella sp.
04/09/1998	INSECTA	DIPTERA	CHIRONOMIDAE	Polypedilum sp.
04/09/1998	INSECTA	DIPTERA	CHIRONOMIDAE	Procladius sp.
04/09/1998	INSECTA	DIPTERA	CHIRONOMIDAE	Psectrocladius sp.
07/09/2001	INSECTA	DIPTERA	CHIRONOMIDAE	Tanytarsus sp.
07/09/2001	INSECTA	DIPTERA	CHIRONOMIDAE	Thienemanniella sp.
27/09/1999	INSECTA	DIPTERA	SIMULIIDAE	Simulium sp.
20/09/1995	INSECTA	EPHEMEROPTERA	BAETIDAE	Baetidae unidentified
20/09/1995	INSECTA	EPHEMEROPTERA	BAETIDAE	Baetis sp.
20/09/1995	INSECTA	EPHEMEROPTERA	BAETIDAE	Callibaetis sp.

20/09/1995 **DateSamp**	INSECTA **Class or Phylum**	**Order or Class**	BAETIDAE **Family**	Centroptilum sp **Genus**
04/09/1998	INSECTA	EPHEMEROPTERA	BAETIDAE	Pseudocloeon sp.
20/09/1995	INSECTA	EPHEMEROPTERA	BAETISCIDAE	Baetisca sp.
20/09/1995	INSECTA	EPHEMEROPTERA	CAENIDAE	Caenis sp.
22/08/1997	INSECTA	EPHEMEROPTERA	EPHEMERIDAE	Ephemera sp.
22/08/1997	INSECTA	EPHEMEROPTERA	EPHEMERIDAE	Hexagenia limbata
22/08/1997	INSECTA	EPHEMEROPTERA	EPHEMERIDAE	Hexagenia sp.
22/08/1997	INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	Heptagenia sp.
27/09/1999	INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	Stenacron sp.
12/09/2000	INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	Stenonema sp.
22/08/1997	INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	Leptophlebia sp.
04/09/1998	INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	Paraleptophlebia sp.
27/09/1999	INSECTA	EPHEMEROPTERA	METRETOPODIDAE	Siphloplecton sp.
04/09/1998	INSECTA	EPHEMEROPTERA	POTAMANTHIDAE	Potamanthus sp.
07/09/2001	INSECTA	EPHEMEROPTERA	TRICORYTHIDAE	Tricorythodes sp.
09/09/1996	INSECTA	HEMIPTERA	CORIXIDAE	Corixidae unidentified
04/09/1998	INSECTA	HEMIPTERA	CORIXIDAE	Sigara lineata
04/09/1998	INSECTA	HEMIPTERA	VELIIDAE	Rhagovelia sp.
04/09/1998	INSECTA	MEGALOPTERA	SIALIDAE	Sialis sp.
22/08/1997	INSECTA	ODONATA - ANISOPTERA	GOMPHIDAE	Dromogomphus sp.
20/09/1995	INSECTA	PLECOPTERA	ACRONEURIINAE (PERLIDAE)	Acroneuria sp.
22/08/1997	INSECTA	TRICHOPTERA	LEPTOCERIDAE	Nectopsyche sp.
22/08/1997	INSECTA	TRICHOPTERA	LIMNEPHILIDAE	Hydatophylax sp.
04/09/1998	INSECTA	TRICHOPTERA	POLYCENTROPODIDAE	Neureclipsis sp.
07/09/2001	INSECTA	TRICHOPTERA	TRICHOPTERA	Trichoptera unidentified
27/09/1999	PELECYPODA	SPHAERIACEA	SPHAERIIDAE (PISIDIIDAE)	Sphaerium sp.

Summary of Methods - macroinvertebrate monitoring in Manitoba

1.Canadian Council of Ministers of the Environment (CCME) Water Quality Index

The CCME Water Quality Index (WQI) assesses non compliance with water quality guidelines and objectives based on three factors: scope (F_1), frequency (F_2), amplitude (F_3) of non compliance at each site and year. The CCME WQI categories are described as excellent (95-100), good (80-94), fair (60-79), marginal (45-59), and poor (0-44). Manitoba Water Quality Standards, Objectives, and Guidelines (Williamson 2002) were used to calculate the CCME WQI.

2. Macroinvertebrate Analyses Protocols

Seven metrics were used in this assessment and they are described briefly as follows:

1. Taxa Richness is a count of the total number of taxa and reflects the health of the community through measurement of the variety of taxa (Plafkin *et al.* 1989).

2. Percent Contribution of Dominant Taxon is a reflection of community balance and compares the number of organisms in the dominant taxon to the total number of organisms in the sample (Plafkin *et al.* 1989).

3. The Ephemeroptera, Plecoptera, and Trichoptera (EPT) Index is a count of the number of taxa within this environmentally sensitive group of organisms. The EPT index generally increases with improving water quality (Plafkin *et al.* 1989).

4. The EPT/C Ratio is a ratio of EPT and Chironomidae abundances, which compares the number of organisms within the EPT group to numbers of Chironomidae. Chironomidae or midges are relatively tolerant organisms. This index is also a reflection of community balance (Plafkin *et al.* 1989).

5. The Modified Hilsenhoff Biotic Index or HBI (Hilsenhoff 1987) is the mean of the sum of tolerance values ranging from 0 to 10, where the values increase as water quality deteriorates (Plafkin *et al.* 1989). The tolerance values used were derived by the New York Department of Environmental Conservation (NYDEC); Hilsenhoff tolerance values. Alternately, US Environmental Protection Agency (EPA) tolerance values were identified using US EPA Macroinvertebrate Species List, Version 1 (May, 1994). However, tolerance values were not available for some species, mainly within the Order Hemiptera.

6. The Biotic Condition Index or BCI (Winget and Mangum 1979) is derived in three stages. First, the average Community Tolerance Quotient (CTQa) is calculated and is the mean of the sum of organism tolerance quotients, which range from 0 to 108, where the values increase as water quality declines. Second is derived the predicted Community Tolerance Quotient (CTQp) using a key that reflects stream gradient, substrate type, total alkalinity, and sulphate. For the purpose of this calculation all stream gradients were estimated to be less than the ratio of 1.2%. Third, the BCI is calculated where BCI = 100(CTQp/CTQa). Since this metric entails both biotic and physical and chemical characteristics of the site, it is particularly site and time specific in nature.

7. The Ratio of Shredders/Total is the ratio of the number of organisms belonging to the shredder functional feeding group to the total number of organisms in the sample. Shredders are sensitive to riparian zone impacts (Plafkin *et al.* 1989).

9. ADDITIONAL ACTIVITIES IN THE RED RIVER BASIN

9.1 Garrison Diversion Project

Dakota Water Resources Act

The Dakota Water Resources Act (DWRA) of December 2000 amended the authorizing legislation for the Garrison Diversion Project. The legislation outlines a program to meet the Indian and non-Indian water supply needs in North Dakota and authorizes water uses including municipal, rural and industrial, fish and wildlife, recreation, irrigation, flood control, stream flow augmentation, and ground water recharge.

Red River Valley Water Supply Project

Authorized in the DWRA, the Red River Valley Water Supply Project is to identify the comprehensive water quantity and quality needs of the Red River valley in North Dakota and the options for meeting those needs.

As required in DWRA, the Bureau of Reclamation is preparing a feasibility level engineering report, the Report on Red River Valley Water Needs and Options (Needs and Options Report), to address the following categories of need: municipal, rural and industrial water; water quality; recreation; aquatic environment; and water conservation measures. Progress to date on the Needs and Options Report includes completion of draft reports on population projections, aquatic needs, water conservation, regulatory overview of the Safe Drinking Water Act, and recreation need. Reclamation is working with the North Dakota State Water Commission, U.S. Geological Survey, and the Minnesota Department of Natural Resources to determine if groundwater can meet a portion of the water needs and will begin surface water hydrology modeling in the fall of 2003. The final Needs and Options report is scheduled for completion by Reclamation in November 2005.

The DWRA also requires completion of an Environmental Impact Statement that evaluates environmental impacts of the alternative ways to meet the water needs of the Red River valley in North Dakota. As directed by the DWRA, Reclamation and the State of North Dakota are jointly preparing the EIS. The Governor of North Dakota has designated the Garrison Diversion Conservancy District as the state entity responsible for serving as co-lead with Reclamation in the preparation of the EIS.

Three groups of alternatives are being studied for inclusion in the EIS: a No action Alternative, required by the National Environmental Policy Act; In-Basin Alternatives that propose use of water sources within the Red River basin; and Import Alternatives that propose moving water from the Missouri River to the Red River valley. A preferred alternative has not been identified and final selection of the preferred alternative will be made by the Secretary of the Interior in consultation with the State of North Dakota in coordination with local affected communities, as required by the DWRA.

Progress reports on Reclamation's Needs and Options Report are available via the Needs and Options Newsletter, and progress on the jointly prepared EIS appears on the EIS website (www.rrvwsp.com) and in the EIS newsletter.

Northwest Area Water Supply Project

The MR&I component of the Garrison Diversion Project also includes the Northwest Area Water Supply Project (NAWS). The NAWS Project, now under construction, will carry pre-treated water from Lake Sakakawea to the City of Minot where it will be fully treated to drinking water standards and distributed to surrounding communities and rural areas in the Souris River basin. Potential international issues related to NAWS are the responsibility of the International Souris River Board. However, the IRRB will

continue to be interested in activities associated with the NAWS project since it does cross into the Red River basin.

9.2 Devils Lake Sub-Basin

State Project

The North Dakota State Water Commission is moving forward with the State's Devils Lake Outlet Project. This proposal provides a discharge of up to 100 cfs, if downstream conditions allow. The outlet channel will be constructed to a capacity of 300 cfs for a possible future expansion of the State's project.

Water Commission staff has been working diligently on acquiring easements for the land along the project route. One landowner owns approximately 21% of the project route. This landowner owns a majority of the 300-cfs portion of the open channel planned for construction in 2003. The Water Commission and the landowner were unable to agree on an easement and the easement has been condemned.

Permits have initially been obtained for the project. The State Engineer's Drain Permit was approved on July 2, 2003. The decision was appealed, and a hearing was held on September 22, 2003. The office of the State Engineer reviewed the testimony obtained at the hearing and affirmed the issuance of the permit on October 2, 2003. A Sovereign Lands Permit was approved on August 15, 2003. The North Dakota Health Department's 402 Water Quality Discharge Permit was approved on August 22, 2003. Requests for review of the Water Quality Discharge Permit have also been made.

A contract has been awarded for a portion of the 300-cfs open channel, consisting of 3.2 miles of open channel with approximately 163,000 cu-yds of earth work. The bid to construct this portion was $766,614. The construction will not include any concrete structures, road crossings, or siphons. These structures will all be included in separate contracts.

The next phases of the project include complete construction of the original 300-cfs portion of the open channel and the acquisition of electrical power for the two pump stations. Acquiring the electrical power for the two pump stations (contract negotiations, survey work, and facility design) will also begin this fall and will be ongoing throughout the winter and into 2004. Most of the power supply construction will be done in 2004. Construction is anticipated to be completed by May of 2005.

The Devils Lake Joint Water Resource District has also obtained funding for a trial irrigation system in the Devils Lake watershed.

Federal Project

The Energy and Water Development Appropriations Act, 2003, Division D of Public Law 108-7, provided $5 million in funding for construction of an emergency outlet from Devils Lake to the Sheyenne River but imposed several conditions before construction could proceed. These include technical soundness, environmental acceptability, determination of emergency need, assurances by the Secretary of State that the Boundary Waters Treaty of 1909 will not be violated, and exclusion of an inlet from the Missouri River. This legislation differs from language in similar Public Laws of 1998 through 2001 by deleting the words “after consultation with the International Joint Commission” in regard to the Boundary Waters Treaty and no longer stating that the outlet be economically justified. Rather, this Public Law requires instead that the justification for the outlet be fully described, including the analysis of the benefits and costs.

The Army Corps of Engineers completed a final Integrated Planning Report and EIS in April 2003. This report, which was available for public review and comment until June 2003, identified the Pelican Lake 300 cfs outlet as the preferred alternative. Action regarding the Record of Decision is being considered by the Army Corps of Engineers.

The North Dakota State Water Commission is continuing to pursue a state-sponsored Devils Lake outlet project because of the delays and high costs associated with the Corps’ outlet project. A NPDES permit under Section 402 of the Clean Water Act has been provided by the North Dakota Department of Health, a construction of an access road and site work for a pump station has been completed and bids have been received for channel excavation work.

