IRRB

THE

INTERNATIONAL RED RIVER BOARD

Ninth Annual

Progress Report

October 2008

INTERNATIONAL JOINT COMMISSION • COMMISSION MIXTE INTERNATIONALE
1909

Blank Page

INTERNATIONAL
RED RIVER BOARD

Canadian Section
Transboundary Waters Unit, Environment Canada
300-2365 Albert Street, Regina SK S4P 4K1
Tel: 306 780-7004 Fax: 306 780-6810

CONSEIL INTERNATIONAL
DE LA RIVIERE ROUGE

United States Section
Great Plains Region, Bureau of Reclamation
P.O. Box 36900, Billings MT 59107-6900
Tel: 406 247-7600 Fax: 406 247-7604

Commissioners:

The International Red River Board is pleased to submit its Ninth Annual Progress Report to the International Joint Commission.

Respectfully submitted,

Mike Renouf
Co-Chair, Canadian Section

Michael J. Ryan
Co-Chair, United States Section

Blank Page

PREFACE

This report documents water quality trends and exceedences of objectives, effluent releases, and control measures for the Red River basin for the 2007 Water Year (October 1, 2006 through September 30, 2007). In addition, this report describes the activities of the International Red River Board during the reporting period October 1, 2007 to September 30, 2008 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.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX E

1.0 SUMMARY

1.01 Water Quantity and Water Quality

Water Quantity

The 2007 spring crest in the City of Winnipeg was close to average but a record ice jam at Selkirk produced the highest levels ever recorded at the City, producing significant flooding of a marine museum, a golf course and many homes near the river. Several apartment blocks in Selkirk had to be evacuated. It was also the longest duration ice jam, lasting 10 days, in part due to very cold temperatures and frazil ice formation. A rain generated peak of 15.9 feet occurred in the City of Winnipeg near the end of June. High river levels disrupted recreation and boating in the City for more than a month. River levels in the City returned to normal on July 20 and remained normal until the end of September 2007.

Flows at Red River at Grand Forks during the spring of 2008 were normal; followed by wet summer due to many precipitation events. However, flows never reached flood stage. Flows at Red River at Fargo were above the 106-year median for the entire summer. The peak flow occurred in June due to precipitation event.

Southern tributaries tended to be above the median for period of record for entire summer due to persistent summer rains. Whereas, northern tributaries tended to be above the median in May and June, with gradual decline in late summer months.

Devils Lake and Stump Lake had equalized in 2007. Levels in both lakes declined over the summer of 2008 and by end of the summer, the two lakes were not connected.

Water Quality

Some exceedences of the International Joint Commission (IJC) water quality objectives were observed at the international boundary during the 2007 water year.

Dissolved oxygen generally remained well above the objective level (5.0 mg/L). Some exceedences of the International Joint Commission (IJC) water quality objectives, and concentrations approaching the objective level for Total Dissolved Solids (TDS) were observed at the international boundary during the 2007 water year. June and July 2007, were the only months where the *total dissolved solids* objective (500 mg/L) was not exceeded. The highest observed value of 691.0 mg/L occurred in January 2007. The *chloride* objective (100 mg/L) was exceeded in December 2006. Other monthly values range from a high of 99.4 mg/L in November 2006 to a low of 10.4 mg/L in June 2007. Similarly, the *sulphate* objective (250 mg/L) was not exceeded in any month with values ranging from a low of 82.6 mg/L in June 2007 to a high of 233.0 mg/L in May 2007.

Twenty four of the suites of pesticides, herbicides and metals for which alert levels were established by the former International Red River Pollution Board were detected during the reporting period. The detection levels were well below the Canadian Aquatic Guidelines. Given that the Red River basin is an agriculturally dominated region, the presence of pesticides and herbicides is expected.

1.02 International Red River Board Activities

As noted in the Preface, this report also describes the activities of the International Red River Board (IRRB) for the period October 01, 2007 - September 30, 2008 which succeeds the 2007 water year. The key activities are highlighted below.

In 2007, the IRRB updated its 3-year work plan to reflect the current status of its activities, and to affirm consistency with the International Watersheds Initiative and the IJC Directive to the IRRB. The work plan priorities include a continued effort to expand the existing scientific knowledge of aquatic ecosystem dynamics and current conditions. The activities encompass assessment of fish and macroinvertebrate communities, distribution and abundance of exotic species, as well as plant community structures and trends. Key IRRB activities also include - development and implementation of apportionment/flow targets at the international boundary; completion of the second of the three-year Pathogen/Parasite Sampling Program; continuation of the development of Comprehensive Flood Mitigation Strategy (CFMS) as per the terms of reference of the Committee on Hydrology Committee; LiDAR mapping of the Lower Pembina River Basin; and setting nutrient objectives for the Red River at the International Boundary.

The IRRB held its third bi-annual meeting January 23-24, 2008 to address select issues in the basin, and the fourth bi-annual meeting July 17-18, 2008 for a more complete review of its responsibilities, activities, and accomplishments. The meetings addressed water quality monitoring and compliance with IJC objectives and established alert levels, and IRRB work plan priorities. The latter included actions to develop and implement water quantity apportionment procedures, prioritized flood mitigation plans, and biological monitoring and nutrient management strategies for the basin.