9.3 Roseau River Watershed

The January 2003 hydrology report completed by UMA Engineering Ltd. for the Canadian portion of the Roseau River was presented to the Manitoba Minister of Conversation by the Roseau River International Watershed Board on October 9, 2003. The scope of the study was outlined, and its recommendations presented.

The UMA recommendations include: repair or removal of aging bridges; reconstruction of the Gardenton Diversion; addition of a retention structure at the north end of the Diversion to reduce peak flood flows downstream; restoration of the natural channel of the Roseau River where it is bypassed by the Diversion; and, construction of linear dikes for the Villages of Gardenton and Stuartburn. Other retention/diversion projects are also recommended to address the frequent flooding in the Lake Roseau area east of St. Jean Baptiste caused by backup flow from the Red River. To facilitate better flood forecasting the addition of hydrometric monitoring sites was also recommended. These projects are presently under consideration by the Province of Manitoba.

A second major study on the Roseau River towards development of a watershed management plan, to match a similar effort on the U.S. portion of the river, is being proposed. The Red River Basin Commission would oversee this project over the next year and a half. Funding for $70,000 of the $85,000 required has been committed with the $15,000 balance having been requested from Manitoba Conservation.

A comprehensive water management plan has been developed for the U.S. portion of the Roseau River basin. This effort combines the identification of flood control options, implementation strategies, costs, and timelines. The total proposal is estimated to cost in the order of $100 million involving a range of federal, state and local authorities. Aspects of the plan are being implemented as noted in other sections of this report.

9.4 USGS Water Resource Investigations and Activities

Evaluation of Contaminant Contributions (Nutrients, Pesticides, and Suspended Sediment) to the Upper Red River of the North Basin

This USGS study will evaluate contaminant contributions in the upper Red River Basin. The objectives of the study are to identify the contributions of contaminants from different sub-basins of the Red River Basin. The study area is the upper Red River Basin from a point downstream from the junction of the Buffalo River with the Red River (Red River at Perley, MN). The study is based on physical and chemical data collected from the Red River and major tributaries to the Red River starting in May 1997. Physical, chemical, and sediment data were collected from 11 sample sites, and pesticide data were collected from two sampling sites during 1997. In 1998, the number of sites was changed to eight sites. The final draft is in review.

Relations of Runoff Processes to Wetlands and Land Uses within Various Landscapes of the Red River of the North

The USGS is studying the relations that wetlands and land use have with hydrology of the Red River Basin. The objectives are to establish small-scale basin sites to monitor, to develop hydrologic models to simulate runoff, and to examine the extent to which results from models could be applied throughout the Red River Basin. One monitoring site has been established near Detroit Lakes, Minnesota, and another has been established near Harvey, North Dakota. Data collection continued in 2003, and a draft report was completed.

Updating Unregulated Flow for Selected Locations in the Red River of the North Basin

The passage of the Dakota Water Resources Act by Congress in 2000 authorized the Bureau of Reclamation, to conduct a comprehensive study of the future water-quantity and quality needs of the Red River of the North Basin in North Dakota and Minnesota. In support of the Bureau's Red River Valley Water Supply Project, the USGS has modified reservoir evaporation estimates based on methods used to estimate evaporation at Williams Lake, Minnesota and Cottonwood Lake, North Dakota. Also, water-use data have been collected from various agencies and reviewed and used to provide better estimates of withdrawals and return flows. Reservoir evaporation estimates and withdrawals and return flows have been used to improve and update an unregulated flow data base for selected locations in the Red River of the North Basin.

Hydrologic Changes from Wetland and Prairie Restoration at Glacial Ridge, Polk and Red Lake Counties, Minnesota

This USGS study is investigating the surficial hydrology of an area of drained wetlands and linear prairies on the eastern edge of Glacial Lake Agassiz. The study will produce a set of background data of surface- and ground-water flow and quality in an area about to undergo major wetland and prairie restorations. This data set can be used in the future to attribute hydrologic changes to this land-use change. The study is also beginning to quantify the short-term hydrologic variability of the area to help separate landuse hydrologic changes from other sources of hydrologic change.

9.5 Corps of Engineer Flood Control Activities

Flood Control Projects for the cities of Grand Forks, North Dakota and East Grand Forks, Minnesota, located at the confluence of the Red River of the North and the Red Lake River, consists of levees and floodwall set back from the river, forming "rings" around three discrete portions of the two communities. In addition, stabilization of an existing dam, removal of a former railroad bridge, interior flood control features, numerous road and railroad closures, extension and expansion of an existing diversion channel, and construction of a new diversion channel with associated structural features are part of the proposed project. The design level of protection is equivalent to the peak discharge experienced during the 1997 flood. Construction is complete on the first two construction projects: the removal of the pedestrian bridge and bank stabilization of the Riverside Dam. Construction is well under way on the first two phases of the levee system in both cities and the English Coulee Diversion and Pump Station. Construction is expected to start this fall-winter on the Heartsville Coulee Diversion and the third phases of the levee system for each city, subject to availability of funds. Project design is ongoing. Construction began during summer 2000, and completion is estimated in 2005-2006. The final project cost is estimated to be $393 million.

Flood protection project for Crookston, Minnesota, located on the Red Lake River, 52 miles upstream from its confluence with the Red River of the North, consists of two downstream high-flow cutoff channels and levees built to the 100-year level of protection for the Thorndale, Woods and downtown/Riverside neighborhoods. The total project cost is estimated at $10.5 million and scheduled for completion in 2004. The City requested the Corps to initiate a Section 205 study for the Sampson's and Chase/Loring neighborhoods, which are not currently part of the authorized project. This study will be initiated when resources are available.

Flood protection projects for Wahpeton, North Dakota and Breckenridge, Minnesota, located at the confluence of the Bois de Sioux and Ottertail Rivers and the beginning of the Red River of the North, are treated as two separate, but dependent projects. The Breckenridge Project consists of a high-flow diversion channel located to the north of the Ottertail River and entering into the Red River and two separable permanent levee reaches that would protect all of Breckenridge. The estimated cost for the levees and diversion plan is $22.2 million. Congress authorized the project consistent with the plans identified in the Feasibility Report and appropriated construction funding in 2001. The Wahpeton Project, authorized under Section 205 of the Continuing Authorities Program, consists of a permanent levee system and flood easements to keep breakout flood flows from being blocked in the future. Construction of the $11 million Wahpeton project began in 2003 and is scheduled for completion in 2006.

Flood protection project for Ada, Minnesota, located in the Marsh River watershed, which is tributary of the Red River of the North. Ada is subject to flooding from the Wild Rice River, which can break out of its banks and flow into the Marsh River. Although initially found not justified under study through the Section 205 Continuing Authority, two record-breaking flood events occurred in June 2002, which drove the benefit-cost ratio over 2.0. The study is running concurrent with a broader watershed study of the Wild Rice River basin.

Flood protection project for Grafton, North Dakota, located on the Park River, a tributary of the Red River of the North, consists of a bypass channel, levees, flow control structures, three railroad bridges, and a highway bridge. The General Reevaluation Report and Environmental Assessment is under review in Corps Headquarters. The total cost of the project is estimated at $32 million. Construction could start in 2005, if funds are made available for preparation of contract documents in 2004.

Flood protection project, Baldhill Dam, North Dakota, located on the Sheyenne River a tributary of the Red River of the North, consists of replacing the existing spillway gates, allowing the dam to store up to 5 feet more (30,000 acre-feet of additional storage) during major floods, acquiring 1,500 acres of flowage

easement around Lake Ashtabula and 300 acres for a mitigation area, raising land and buildings at a church camp, and constructing several small levees and placing fill near structures around the reservoir. No permanent increase storage will result. Estimated costs are $9.5 million. Operation of the project will begin in 2004.

Feasibility study, prepared under the Section 205 Continuing Authority, for a flood protection project for Ridgewood Addition, Fargo, North Dakota, is scheduled for completion in November 2003. The will provide protection to the portion of Fargo between 15th Avenue North and 22nd Avenue North and the Veterans Administration hospital. Total project costs are estimated at $10.7 million.

Flood protection for Neche, North Dakota, located on the south side of the Pembina River, 32 miles upstream from its confluence with the Red River of the North, consists of an earthen levee with associated interior drainage facilities, a road raise, and modification of a cut-off channel. The Corps of Engineers' effort to update a decision document and initiate preparation of construction documents is on hold pending resolution of local issues.

Flood protection project for Minnewaukan, North Dakota, located on the western shore of Devils Lake. The Corps has reviewed the 1998 Federal Interest Report for Minnewaukan, North Dakota. The 1998 evaluation indicated that a flood control project was not economically justified at the Devils Lake elevation in 1998. Higher lake elevations have prompted a reassessment of the feasibility of a Section 205 project.

Feasibility study for a flood protection project for Drayton, North Dakota has been initiated by the Corps of Engineers.

Hay Creek Project, located in the Roseau River watershed, 5 miles northeast of Roseau, Minnesota is a multipurpose project that will improve the wildlife habitat and reduce flood damages by restoring more natural hydrologic and hydraulic behavior. Features include replacement of a six-mile ditch with a 500-foot stream corridor border by setback levees and 1000 acres of permanent wetland and adjacent buffer zone. Total project cost is approximately $8 million. Construction will begin in 2004.

Reconnaissance level study of flood protection for Roseau, Minnesota, located on the Roseau River, a tributary to the Red River of the North, affirmed a Federal interest. However, it was determined that the cost of a project would likely exceed the Continuing Authorities Program funding limitation. Therefore, in early July 2003, a Section 905(b) Analysis was prepared and submitted to higher authority to shift the project to a specifically authorized study authority. The recommendation was approved and a Feasibility Cost Share Agreement has been signed with the City of Roseau. Initiation of the Feasibility Study is currently scheduled to begin in October 2003.

A feasibility study of the Wild Rice River watershed is underway that is based largely on the Wild Rice River Watershed District's watershed management plan update. Types of measures that will be investigated under this study are gated diversion, setback levees along the Wild Rice River, restoration of the Wild Rice River, and off-channel storage. This study will also address flood protection for the City of Ada. Phase 1 of the $2.2 million study is scheduled for completion in 2004. Phase 1 is a preliminary assessment of measures to determine their potential for Federal partnership. Phase 2 will be a more rigorous analysis of measures that survive Phase 1.

A multi-purpose, cost-shared feasibility study of the Red River of the North watershed above Fargo-Moorhead will be initiated after resolution of funding issues at the local level.

A Section 905b Analysis (for purposes of determining the potential for Federal interest) underway for the Pembina River watershed will be completed during the fall of 2003.

More detailed information may be obtained from the Corps of Engineers website: http://www.mvp.usace.army.mil/

9.6 Minnesota Red River Basin Water Quality Team

MPCA reports that the Minnesota Milestone water quality monitoring does not provide enough information to characterize water quality across a watershed, and it does not provide data to establish trends in water quality over time. They feel that it is necessary to provide more comprehensive information about water quality that helps basin resource managers determine the effect of land use on the water body. Such monitoring must capture how soils, geology, vegetation, land use and the changes in

seasons influence the movement of rain and snow melt from the land to the water. The Red River Basin Water Quality Team analyzed ten sources of information about water quality in the Red River Basin. The resulting analysis is used the Team to develop objectives for water quality and specific projects to improve conditions

The Red River Basin Water Quality Team has recommended that a basin-wide monitoring network be developed to provide a single, coordinated source of water quality information that can be applied to various needs of water resource managers. The MPCA Northwest Office is developing this network, by working in partnership with local and regional watershed managers. The existing River Network monitoring project is providing the basis for the new water quality monitoring network. Data gathered by the network will be used to:

- Assess loadings of sediments and nutrients to tributaries of the Red River;
- Establish a baseline to measure trends in water quality over time;
- Provide a basis for establishing goals for water quality improvement, and
- Help managers assess performance of practices and projects in achieving water quality goals.

Chemical conditions are assessed 10 to 15 times over the high flow season (typically April through September); these measures include water temperature, dissolved oxygen, pH, conductivity, turbidity, nutrients and sediments. These parameters are collected at the mouths of the major tributaries (defined as contributing 100 cubic feet per second to the Red River of the North and draining at least 300 square miles in area). The Red River Basin Monitoring Network has professionally credible operating procedures and quality assurance measures to assure high quality information.

This type of monitoring enables managers to statistically analyze the amount of constituents in water over time and space. Information should be collected at the mouth of every significant tributary (defined as contributing at least 100 cubic feet per second to the Red River of the North and draining more than 300 square miles), at least 11 times over the highest flows of the season, typically April through August. In order to gain enough information to characterize water quality of tributaries or to establish trends over time, it is necessary to establish monitoring sites at the mouths of the 17 major watersheds in the Red River Basin. These sites can be established in coordination with the existing Minnesota Milestone sites and U.S. Geological Survey staff gage sites.