Development and implementation of a three-year sampling program for parasites and pathogens as a result of multi-agency negotiations led by The White House Council on Environmental Quality (CEQ) was a significant IRRB undertaking during the reporting period. The objective of the sampling program, which was initiated in September 2006, is to determine the presence and prevalence of fish parasites and pathogens in resident fish from Devils Lake, the Sheyenne River, Red River, and Lake Winnipeg, and to address the risks associated with transfer of such biota from the Devils Lake outlet to aquatic ecosystems downstream. A further objective is to use the comprehensive fish survey data to support the overall framework for biological monitoring in the Red River basin as identified in the IRRB work plan (refer to Appendix E – IRRB Multi-Year Work Plan: 2008-2012).

The IRRB has now completed the final year of sampling (2008) of its three-year survey. Results from the 2007 data analysis are consistent with findings in 2006 and include:

- Fish from all sites in Canada and USA did not show clinical signs of disease from bacteria.
- No indication of clinical disease resulting from bacterial or viral agents in any fish species in the US. Several walleyes from Canada showed signs of a common type of cancer and one walleye showed signs of an iridovirus (2006).
- A foreign and invasive parasite, called the Asian tapeworm, has colonized the Red River delta and Lake Winnipeg from an unknown source. This parasite has not been detected in the U.S. but was found in samples collected in the Red River at Emerson, MB in 2007.
- *Gyrodactylus hoffmani,* a parasite of concern was detected on fathead minnows from Devils Lake, Lake Traverse and Lake Winnipeg sampling sites in 2007.

- In 2007, there were 5 parasites at Devils Lake not previously observed in surveys from 2005 - 2006. However, **t**hese five parasites are common and have been found in the Red River basin previously with the exception of one species (*Onchocleidus chrysops)* but this species is common in North America and has been reported from Ontario, Canada.

Analysis of samples collected in the spring of 2008 is ongoing and will be completed in 2009. A final report on the results of the three year monitoring program will be completed in 2009. A risk analysis will be completed in 2009 using results obtained from the three year monitoring program.

1.03 International Red River Board Five-Year Draft Work Plan (2008-2012)

A draft five-year work plan was circulated to Board and Committee members and reviewed at the July 2008 Board meeting in Grand Forks (see Appendix E). The work plan is expected to be formalized at the January 2009 Board meeting in Winnipeg, Manitoba. Priorities include:

Report Water Quality Objectives,
Parasite/Pathogen Sampling Program,
Comprehensive Flood Mitigation Strategy,
Water Quantity Apportionment,
Lower Pembina Flooding,
Enhanced Bio Assessment,
Nutrient Objectives, and
IWI funded Projects.

Blank Page

2.0 INTRODUCTION

In April 2000, the International Joint Commission (IJC) formally merged its International Red River Pollution Board and International Souris-Red Rivers Engineering Board 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 toward 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. The directive is included in Appendix A.

In April 2003, the IJC requested further discussion with the IRRB on how to achieve a more ecosystemic approach and a capacity to respond to the range of environmental and water-related challenges of the 21st century. In April 2004, the IJC adopted guiding principles aimed at broadening the partnership efforts of its international boards with other watershed entities for a more inclusive approach. The IJC refers to this effort as the International Watersheds Initiative. The various water management organizations in the Red River Basin appear receptive to the Initiative while at the same time recognizing the independent, impartial and objective role of the IJC and its boards in providing advice to governments. In June 2005, the IJC recommended that the governments of Canada and the United States confirm their support for the Initiative. The Red River basin is one of three pilot watersheds recommended by the IJC for implementation of the Initiative and for funding support.

In brief, 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. The Red River Basin is illustrated in Figure 1.

This report is the ninth IRRB annual progress report to the IJC.