Members of the Red River Basin Monitoring Network are the organizations and agencies interested in, or responsible for, managing water resources in the Minnesota portion of the Red River Basin. This includes, but is not limited to, the following:

- Watershed districts
- Red River Basin Watershed Management Board
- MPCA
- Minnesota Department of Natural Resources
- Red River Basin Commission
- Red River Basin Institute
- University of Minnesota Crookston
- Energy and Environment Research Center at University of North Dakota

Management is provided by an advisory committee, composed of organizations and agencies interested in water quality of the Red River Basin in Minnesota. MPCA is the responsible party for the Network. Fiscal administration is provided by the Red River Basin Watershed Management Board. Day to day coordination is provided by two full-time staff. MPCA also provides training for participants, implementation of the monitoring plan and equipment acquisition.

Participating members of the network provide advice on the monitoring plan, data analysis and interpretation. Participating members also provide resources in support of monitoring, including equipment, staff and dollars, where feasible.

The network stores, analyzes, interprets and disseminates data as follows:

- Results are entered in MS Access by Red River Basin Monitoring Network staff. MS Access reports are provided to MPCA Environmental Outcomes staff for entry into STORET, the national water quality data base. MS Access reports are also provided to the Red River Basin Commission, for entry into the Red River Basin Decision Information Network.

- The Red River Basin Monitoring Network staff provides monthly monitoring summaries to the managers of participating watersheds.

- The Red River Basin Monitoring Advisory Committee presents annual summaries of monitoring to the Red River Basin watershed districts and other resource managers.

9.7 Minnesota Clean Water Initiative

On June 24, 2003, Minnesota Governor Tim Pawlenty announced a new Clean Water Initiative. The initiative calls for the establishment of a "Clean Water Cabinet", the development of a proposal for the next generation of Minnesota's Conservation Enhancement Program (CREP), and the creation of a series of regional pilot projects across the state that represent a "watershed approach" to enhancing water quality. One pilot project will be located in the Red River basin.

Priorities include: keeping Minnesota's waters clean by protecting them from present and future threats; ensuring safe water to sustain healthy communities; maintaining an accurate and realistic picture of the condition of Minnesota's waters so citizens and policymakers can effectively respond; and working aggressively within available means to restore waters that have been the casualties of society's progress.

Part of the Governor's vision for clean water also includes a "watershed approach," which recognizes the unique and diverse challenges from one part of the state to the next. By bringing together local partners and focusing federal and state resources, unique challenges will be addressed. The Minnesota Pollution Control Agency (MPCA) is working with the Governor to align water programs with the new initiative.

At the heart of the clean water vision are four guiding principles to ensure Minnesota's water quality is improved:

- Keep working lands working: Protecting water resources while preserving Minnesotans' ability to farm their land and enjoy the outdoors is sustainable, realistic and an absolute necessity.
- Focus on priorities: By focusing on state, federal, local and private efforts, the best possible results can be achieved.
- Apply individualized solutions: Threats to one watershed may be entirely different than another. Problem-solving strategies must be uniquely tailored to address the challenge.
- Cooperation is essential: No single agency or organization can meet these challenges alone.

9.8 EPA-Funded Activities

The US EPA provides grant funding support to a number of activities that are consistent with the objectives and ideals of the IRRB. The project periods for a number of these activities are coming to a close. Projects include the following:

Watershed Information Network (WIN)
In support of a request from the IJC, EPA awarded a grant to the Red River Basin Board in September 2001. The grant was intended to promote international, interregional, interstate, and locally-based efforts in dealing with basin-wide ecosystem issues. The grant resulted in funding a watershed coordinator, who undertook coordination efforts between North Dakota and Minnesota on joint Total Maximum Daily Loads (TMDLs), provided community assistance in protection of sources of drinking water, enhanced coordination with locally-based organizations, enhanced US/Canada communication, and other ecosystem basin efforts. In January 2002, the Red River Basin Board, now the Red River Basin Commission, released the first issue of a WIN-funded newsletter that covers basin-wide activities, and now has a mailing list of over 4,900 addresses. A Watershed Information Network Report was released in July 2003. The report summarizes known water quality monitoring efforts in the basin, and provides a suggested framework for integrating water quality monitoring efforts. The report is available on the Red River Basin Commission website at: http://www.redriverbasincommission.org. The WIN grant ended September 2003.

FM River
FM River is a project undertaken by a consortium of organizations including the Energy and Environmental Research Center, River Keepers, and Prairie Public Broadcasting. Other cooperating partners include: City of Fargo, City of Moorhead, Moorhead Public Service, Minnesota Pollution Control Agency, North Dakota Health Department, and EPA Region 8. The project uses volunteer water monitoring and city water data to assess the aquatic health of the Red River in the Fargo/Moorhead area, and raise river public awareness and involvement. A half hour special and 18 educational water spots

were televised, and water festivals hosted with over 1400 students in attendance . A website with educational material and water quality monitoring results is located at: http://www.fmriver.org. Water quality monitoring from the original project has been completed and the data posted. Monitoring and educational efforts will continue with an additional EPA grant to River Keepers. The monitoring data from the project have been expanded and are being used in development of TMDLs in the Fargo/Moorhead area.

Greenway on the Red

Greenway on the Red is a multi-state and international effort to establish a 600 mile Greenway along the Red River in both the US and Canada. Activities include mapping to support Greenway siting, Greenway riparian restoration planning in conjunction with the Red River Basin Research Institute and other project partners, development of program elements for Gateway to the Greenway Audubon Nature Center, dissemination of successful urban Greenway protocols and initiatives among other municipalities, continued compilation of landowner handbook and web-based outputs, hydrologic modeling partnership and coordination with Canadian efforts, continued development of basin wide hydrologic monitoring data for Greenway sites and associated wetlands restoration and protection, and outreach and education.

Red River Basin Biological Monitoring Workgroup

The Red River Biological Monitoring Workgroup is undertaking an effort to improve and expand biological monitoring efforts in the basin and develop benthic macroinvertebrate sampling protocols for slow moving muddy bottomed rivers. These efforts are being coordinated with the, North Dakota Health Department, FM River project and the IRRB Aquatic Ecosystem Health Committee.

Glacial Ridge Restoration

The Nature Conservancy and its partners are undertaking the largest tallgrass prairie and wetland restoration project in U.S. history. Very little of this glacial Lake Agassiz shoreline restoration area near Crookston, MN are native prairie; the rest has been used for gravel extraction, crop production and cattle and sheep grazing. Primary threats to the area include wetlands drainage, erosion, habitat fragmentation, and invasion of exotic species. When restored, the grassland and wetland areas will connect with other wildlife and recreation areas, and provide 32,000 contiguous acres of excellent habitat for prairie nesting birds, threatened prairie plants and animals.

Discover a Watershed

The Montana Watercourse group is developing a 'Discover a Watershed: Red River KIDS Activity Booklet'. This is one of a series of children's watershed education tools that are being distributed in several basins across The US, Canada, and internationally through the International Project WET (Watershed Education for Teachers). The Red River project will be completed by the end of 2003, but additional funding is desired to complete the entire curriculum package.

Devils Lake Ecotourism Development

The North Dakota Consensus Council, US Fish and Wildlife Service, and locally-based partners completed a Devils Lake Ecotourism development project in 2003 which involves a Lake Region birding trail, a birding trail guide, and interpretive kiosk, and a wetlands overlook.

Brownfields

The EPA Brownfields program is driven by the concept that real or perceived environmental contamination keeps developers and lenders from redeveloping old industrial sites. The new US federal brownfields legislation provides authority to award cleanup grants to non-profit organizations. The creation, preservation, or addition to a park, a greenway, undeveloped property, recreational property, or other property used for nonprofit purposes are considerations for selecting projects - brownfields are not just urban industrial areas. While several meetings have been held in the US section of the Red River basin, to date, EPA has not received any Targeted Brownfield Assessment applications, or grant proposals, but continues to keep lines of communication open with all communities.

APPENDIX A

INTERNATIONAL RED RIVER BOARD DIRECTIVE

DIRECTIVE TO THE INTERNATIONAL RED RIVER BOARD

1. Pursuant to the Boundary Waters Treaty of 1909, responsibilities have been conferred on the Commission under a 1948 Reference from the governments of Canada and the United States with respect to the use and apportionment of the waters along, across, or in the vicinity of the international boundary from the eastern boundary of the Milk River drainage basin on the west up to and including the drainage basin of the Red River on the east, and under the May 1969 authorization from the governments to establish continuous supervision over the quality of the waters crossing the boundary in the Red River and to recommend amendments or additions to the objectives when considered warranted by the International Joint Commission.

2. This directive replaces previous directives and instructions provided by the International Joint Commission to the International Souris-Red Rivers Engineering Board, and in the February 8, 1995 Directive to the International Red River Pollution Board. This Directive consolidates the functions of those two former boards into one board, to be known as the International Red River Board (Board).

3. The Board's mandate is to assist the Commission in preventing and resolving transboundary disputes regarding the waters and aquatic ecosystem of the Red River and its tributaries and aquifers. This will be accomplished through the application of best available science and knowledge of the aquatic ecosystem of the basin and an awareness of the needs, expectations and capabilities of residents of the Red River basin.

4. The geographical scope of the Board's mandate shall be the Red River basin, excluding the Assiniboine and Souris Rivers. The Board's activities shall focus on those factors which affect the Red River's water quality, water quantity, levels and aquatic ecological integrity.

5. The Board's duties shall be to:

   A. Maintain an awareness of basin-wide development activities and conditions that may affect water levels and flows, water quality and the ecosystem health of the Red River and its transboundary tributaries and inform the Commission about transboundary issues.

   B. Provide a continuing forum for the identification, discussion and resolution of existing and emerging water-related issues relevant to the Red River basin.

   C. Recommend appropriate strategies to the Commission concerning water quality, quantity and aquatic ecosystem health objectives in the basin.

   D. Maintain continuing surveillance and perform inspections, evaluations and assessments, as necessary, to determine compliance with objectives agreed to by governments for water quality, levels and quantity in the Red River basin.

   E. Encourage the appropriate regulatory and enforcement agencies to take steps to ensure that agreed objectives are met.

   F. Encourage the appropriate authorities, such as resource and emergency planning agencies, to establish and maintain contingency plans, including early warning procedures, for appropriate reporting and action on accidental discharges or spills, floods and droughts.

   G. Monitor and report on flood preparedness and mitigation activities in the Red River basin and their potential effects on the transboundary aquatic ecosystem, and encourage and facilitate the development and. maintenance of flood-related data and information systems and flood forecasting and hydrodynamic models. In carrying out this responsibility, the Board shall:

i. Monitor progress by the governments (federal, state, provincial, municipal) in implementing the recommendations of the Commission's report on Red River basin flooding, and in maintaining and advancing the work of the Task Force's legacy projects, and to this end provide opportunities for the public to comment on the adequacy of such progress.

ii. Encourage governments to develop and promote a culture of flood preparedness in the Red River valley.

iii. Encourage government efforts to develop and implement a long-term strategy for flood mitigation and emergency preparedness.

iv. Encourage the sharing of accurate and timely transboundary information to support the development of improved flood forecasting techniques and procedures for early flood warnings and to improve communication of flood forecasts.

v. Provide through the activities of the Board a forum for the exchange of best practices and for other flood-related information on preparedness, mitigation, response, and recovery, to assist in transboundary problem solving.

vi. Promote the application of innovative technologies for supporting flood modelling and mapping.

vii. Monitor the adequacy of data and information collection networks (meteorological, hydrometric, water quality) for flood preparedness, forecasting and mitigation, within the larger context of overall water management needs in the basin.

viii. Monitor potential transboundary effects of flood mitigation and other works in the basin, and encourage cooperative studies necessary to examine these effects.

ix. Encourage governments to integrate floodplain management activities in watershed and basin management.

x. Interact with all levels of government to help decision-makers become aware of transboundary flood-related and associated water management issues.

xi. Assist in facilitating a consultative process for resolution of the lower Pembina River flooding issue.

H. Involve the public in the work of the Board, facilitate provision of timely and 'pertinent information within the basin in the most appropriate manner including electronic information networks, and conduct an annual public meeting in the Red River basin;

I. Provide an annual report to the Commission, plus other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive.

J. Maintain an awareness of the activities of other agencies and institutions, in the Red River basin;

6. The Board shall continue to report on the non-Red River geographic areas under the responsibility of the former International Souris-Red Rivers Engineering Board, including the Poplar and Big Muddy basins, but excluding the Souris River basin, until the Commission determines otherwise.