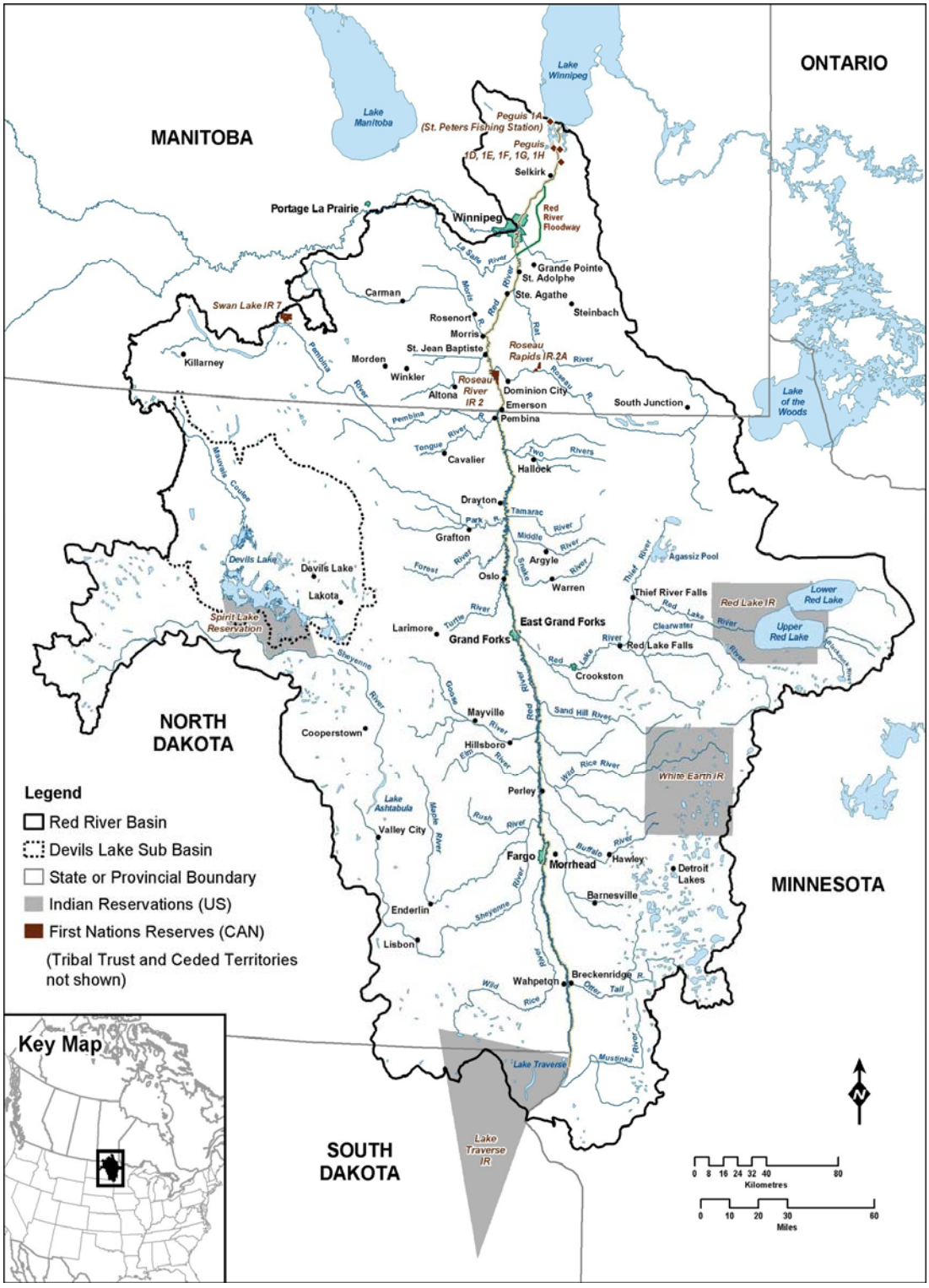


Figure 1. Red River and its Tributaries

3.0 INTERNATIONAL RED RIVER BOARD MEMBERSHIP

In its 1997 report *The IJC and the 21st Century*, the IJC proposed comprehensive international watershed boards as an improved mechanism for avoiding and resolving transboundary disputes. The intent was to broaden the scope of information upon which decisions relating to water and air are being made.

Through the continued integration of its water quality and water quantity responsibilities, and through efforts to increase stakeholder involvement, many of the goals of a comprehensive watersheds approach are being achieved by the International Red River Board. To facilitate these objectives, Board membership has been expanded to include non-government participation.

In 2008, Wayne Dybvig was replaced by Mike Renouf, Environment Canada as Canadian Co-Chair and Robert Bezek replaced Don Buckhout, Minnesota Department of Natural Resources as Member. At present there is a full complement of nine members each on the United States side and the Canada side appointed to the Board.

United States

Michael Ryan – U.S. Chair
Regional Director, Great Plains Region
U.S. Bureau of Reclamation

Col. Jonathon Christenson
District Engineer, St. Paul District
U.S. Army Corps of Engineers

Will Haapala
Detroit Lakes Office
Minnesota Pollution Control Agency

Dennis Fewless
Director, Division of Water Quality
North Dakota Department of Health

Randy Gjestvang
Red River Water Resources Engineer
North Dakota State Water Commission

Bert Garcia
Director of Ecosystems Protection Remediation
U. S. Environmental Protection Agency, Region 8

Daniel Wilkens
Administrator
Sand Hill River Watershed District, Minnesota
(Red River Basin Commission)

Gregg Wiche
Director, North Dakota
U.S. Geological Survey, Water Science Center

Robert Bezek
Regional Hydrologist
Minnesota Department of Natural Resources, Waters

Stefanie Jordan - U.S. Secretary
U.S. Bureau of Reclamation

Canada

Mike Renouf – Canadian Chair
Executive Director, Transboundary Waters Unit
Environment Canada

Dwight Williamson
Director, Water Science & Management Branch
Manitoba Water Stewardship

Steven Topping
Executive Director, Infrastructure & Operations
Manitoba Water Stewardship

Phil Adkins
A/Director, Ag Water Directorate
Agriculture & Agri-Food Canada

Dr. L. Gordon Goldsborough
Delta Marsh Field Station and Department of Botany
University of Manitoba

Herm Martens
Red River Basin Commission

Dr. Kevin Cash
Director, Water Science & Technology Directorate
Environment Canada

Dr. Joseph O'Connor
Director, Fisheries Branch
Manitoba Water Stewardship

Dr. Susan Cosens
Manager, Environmental Science Division
Fisheries & Oceans Canada

Girma Sahlu - Canadian Secretary
Environment Canada

4.0 INTERNATIONAL RED RIVER BOARD ACTIVITIES

During the reporting period October 01, 2007 - September 30, 2008, the International Red River Board met with the IJC at the fall and spring semi-annual meetings at which Board priorities, activities and funding requirements were discussed. The Commissioners were apprised of basin developments and their potential transboundary implications.

4.01 Interim and Annual Board Meetings

The IRRB held its third bi-annual meeting January 23-24, 2008 to address select issues in the basin, and the fourth bi-annual meeting July 17-18, 2008 for a more complete review of its responsibilities, activities, and accomplishments. The meetings addressed water quality monitoring and compliance with IJC objectives and established alert levels, and IRRB work plan priorities. The latter included actions to develop and implement water quantity apportionment procedures, prioritized flood mitigation plans, and biological monitoring and nutrient management strategies for the basin.

Except for half-day executive sessions during the January and July bi-annual meeting, both meetings were 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. In addition to invited presentations from interested groups, the public audience was invited to share its views on basin issues.

4.02 IJC International Watersheds Initiative

In 2004, the IJC adopted guiding principles aimed at broadening the partnership efforts of its international boards with other watershed entities for a more inclusive approach. The IJC refers to this effort as the 'International Watersheds Initiative'. The aim of the Initiative is to enhance the capabilities of existing IJC international boards while at the same time, strengthening cooperation among the various local entities. Building this capability includes[1]:

- employing a broader, systemic perspective of the watershed;
- expanding outreach and cooperation among organizations with local water-related interests and responsibilities;
- promoting the development of a common vision for the watershed;
- developing a better hydrologic understanding of the water-related resources; and
- creating the conditions for the resolution of specific watershed-related issues.

---

[1] *A Discussion Paper on the International Watersheds Initiative: Second report to the governments of Canada and the United States under the Reference of November 19, 1998 with respect to International Watershed Boards, June 2005.*

4.03 Improving the Information Base to Address Transboundary Issues

The IRRB monitors water quality at the international boundary; maintains awareness of development activities basin-wide; provides a forum for the identification and resolution of water-related transboundary issues; recommends strategies for water quality, water quantity, and ecosystem health objectives, and; monitors flood preparedness and mitigation activities.

To effectively address this mandate a focused effort through the application of best available science and knowledge of the hydrology and aquatic ecosystems of the basin is required. Hence, in 2001 the Board established two committees, a Committee on Hydrology (COH) and Aquatic Ecosystem Committee (AEC) under which access to expertise could be consolidated with the capacity to undertake specific investigations and tasks. Specific activities assigned to the Committees include establishing natural flow and water usage databases, evaluating current water quality monitoring and reporting protocols, developing biological monitoring strategies, and developing recommendations on an inter-jurisdictional drainage policy for the basin. These efforts are characterized by strengthened coordination with key water-oriented organizations in the watershed, and improved partnerships to develop a knowledge base and a shared understanding of water issues. Most frequently, the interests, objectives, and activities of the Committees intersect. Cross-membership also contributes to an integration of effort.

The Committee on Hydrology (COH) was re-established in 2006-2007 with a broader agency representation and new members.

4.03-1 Water Quality Monitoring at the International Boundary and Red River Basin

During the reporting period, Environment Canada continued to provide water quality monitoring at the international boundary, and provided reports on the status of compliance with established [IJC] water quality objectives. This was augmented with reports on the presence of pesticides, herbicides and other chemical constituents for which alert levels had been established (see reports summarized in Chapter 5).

IRRB Member agencies also reported on the status of water quality surveillance and water pollution control in their respective portions of the basin. The scope of this work and its significant contribution to the information base is described in Chapters 6 and 7.

4.03-2 Water Quality and Ecosystem Health

In 2003, the AEC prepared a conceptual framework to monitor the long-term aquatic ecosystem health of the watershed and an action plan outlining specific activities and resource requirements. The framework and action plan were endorsed by the Board and form the basis of the IRRB work plan. The overarching aquatic ecosystem health goal for the watershed, as articulated by the AEC is to “assure that water resources of the Red River of the North basin support and maintain a balanced community of organisms with species composition, diversity and functional organization comparable to the natural habitats within the basin without regard to political boundaries”. No new work was undertaken in this area since the last report.

<u>Devils Lake Outlet Enhanced Monitoring</u>

In early 2005, the North Dakota Devils Lake state outlet was completed and operation of the outlet was imminent. Operation of the outlet connects a closed basin in North Dakota, which is also part of the Hudson Bay drainage system, with the additional potential of transferring fish parasites and pathogens into the Hudson Bay watershed to the detriment of fish populations, especially to commercial and sport fish populations in the Red River and in Lake Winnipeg.