7. The Board shall have an equal number of members from each country. The Commission shall normally appoint each member for a three-year term. Members may serve for more than one term. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. The Commission shall appoint one member from each country to serve as co-chairs of the Board. An alternate member may not act as a co-chair.

8. At the request of any member, the Commission may appoint an alternate member to act in the place of such member whenever the said member, for any reason, is not available to perform such duties as are required of the member.

9. The co-chairs of the Board shall be responsible for maintaining proper liaison between the Board and the Commission, and among the Board members. Chairs shall ensure that all members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

10. Each chair, after consulting the members of the Board, may appoint a secretary. Under the general supervision of the chair(s), the secretary(ies) shall carry out such duties as are assigned by the chairs or the Board as a whole.

11. The Board may establish such committees and working groups as may be required to discharge its responsibilities effectively. The Commission shall be kept informed of the duties and composition of any committee or working group. Unless other arrangements are made, members of the Board, committees, or working groups will make their own arrangements for reimbursement of necessary expenditures.

12. The Commission should also be informed of the Board's plans and progress and of any developments or cost impediments, actual or anticipated, which are likely to affect carrying out the Board's responsibilities.

13. The Commission shall be informed, in advance, of plans for any public meetings or public involvement in the Board deliberations. The Board shall report, in a timely. manner, to the Commission on these meetings, including representations made to the board.

14. The Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers, prior to their release.

15. Reports, including annual reports, and correspondence of the Board shall, normally, remain privileged and be available only to the Commission and to members of the Board and its committees until their release has been authorized by the Commission.

16. If, in the opinion of the Board or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, the matter shall be referred promptly to the Commission for appropriate action.

17. In the event of any unresolved disagreement among the members of the Board, the Board shall refer the matter forthwith to the Commission for decision.

18. The Commission may amend existing instructions or issue new instructions to the Board at any time.

APPENDIX B

B.1 WATER QUALITY OBJECTIVES

B.2 WATER QUALITY ALERT LEVELS

B.1 WATER QUALITY OBJECTIVES

The purpose of the water quality objectives and alert levels is to restore and maintain the chemical, physical, and biological integrity of the waters of the Red River. Five specific objectives were adopted for the Red River by the IJC in 1969.

Water quality objectives are used when necessary to secure government commitment to pollution abatement action. Compliance with the objectives is the primary means by which the Board identifies major water quality issues to the Commission.

The term "exceedence" is used to describe a situation where an objective is not met. A situation is classified as an exceedence if an individual instantaneous sample, obtained from the continuous auto-monitor, or through a grab sample, is equal to or greater than the corresponding water quality objective (except for dissolved oxygen, which must be observed to be equal to or less than the objective). The five specific parameters and corresponding objective are listed below.

Fecal Coliform	200 colonies/100 ml
Chloride	100 mg/L
Sulphate	250 mg/L
Total Dissolved Solids	500 mg/L
Dissolved Oxygen	5 mg/L

B.2 WATER QUALITY ALERT LEVELS

Water quality alert levels are used to complement water quality objectives. If exceeded, alert levels will trigger investigative action on the part of the Board or its representatives. The exceedence is addressed in terms of its magnitude, implications to water uses and possible resolutions. On the basis of alert level exceedences and subsequent investigations, the Board may advance proposals for additional objectives.

Water quality alert levels, for a wide range of parameters, in addition to the five specific parameters noted above, were developed by a working group in 1985. These alert levels were approved by the predecessor International Red River Pollution Board in January 1986. The alert levels that are currently in effect are listed in the following table. Further, the table provides a comparison of alert levels with the North Dakota and Minnesota Water Quality Standards, and with the Manitoba Water Quality Objectives as of 1990. The table has not been updated to reflect recent state or provincial revisions. The Aquatic Ecosystem Health Committee established by the Board in June 2001 will be reviewing the issue of objectives and alert levels with respect to monitoring requirements, analytical methodologies, and reporting protocols.

APPENDIX C

WATER POLLUTION CONTROL
CONTINGENCY PLAN

LIST OF CONTACTS

Notification List
For D.O Depletions, Non-toxic , Oil, and Toxic Spills

United States:

Minnesota Pollution Control Agency – Detroit Lakes, MN

Jeff Lewis
(218) 846-0730 office
(218) 846-0719 fax
1-800-422-0798 (24 hr)

Molly MacGregor
(218) 846-0494 office
(218) 846-0719 fax
1-800-422-0798 (24hr)

Minnesota Department of Natural Resources – Bemiji, MN (fisheries)

Henry Drews
(218) 755-3959 office
1-800-422-0798 (24hr)

North Dakota Health Department – Bismark, ND

Dennis Fewless
(701) 328-5150 office
(701) 328-5200 fax
1-800-472-2121 (24hr in-state – ask for REACT Officer)
(701) 328-9921 (24hr out-of-state – ask for REACT Officer)

Environmental Protection Agency – Denver, CO

Max Dodson
(303) 312-6598 office
(303) 312-6897 fax
1-800-424-8802 (24hr National Response Center)

John Giedt
(303) 312-6550 office
(303) 312-6897 fax
1-800-424-8802 (24hr National Response Center)

Canada:

Manitoba Conservation – Winnipeg, MB

Dwight Williamson
(204) 945-7030 office
(204) 948-2357 fax
(204) 256-3706 home
(204) 944-4888 (24hr telephone service emergency number)

Environment Canada- Regina, SK

David Donald
(306) 780-6723 office
(306) 780-6810 fax
(306) 586-1468 home

Environment Canada – Winnipeg, MB

Michael Kowalchuk
(204) 983-5500 office
(204) 983-4884 fax
(204) 256-7784 home

APPENDIX D

HISTORICAL STREAMFLOW AND WATER QUALITY CHARACTERISTICS

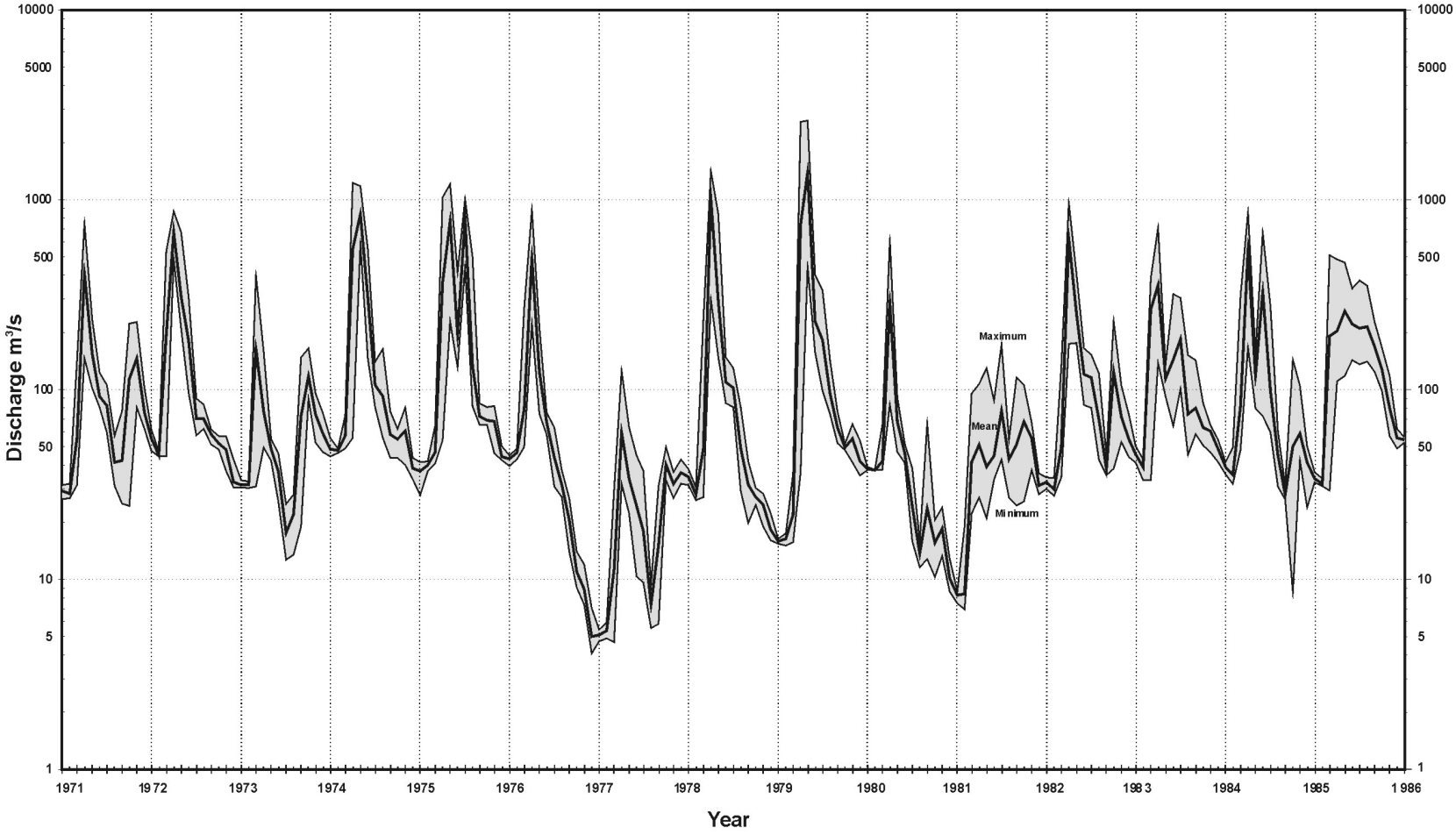


Figure 2a
Variability in mean monthly Discharge (m^3/s), 1971-1986
Red River near the International Boundary

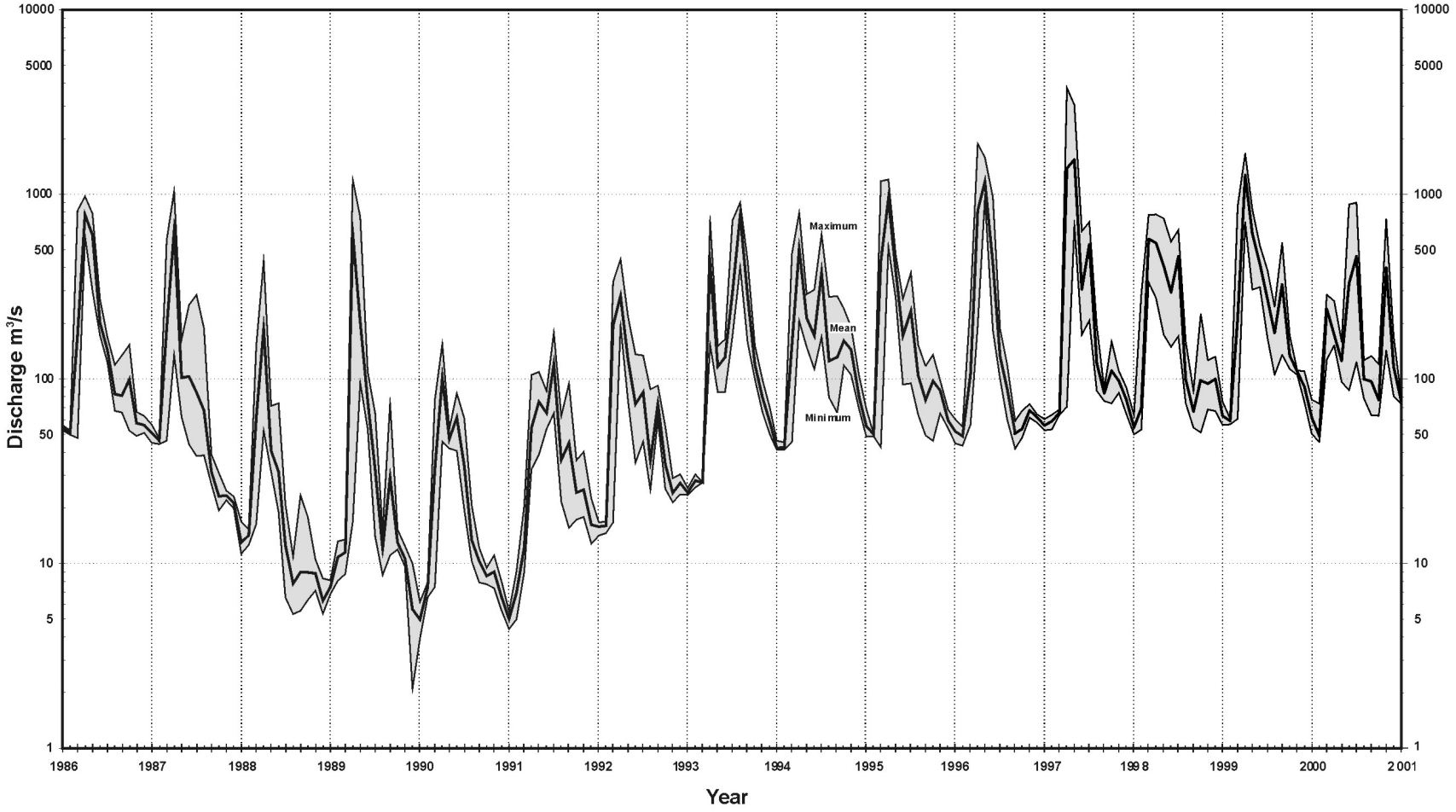


Figure 2b
Variability in mean monthly Discharge (m^3/s), 1986-2001
Red River near the International Boundary

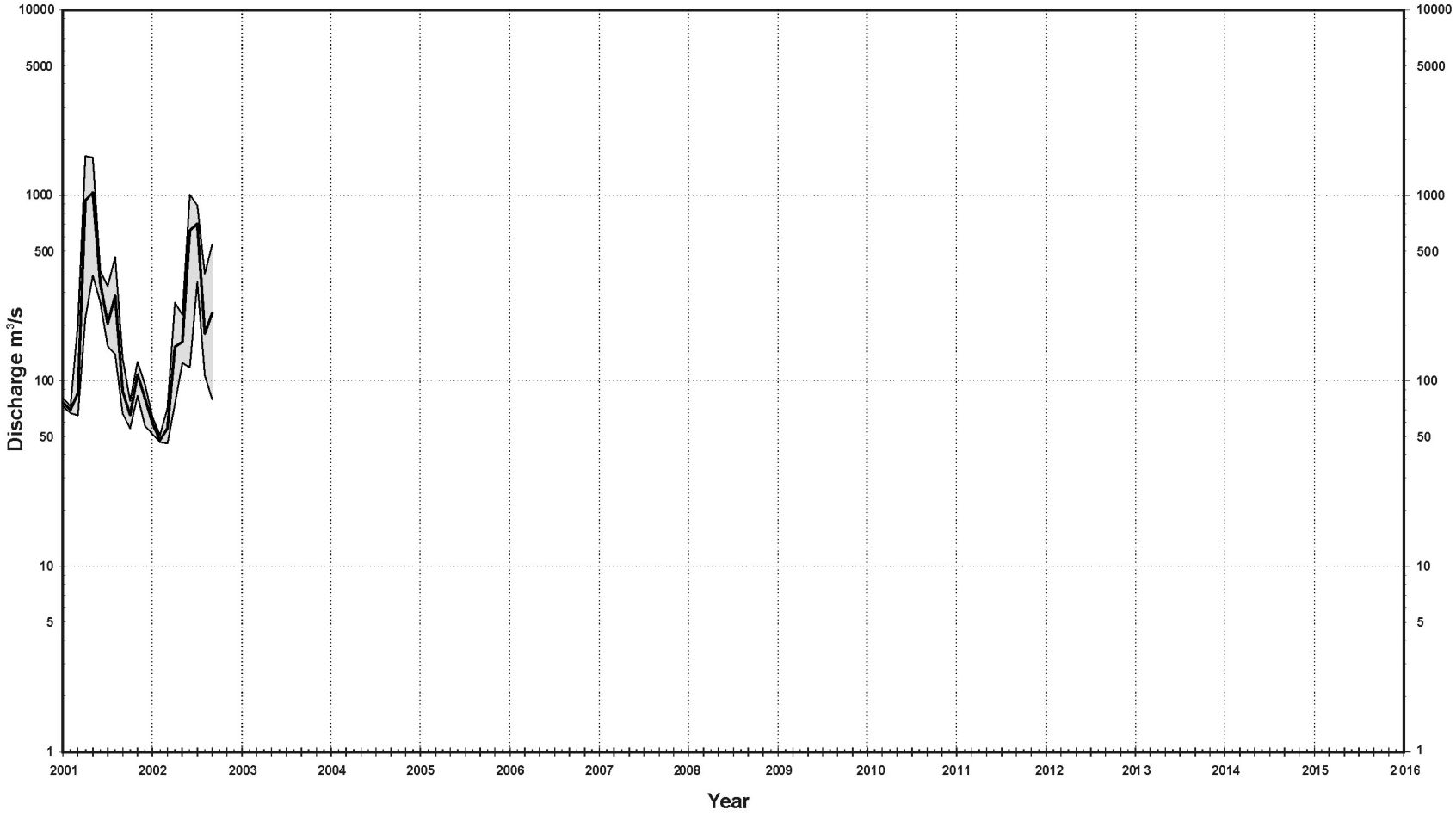


Figure 2c
Variability in mean monthly Discharge (m^3/s), 2001-2016
Red River near the International Boundary

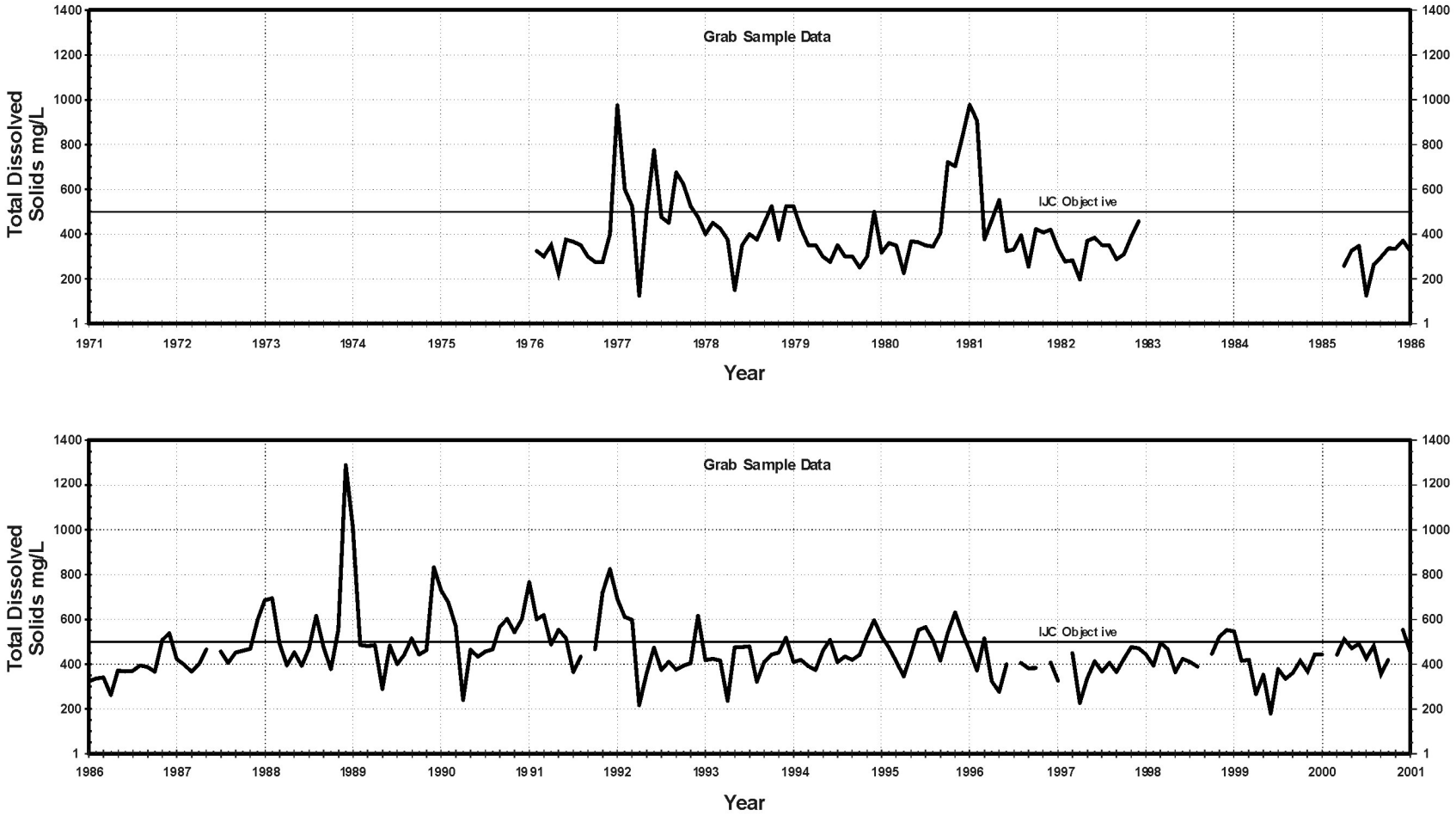


Figure 3a
Mean monthly Total Dissolved Solid (mg/L), 1971-2001
Red River near the International Boundary

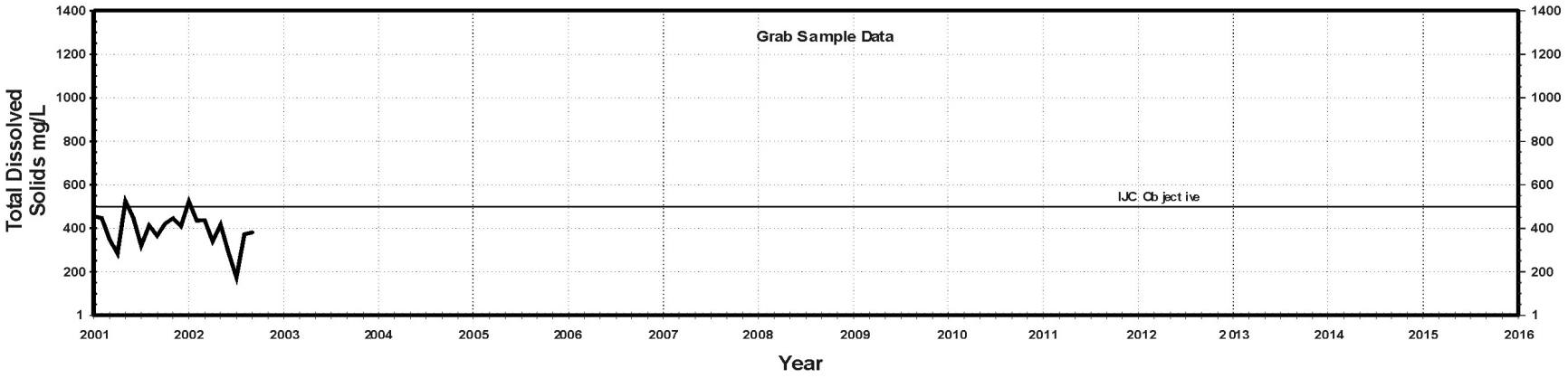


Figure 3b
Mean monthly Total Dissolved Solid (mg/L), 2001-2016
Red River near the International Boundary