Given the transboundary implications of outlet operations and concerns to Manitoba and Canada regarding potential transfer of foreign organisms, multi-lateral negotiations were launched involving diplomatic levels, federal, state and provincial authorities, and The White House Council on

Environmental Quality (CEQ). The negotiations resulted in the installation of a temporary gravel filter at the outlet to act as a barrier against the transfer of fish and some plants into the Red River system. Following pump testing, operation of the outlet began on August 15, 2005 and continued intermittently for about 10 days. Operation was halted when permitted sulphate levels in the Sheyenne River were reached. Given the dilution capacity of the Red River and small volume of diverted water, the increase in sulphate levels is not considered to have caused harm to Canadian waterways or to violate IJC water quality objectives at the international boundary.

In summary, the objectives of the sampling program are to: determine the presence and prevalence of fish parasites and pathogens in resident fish from Devils Lake, the Sheyenne River, Red River, and Lake Winnipeg, and; to address the risks associated with transfer of such parasites and pathogens from the Devils Lake outlet to aquatic ecosystems downstream. A further objective is to use the comprehensive fish survey data to support the overall framework for biological monitoring in the Red River basin as identified in the IRRB work plan.

The three-year program comprising 7 sampling sites and 13 target fish species was initiated in September 2006. A report on the 2006 data collection was to provide the basis for any necessary refinement of the program for the following 2 years. Further, the results of the 3-year sampling program would be used to establish a focused long-term monitoring program for fish parasites and pathogens in the Red River basin, including select tributaries to the Red River and Lake Winnipeg.

The project plan assigns technical and financial responsibility to Canada for the collection and analysis of the biological data in the Canadian portion of the basin, and to the United States for like work carried out in the United States. Consistent methods, as confirmed in a workshop of experts in August 2006, are being applied to both streams of work. The project is being coordinated and managed by the Canadian and United States Co-Chairs of the AEC, with implementation and technical management of the project assigned to Fisheries & Oceans Canada and US Fish & Wildlife Service. The project design allows for peer review of the interpretive reports.

The results from the 2006 and 2007 Pathogen Survey of Devils Lake, the Red and Sheyenne Rivers indicate statistical confidence on six species from Devils Lake. There was no detection of viral agents, which was very significant. Some of the bacterial findings were not unusual for this type of aquatic environment; and the results were repeatable from previous years. In summary:

- No new or unusual findings from the 2006 and 2007 results for Devils Lake - including parasites,
- No indication of clinical disease resulting from bacterial or viral agents in any fish species,
- AEC plans to develop proposal and budget for 2009 activities,
- Secure funding for 2009 activities in October 2008,
- Complete lab work on 2007 and 2008 samples,
- Complete final report on results of 2006-2008 monitoring, and
- Complete risk assessment in 2009.

AEC has been approved for funding from the IJC in 2008 to finalize its Devils Lake Fish Pathogens and Parasites Survey.

4.03-3 International Water Quality Objectives for Nutrients

In 2004, the AEC met to consider the Manitoba proposal to the IRRB that water quality objectives for nitrogen and phosphorus be established for the Red River at the international boundary. The Manitoba proposal reflects concerns about the continued eutrophication of Lake Winnipeg. One of the key AEC recommendations presented to the IRRB was the need for a joint effort on the part of the U.S. and Canada to protect and restore Lake Winnipeg's trophic status. Lake Winnipeg is the main ecological end point in the Red River system, and an integrated analysis of the conditions in the watershed is required to identify the numerous factors that are contributing to the trophic status of the lake.

The AEC recommended a two-step approach: assembly of nutrient water quality data for the Red River mainstem and tributaries in the U.S. and Canada and Lake Winnipeg, and; analysis and interpretation of the data for use in developing recommendations on nutrient objectives for sites in the basin.

The objective of Step 1 is to obtain and assemble nutrient data, including turbidity, phosphorus, nitrogen, dissolved organic carbon, and particulate carbon, for the period of record from federal, provincial and state agencies. This assembly would include corresponding flow data and identification of gaps.

With [U.S.] IJC funding, the Red River Basin Commission undertook assembly of the relevant data.

The objective of the Step 2 analysis is to provide: an evaluation of the statistical validity of the data; interpretation of the nutrient dynamics in the basin; identification of point and non-point sources and long-term trends, and; recommendations on approaches that could be used to develop nutrient objectives (including parameters) at sites in the basin, from nutrient source to Lake Winnipeg. With [U.S.] IJC funding the International Water Institute (IWI) has undertaken this work, with oversight and guidance provided by the AEC and IJC as needed.