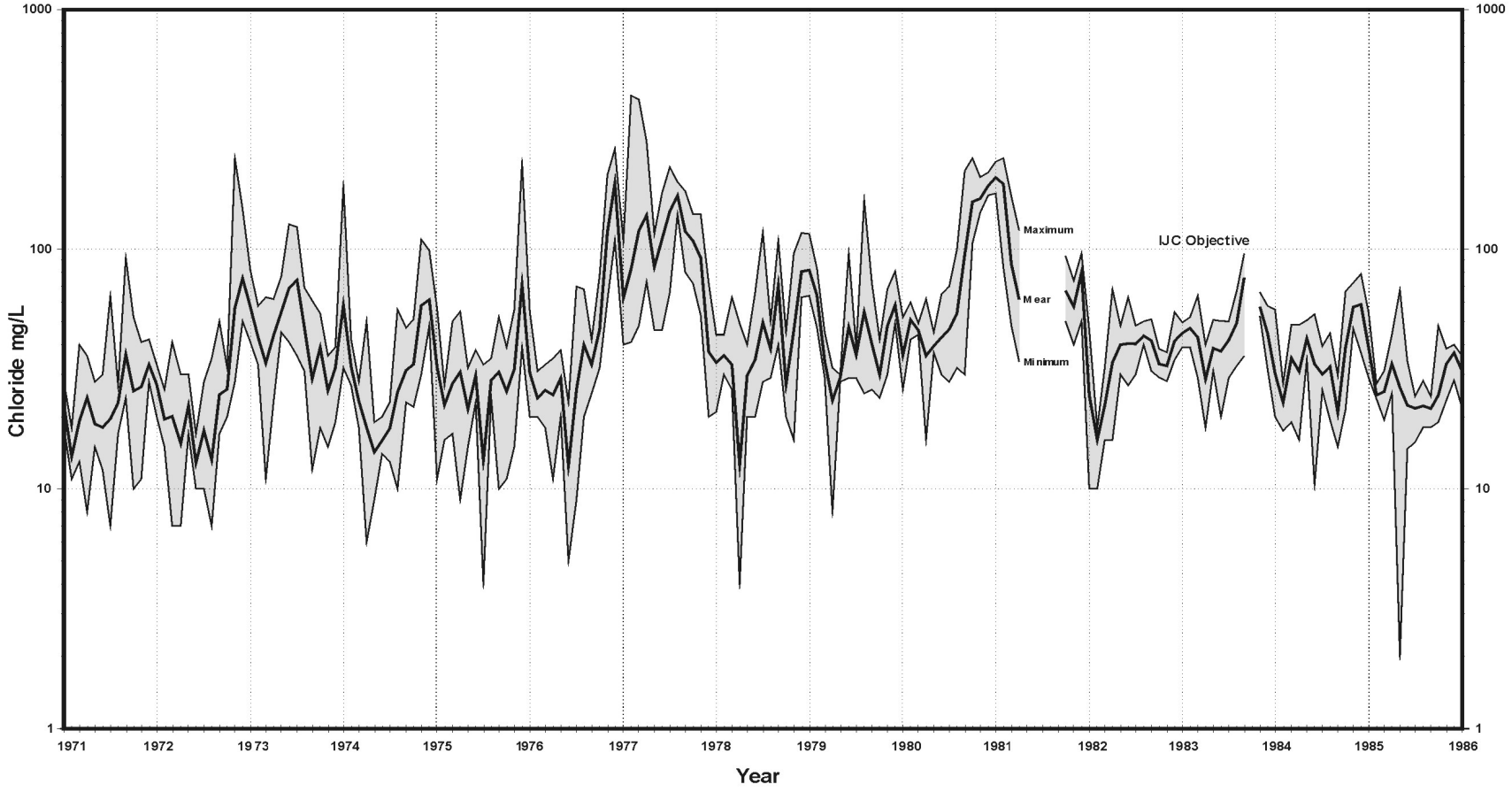


Figure 4a
Variability in monthly Chloride Levels (mg/L), 1971-1986
Red River near the International Boundary

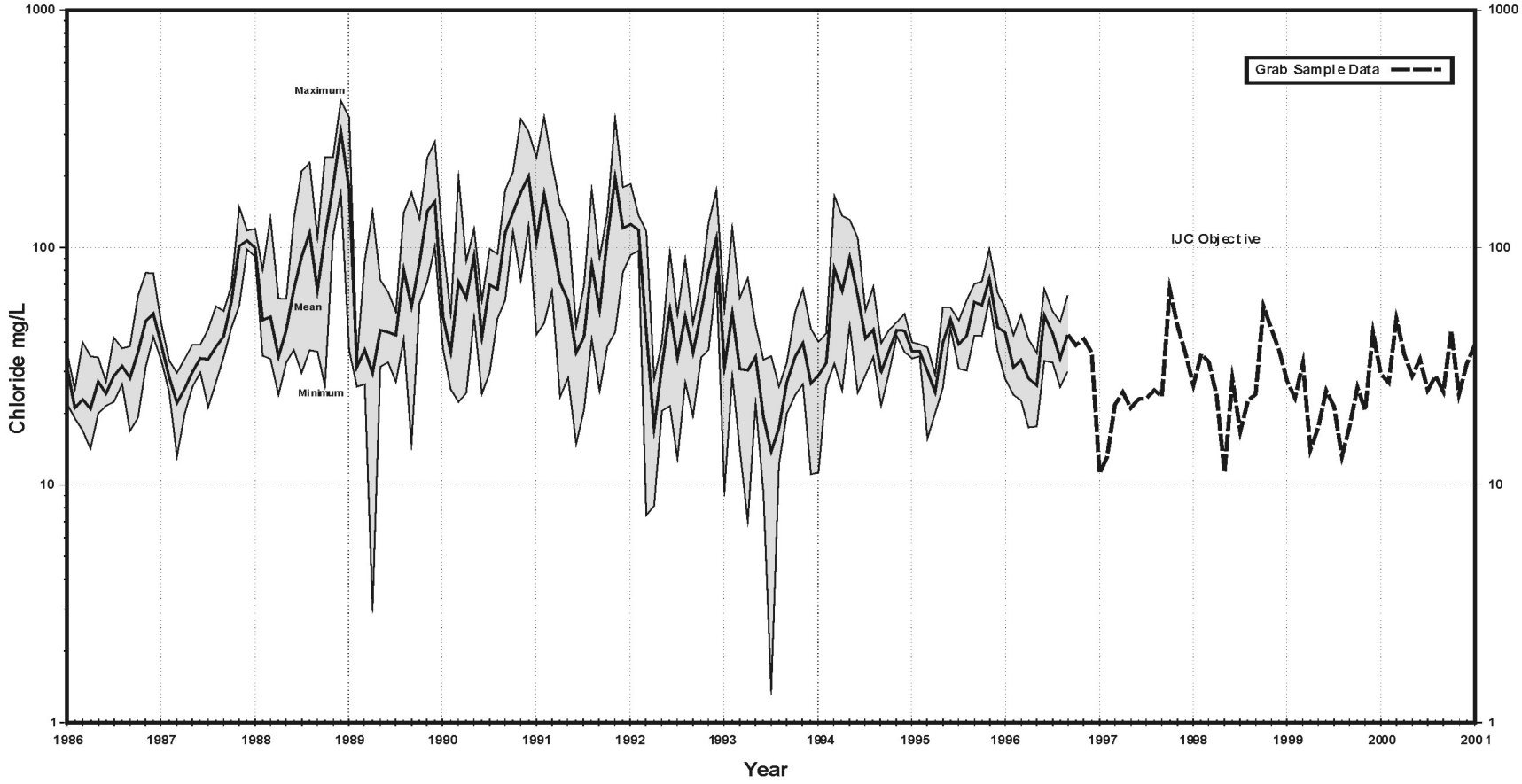


Figure 4b
Variability in monthly Chloride Levels (mg/L), 1986-2001
Red River near the International Boundary

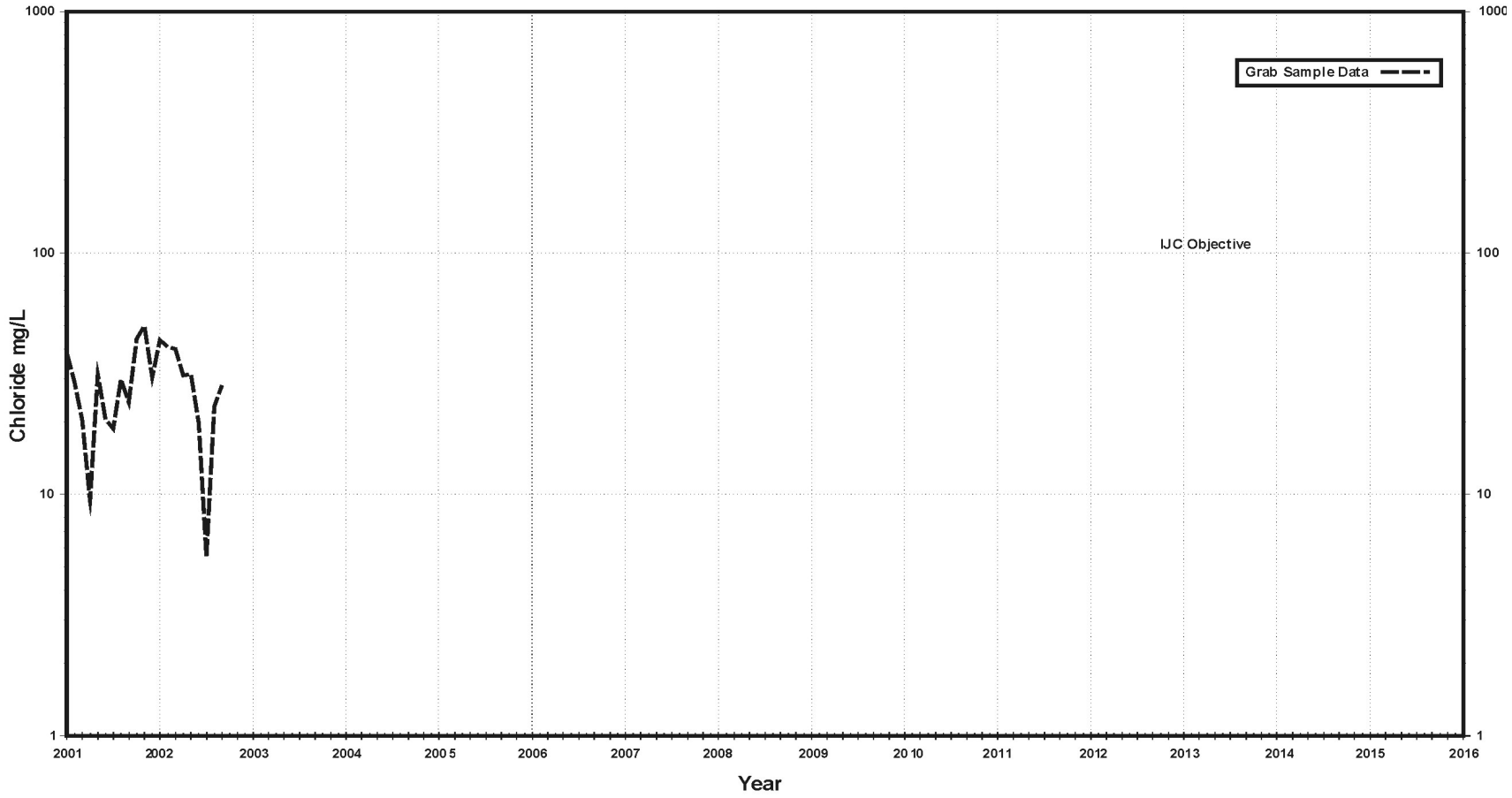


Figure 4c
Variability in monthly Chloride Levels (mg/L), 2001-2016
Red River near the International Boundary

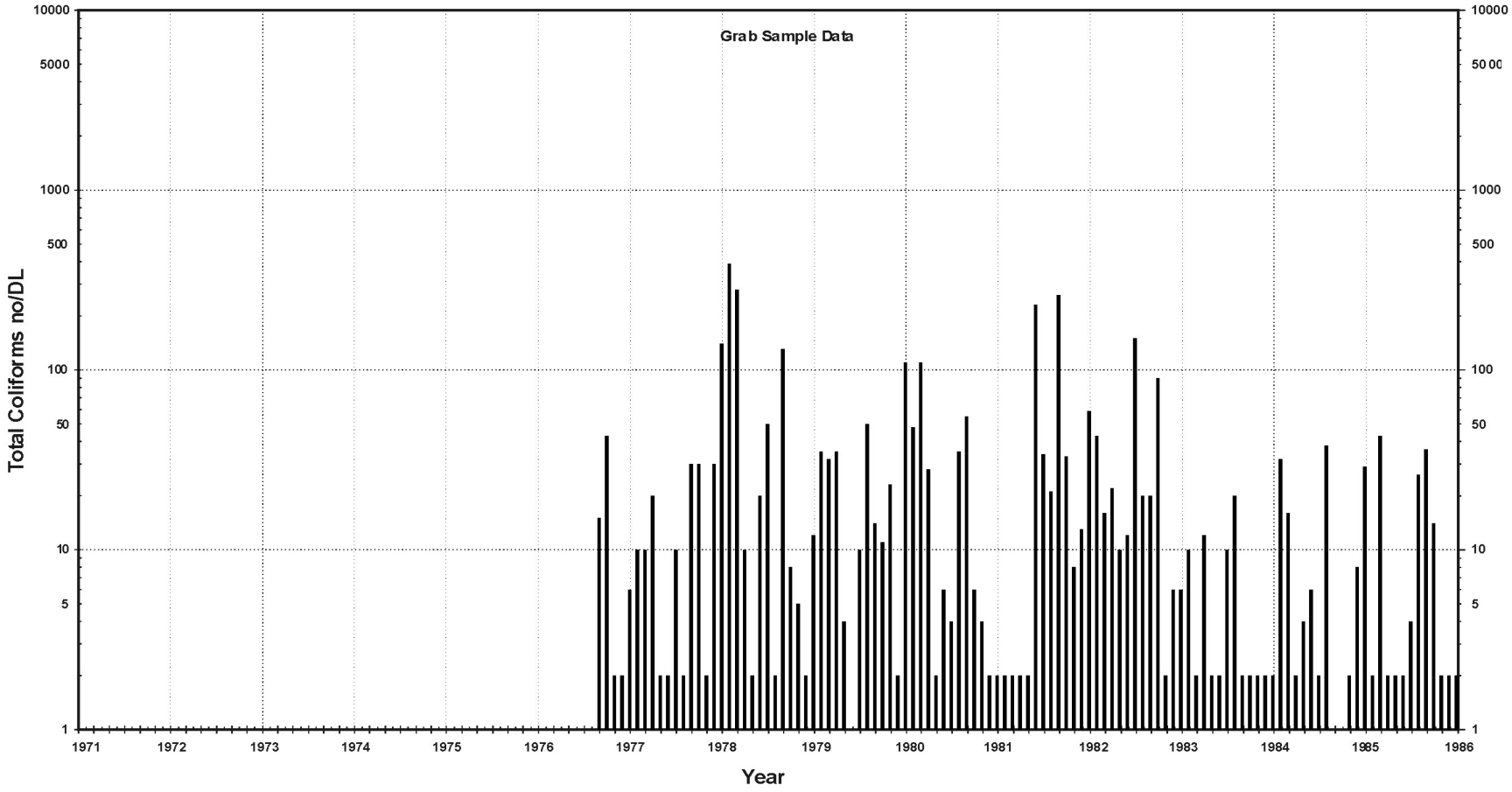


Figure 5a
Variability in Fecal Coliforms (no/DL), 1971-1986
Red River near the International Boundary