The Board had requested AEC to develop nutrient objectives for the Red River at the International Boundary. Subsequently, the AEC prepared a proposal to establish nutrient objectives at the International Boundary and has identified the following technical aspects:

- The trophic status of Lake Winnipeg is changing and this is a long-term trend,
- What factors are contributing to trophic change?
- How would setting standards at the border affect the trophic status in Lake Winnipeg?
- Lake Winnipeg is the main ecological end point. It is probable that nutrient reduction in the Red River will have little impact on the river but could benefit Lake Winnipeg,
- As part of nutrient objective development, long term effects and the trophic response of Lake Winnipeg should be assessed by long term monitoring,
- Recommendations on nutrient reductions will have land and water management implications requiring new resources,
- Given the IJC process for establishing objectives, numbers tied to objectives must have meaning. Once established it will be difficult to change objectives, and
- Objectives have been useful as a starting point for water quality discussions. Alert levels are used to address specific water quality parameters.

In addition, AEC identified the following scientific information needed to establish numerical objectives for nutrients at the International Border:

a) Modeling Lake Winnipeg is a key exercise,
b) Modeling will be used to identify chemical and biological indicators of health/productivity,
c) A suite of indicators will be used in long term monitoring to assess trophic status and changes in Lake Winnipeg, and
d) Lake Winnipeg research workshop will identify research needs for the lake and the drainage basin.

AEC Interim Recommendations:

a) Participating jurisdictions and water management agencies work toward reducing nutrient loading into Lake Winnipeg over the next five years by 10%, as an interim goal,
b) Lake Winnipeg is the goal/ecological end point,
c) AEC will develop strategies to meet the interim goal and strategies to replace the interim goal with a science based goal/targets. Report to IRRB at July 2008 meeting, and
d) AEC will identify short term and long term research needs with recommendations to the IRRB.

AEC identified the following key concepts (goals/objectives) related to monitoring:

a) Water quality stations should be similar to flow stations. Need a backbone of stations to provide daily water quality concentrations and flow data,
b) Standard methods and standard list of core parameters for the basin,
c) Compare methods and calibrate via comparative sampling,
d) Monitor good sites as well as hot spots,
e) Monitoring may be needed for long term and short term purposes,
f) May be monitoring to address future questions, and
g) Need agency wide effort to develop consistency.

AEC Recommendation

Objectives development for nutrients at the international boundary be delayed until Manitoba identifies the target trophic status for Lake Winnipeg and numerical nutrient objectives for Lake Winnipeg.

4.03-4 Water Quantity Apportionment

As indicated by the historic streamflow records, water supply in the Red River basin is highly variable seasonally, annually, and over longer time periods. Recent forecasts of water demand based on population and economic growth projections further test the adequacy and reliability of these supplies. Scientific opinion with respect to climate change provides added caution regarding future hydrologic trends and the prospect of greater instability in water supply in the region.

The factors noted above and projected increases in water use causing larger departures from the natural regime to occur, prompt action to set flow targets at the international boundary. The IRRB considers it prudent to consider establishment of such targets before they are needed. In July 2006, the Committee on Hydrology (COH) was asked to prepare a detailed proposal to establish the 'processes for undertaking development and implementation of apportionment procedures. The proposal is to identify the project elements, participating agencies, related capacity issues, and timelines.

The COH presented a proposed framework on the development and implementation of flow apportionment on the Red River at the January 2008 meeting. The Committee noted the establishment of a process for the development and implementation of water quantity apportionment requires an understanding of the natural flow regime on the Red River. Any acceptance of an apportionment procedure will require agreement on the method of computing the natural flow in the Red River basin and understanding water uses in the Basin. The proposed framework plan developed is multi-year and will require involvement of many partners. The identified framework plan with associated costs and resources is shown in Table 1.

Table 1. Committee On Hydrology Apportionment Framework Plan

Task	Description	Time (Weeks)	Estimated Cost
1	**Documentation of Background Information** • Description of hydrologic and climatologic basin conditions including historic low flows, median flows, and Q90 flows. • Current water use and allocations**.**	4	16,000
2	**Document Significant Red River Basin Apportionment Issues** • Availability of water control infrastructure to deliver apportionment flows. • Environmental Flow Requirements • Each jurisdiction operates within its own laws and regulations. • Increased occurrence of climatological extremes than already	4	16,000
4	**Research of Relevant Apportionment Procedures**	4	16,000
6	**Natural Flow Determination.** USGS naturalized monthly streamflow for the period 1931-2001 is available. Determine its adequacy for characterization of the natural flow regime. • Is a monthly computational period appropriate, or is a more frequent computation period required? • Determine the frequency of natural flow updating.	25	100,000
7	**Aquatic Ecosystem Needs Identified**		
8	**Evaluation Tool Selection** • Determination of appropriate time step. • Develop selection criteria. • Water model identification and evaluation.	8	32,0000
9	**Develop Procedures for Implementation of Apportionment** • Who or what agency will be responsible for natural flow computations? • Who or what agency will be responsible for maintaining the natural flow database and disseminating data? • How and to whom will computations be reported?	Undefineable	
	TOTAL		$300,000+