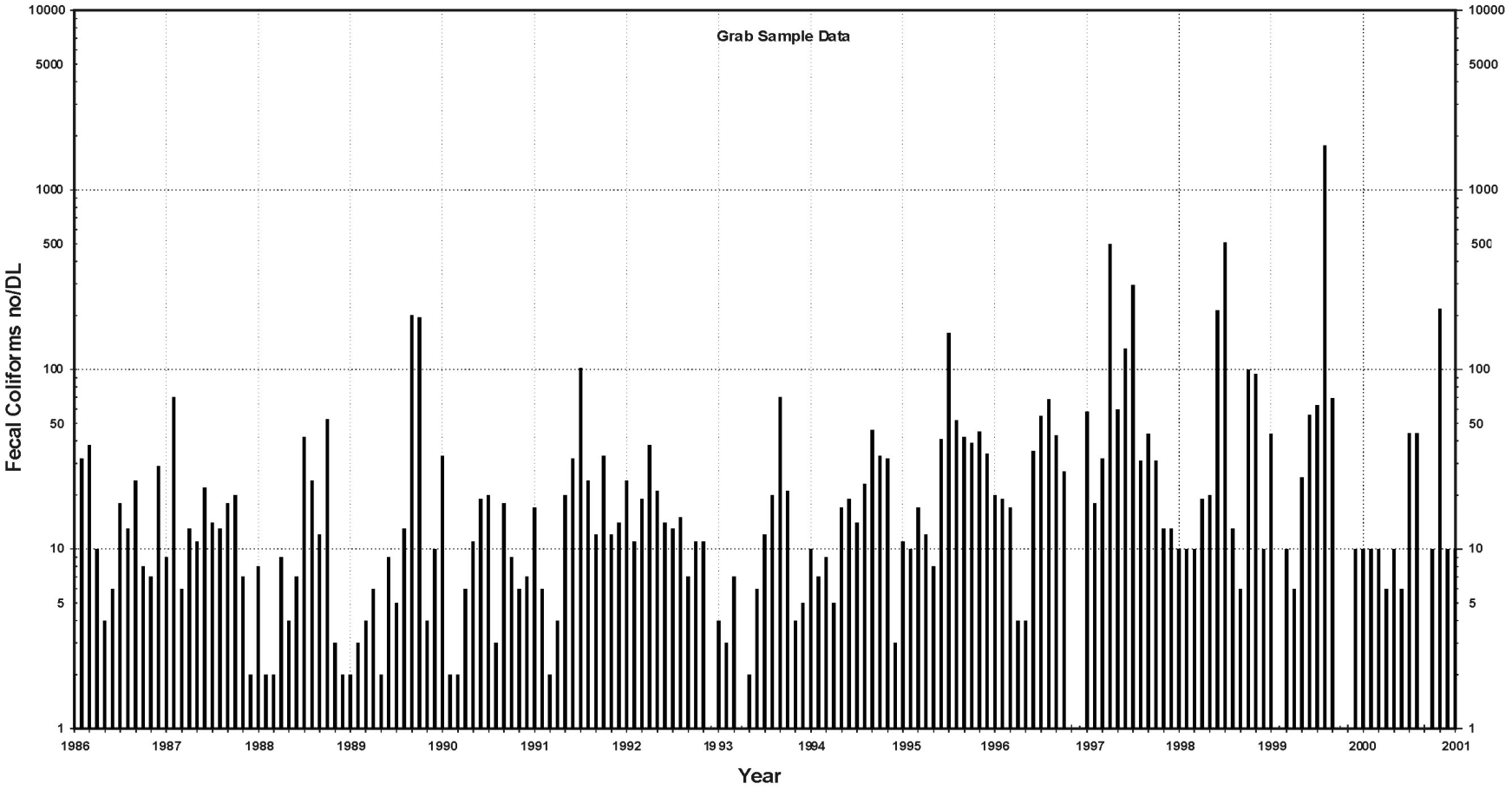


Figure 5b
Variability in Fecal Coliforms (no/DL), 1986-2001
Red River near the International Boundary

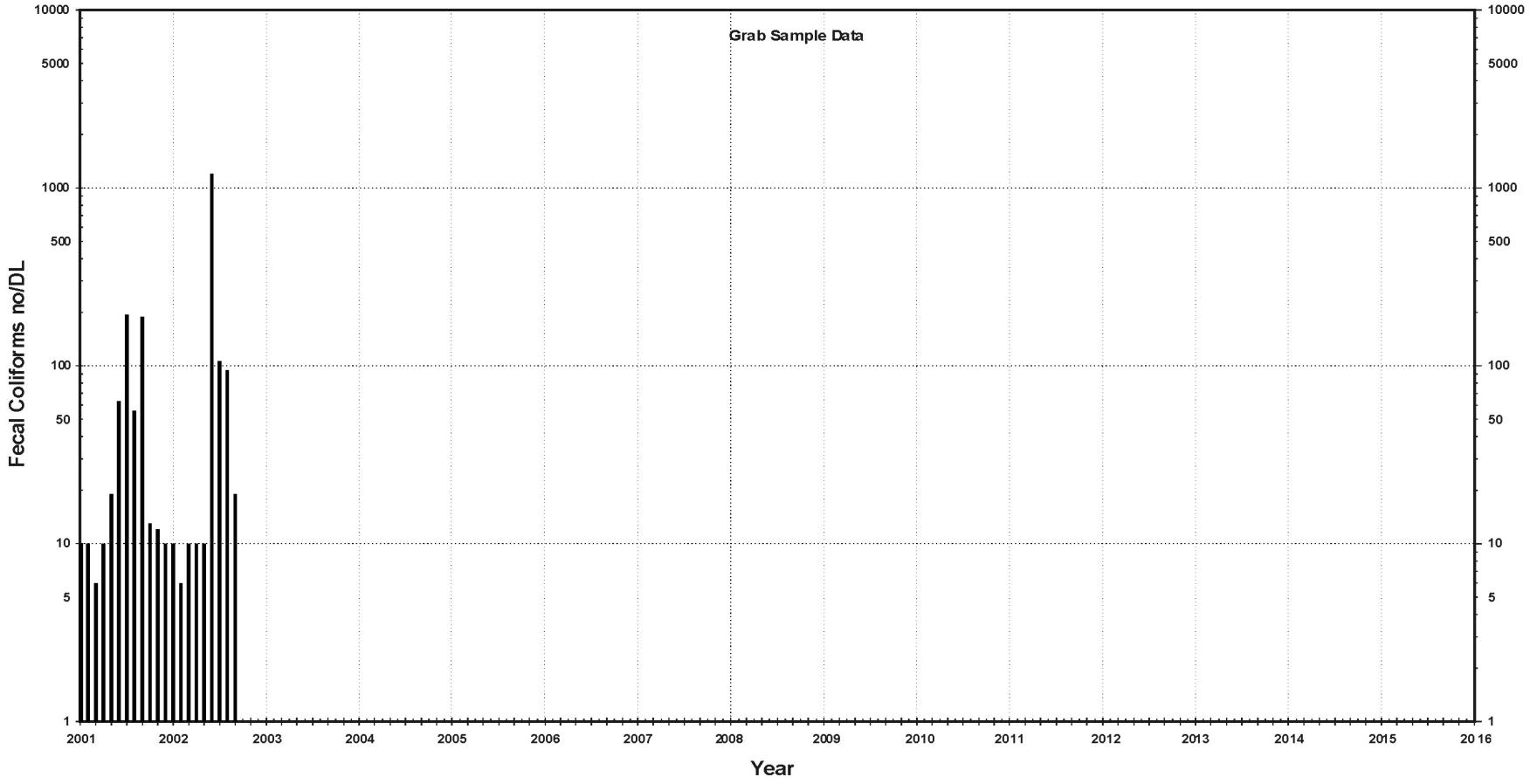


Figure 5c
Variability in Fecal Coliforms (no/DL), 2001-2016
Red River near the International Boundary

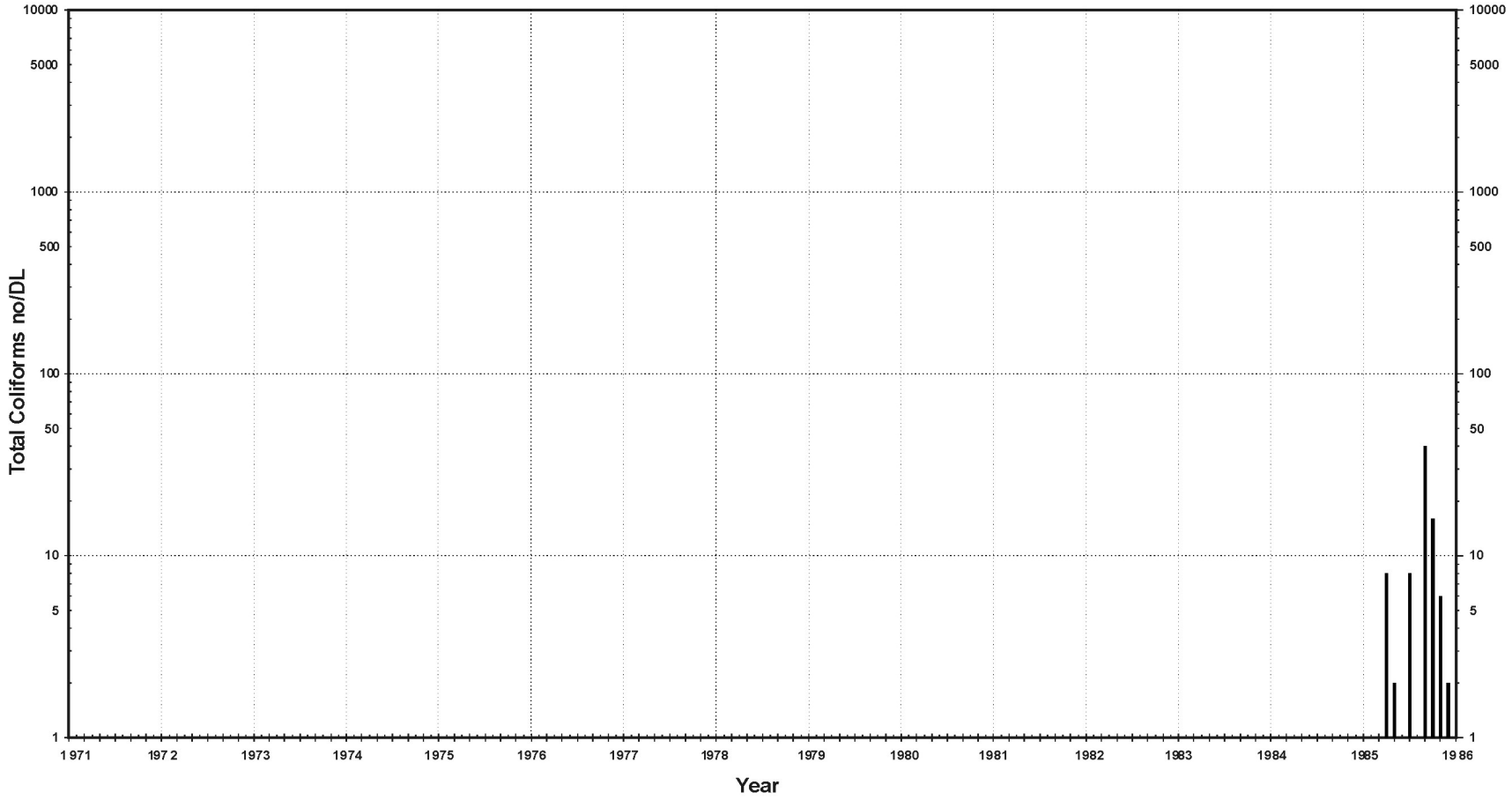


Figure 6a
Variability in Total Coliforms (no/DL), 1971-1986
Red River near the International Boundary

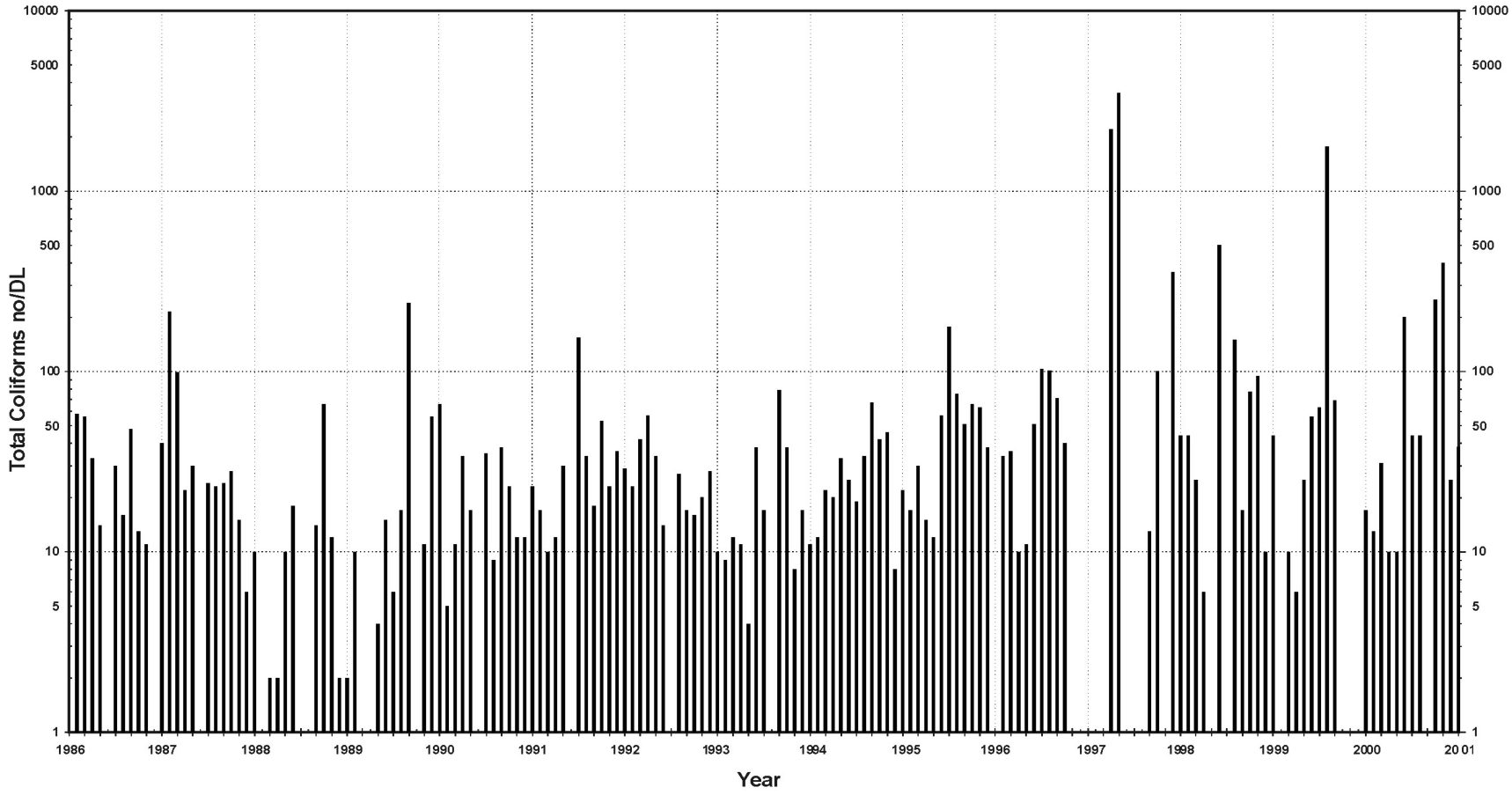


Figure 6b
Variability in Total Coliforms (no/DL), 1986-2001
Red River near the International Boundary

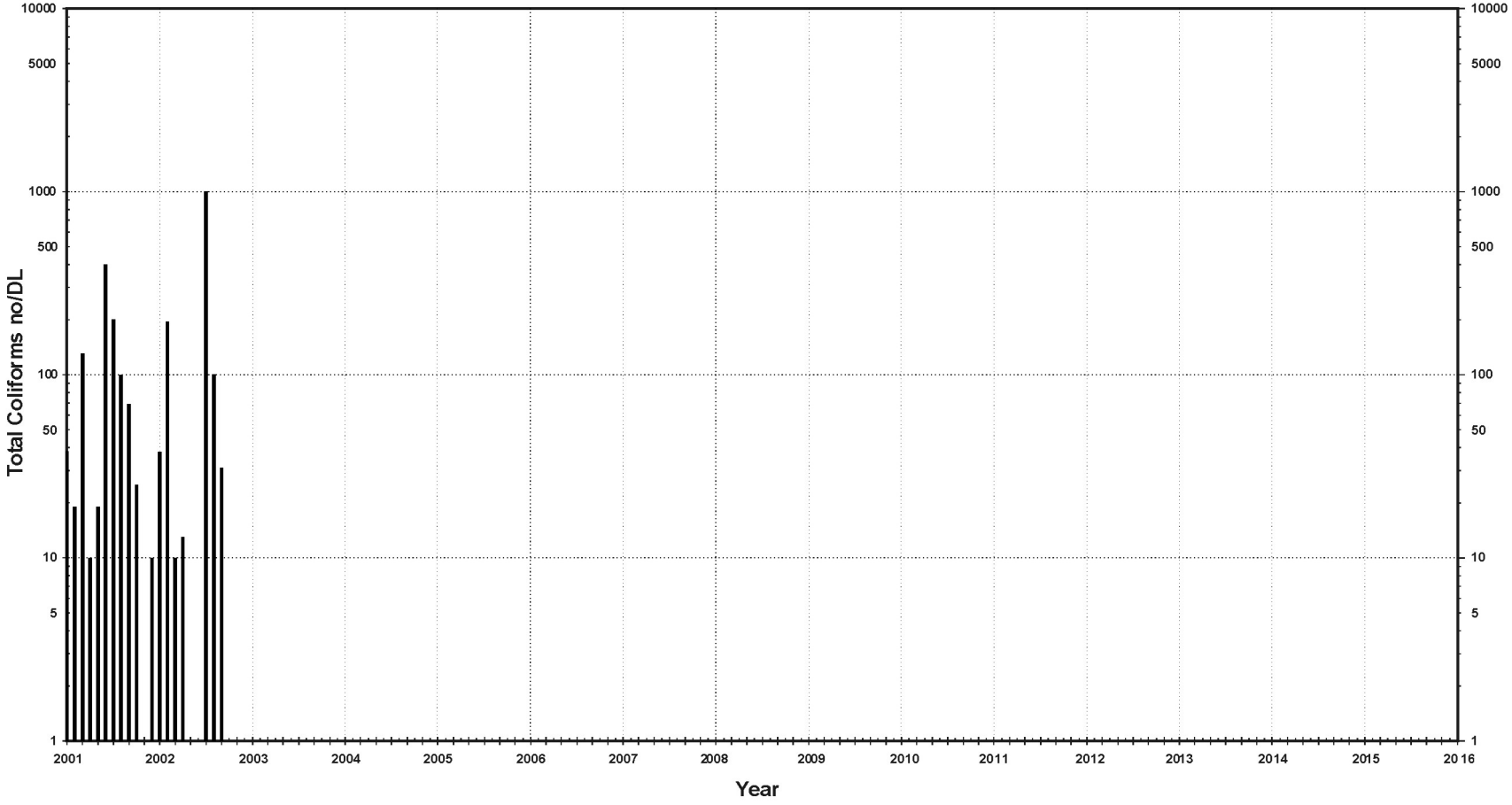


Figure 6c
Variability in Total Coliforms (no/DL), 2001-2016
Red River near the International Boundary

APPENDIX E

HYDROLOGY COMMITTEE AND AQUATIC ECOSYSTEM HEALTH COMMITTEE
MEMBERSHIP LIST

International Red River Board
Hydrology Committee

Membership

Name	Organization	Phone	E-mail
Rick Bowering (Chair) Steve Topping (Alt.)	Manitoba Conservation, Winnipeg	(204) 945-6397 (204) 945-6398	Rbowering@gov.mb.ca stopping@gov.mb.ca
Steve Robinson (Chair) Gregg Wiche (Alt.)	USGS, Grand Forks USGS, Bismark	(701) 775-7221 (701) 250-7400	Smrobins@usgs.gov gjwiche@usgs.gov
Michael Kowalchuk (Secretary)	Environment Canada, Secretary IRRB, Winnipeg	(204) 983-5500	Michael.Kowalchuk@EC.GC.CA
Alain Vermette	PFRA, Winnipeg	(204) 984-3694	Vermettea@em.agr.ca
Scott Jutila Greg Eggers (Alt.)	Corps of Engineers, St. Paul	(651) 290-5631 (651) 290-5607	Scott.A.Jutila@usace.army.mil Gregory.W.Eggers@usace.army.mil
Maurice Sydor	Environment Canada, Ottawa	(819) 953-1528	maurice.sydor@ec.gc.ca
Randy Gjestvang	N.D. State Water Commission, West Fargo	(701) 282-2318	rgjest@water.swc.state.nd.us
Chuck Fritz	Red R. Basin Commission, Moorhead	(218) 291-0422	Chuckr2b2@corpcomm.net
Harold Taylor	Red R. Basin Commission, Winnipeg	(204) 982-7254	ticwpg@ilos.net
Ron Harnack Al Kean (Alt.)	Minnesota Board of Water and Soil Resources,	(651) 296-0878 (651) 297-2907	Ron.harnack@bwsr.state.mn.us Al.kean@bwsr.state.mn.us
Kip Gjerde Amy Lieb (Alt.)	U.S. Bureau of Reclamation, Billings/Bismark	(406) 247-7813 (701) 250-4242 ext. 3615	jgjerde@gp.usbr.gov alieb@gp.usbr.gov

International Red River Board
Aquatic Ecosystem Health Committee

Membership

Name	Organization	Phone	E-mail
John Giedt (Sec.)	EPA/Denver	(303) 312-6550	giedt.john@epa.gov
Stacey Eriksen	EPA/Denver	(303) 312-6692	eriksen.stacey@epa.gov
Mike Sauer	NDHD/Bismarck	(701) 328-5237	msauer@state.nd.us
Mike Ell	NDHD/Bismarck	(701) 328-5214	mell@state.nd.us
Rick Nelson (Chair)	USBR/Bismarck	(701) 250-4242	rnelson@gp.usbr.gov
Wayne Berkas	USGS/Bismarck	(701) 250-7429	wrberkas@usgs.gov
Molly MacGregor	MPCA/Detroit Lakes	(218) 846-0494	molly.macgregor@ pca.state.mn.us
Lance Yohe	RRBC/Moorhead	(218) 291-0422	lancer2b2@corpcomm.net
Chuck Fritz	RRBC/Moorhead	(218) 291-0422	chuckr2b2@corpcomm.net
David Donald (Chair)	EnvironmentCanada/ Regina	(306) 780-6723	david.donald@ec.gc.ca
Dwight Williamson	Manitoba Conservation/ Winnipeg	(204) 945-7030	dwilliamso@gov.mb.ca
Joe O'Connor	Manitoba Conservation/ Winnipeg	(204) 945-7814	joconnor@gov.mb.ca
Terry Shortt	DFO/Winnipeg	(204) 983-5062	shorttt@dfo-mpo.gc.ca
Pat McGarry	PFRA/Winnipeg	(204) 983-4832	mcgarryp@em.agr.ca