As part of the COH's work on the development and implementation of a flow apportionment procedure for the Red River, an IWI proposal for a literature review of applicable apportionment procedures to the Red River Basin was developed and submitted. The research will explore other agreements for sharing of multi-jurisdictional waters, like water pacts among states in the U.S., European countries, and the Prairie Provinces in Canada, to gain some insights for setting apportionment. The review could include but not be limited to:

- A summary of the background and need for the agreements.
- A review of water apportionment models used in other jurisdictions, and identification of potential issues and stumbling blocks in their implementation,
- A report on procedures used in other jurisdictions.
- An investigation of the impacts of apportionment requirements on water management practices in the basin.
- An Evaluation of applicability to Red River basin.
- Suggestions regarding computation methods/procedures for use in the Red River Basin

4.04 Comprehensive Flood Mitigation Strategy

In its report *Living with the Red*, the IJC noted that there is no single solution to reduce, mitigate and prevent harm from future flooding, and that comprehensive, integrated, binational approaches must be pursued and implemented. The report follows with a list of recommendations to include, " Governments immediately take steps, on a binational basis, to begin development of a comprehensive flood damage reduction plan for the Red River basin".

In 2003, at the request of the IJC, the IRRB completed a basin-wide survey and analysis of actions taken by governments at all levels in implementing the recommendations contained in *Living with the Red*. The final survey report titled *Flood Preparedness and Mitigation in the Red River Basin - October 2003*, indicated that while considerable progress had been made in increasing preparedness for major floods and in mitigating potential harm from future floods, there was a need for continued and concerted effort to address those IJC recommendations entailing multiple objectives and inter-jurisdictional cooperation. Further to this report, the IRRB indicated that a comprehensive flood mitigation plan as proposed by the IJC in January 2003 would provide an appropriate mechanism to mobilize the multi-jurisdictional co-operation necessary to assure cohesion on flood management and long-term resiliency in the basin.

In 2005 the document titled *Comprehensive Flood Mitigation Plan* (CFMP) was prepared by the IJC in consultation with the Red River Basin Commission (RRBC) and the IRRB, and advice regarding preferred options for advancing the document to the political level was sought from senior officials in the three jurisdictions (North Dakota, Minnesota, and Manitoba). The proposed CFMP is intended to build on the Memorandum of Understanding for Flood and Drought Mitigation on the Red River that was signed by the governors of North Dakota, Minnesota and South Dakota and the Premier of Manitoba in April 2004. Further, the Plan recognizes current efforts led by the RRBC to develop a Natural Resources Framework Plan (NRFP). The CFMP would contribute to and become an integral part of the NRFP.

Support for the CFMP was discussed further at the IRRB annual meeting in July 2006. It was concluded that while members do not all have the same interpretation of the priorities for flood mitigation in the basin or on follow-up approach, the components under a CFMP, or Flood Mitigation Strategy as the suggested name-change, need to be determined. Integral to this task is a [current] documentation of the

accomplishments and the positive benefits that have accrued to the basin and communities. The latter represents an important communications document reflecting the actions and achievement of many agencies, including the IJC and IRRB. This undertaking would also provide insight into how the IRRB and others might support or influence continued preparedness and mitigation activities in the basin.

As agreed at the 2006 annual meeting, the IRRB Co-Chairs prepared a Terms-of-Reference for the Committee on Hydrology Committee (COH) to develop a detailed project proposal that outlines the scope of work required to document the flood mitigation accomplishments to date and to identify the remaining mitigation priorities for the basin. The individual and collective capacity of participating agencies, and options to engage Committee members, IRRB members, and/or independent consultants, to complete the task is to be explored.

The IRRB Co-Chairs reviewed the March 2007 letter they had sent to the COH regarding the IRRB's role in identifying priority flood mitigation activities for the basin. In their letter, the Co-Chairs asked the COH to continue providing a current inventory of improvements and deficiencies based on agency knowledge. The same letter was also discussed with the IJC Commissioners at the April 2007 meeting. Based on the discussion, the Commissioners clarified their position on the Comprehensive Flood Mitigation Strategy (CFMS), previously known as the Comprehensive Flood Mitigation Plan (CFMP), and it was agreed that the IRRB should continue with the development of the CFMS as per the terms of reference provided to the COH. The Co-Chairs have indicated that based on the discussion with the IJC, they would amend their direction to the COH.

Since the 1997 Red River Flood there has been a legacy of accomplishments in the areas of cooperation between jurisdictions, improvements in predictive tools, public involvement and changes in legislation and development of data dissemination tools. However, there are still challenges in improving the predicative tools, maintaining and improving databases, data collection and data dissemination, maintaining flood protection infrastructure and continued review of flood protection policy and legislation. The Board provided an overview of the accomplishments and future challenges at the Fourth International Flood Symposium on Flood Defense held in Toronto from May 6-8, 2008. The plenary session was entitled, "Red River Flood of the Century – 10 Years Later". The Hydrology Committee co-chairs were involved in the organization of the session. The session was well received.

Based on these accomplishments and challenges the Board felt it was time to update the IJC report "Living with the Red". The COH was instructed to develop a project proposal under the IWI initiative for the publication of a document entitled "How Are We Living with The Red". In 2008, the IJC approved funding for this project and the COH will carry out the work. The intent of the document is to inform the public of accomplishments and challenges regarding flood mitigation in the basin and to supplement IRRB information available via the IJC International Red River web page.

4.05 Lower Pembina River Flooding

In 2003, the Pembina River Basin Advisory Board (PRBAB) formally requested the assistance of the IRRB to resolve the long-standing flooding/drainage issue along lower Pembina River and the international boundary (Figure 2). In response to this request, and with funding support from the IJC and Environment Canada, the IRRB assembled a three-person Study Team comprising an independent team chairperson and one IRRB member from North Dakota and one IRRB member from Manitoba to work with the Advisory Board. The Team was tasked with providing a situation analysis and to recommend actions that would lead to resolution of the problem.

Discussion at the July 2006 IRRB meeting culminated with agreement that the IRRB would continue to gather technical information that could contribute to a cooperative transboundary solution to the drainage/flooding issues in the lower Pembina basin. In the context of this agreement, Members were informed that Agriculture & Agri-Food Canada would provide technical and financial support to undertake LiDAR mapping of the lower basin. The mapping was planned for fall 2006.

Subsequently, the Committee on Hydrology was tasked by the Board with a project to investigate measures to alleviate flooding problems in the lower Pembina River Basin. The purpose of the project was to develop a detailed hydraulic model to improve the analysis of flow characteristics for existing and natural conditions on the lower portion of the Pembina River. The model should have enough detail to assist in the design of a floodway, or other flood damage reduction structure. Recent ongoing studies include:

- Hydrodynamic Modeling of the Lower Pembina River, 2000, by Water Management Consultants for IJC, utilizing the MIKE 11 Model,
- HEC-RAS Unsteady Flow Model, by North Dakota State Water Commission,
- Modeling of Choke Points on the Red River by Water Management Consultants for IJC,
- Culvert Inventory, by Houston Engineering, for IJC,
- LiDAR was obtained by Agriculture & Agri-Food Canada (PFRA) in the fall of 2006. The area covers the Red River and extends west to just beyond Walhalla. The northern limit was short distance north of the U.S.-Canadian border and extended south beyond Pembina County Road #55. The data has been reviewed and found to be of good quality.

As part of its Lower Pembina activities, and to help better understand flooding issues in the Lower Pembina, the Lower Pembina Task Team organized a two-day field tour of the basin on both sides of the International Border on July 15-16, 2008 just before the Board meeting in Grand Forks. IJC personnel, Board members, RRBC, participants, and members from the Lower Pembina River Advisory Board (PRBAB) participated in the field tour. The PRBAB provided the tour guides and RRBC provided ground transportation. IRRB acknowledges and appreciates PRBAB and RRBC for their contribution to the tour.

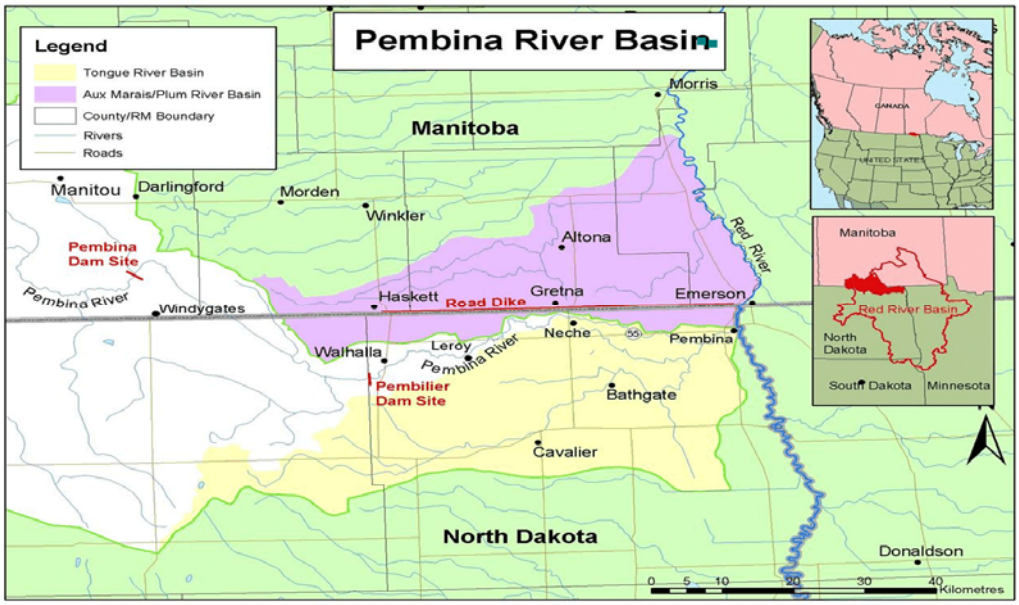


Figure 2. Pembina River Basin. The yellow and white areas comprise the Pembina River Basin.

4.06 Poplar River Basin

The Poplar River forms an international river basin shared by Saskatchewan and Montana. Although not geographically located within 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 in consideration of the thermal power station and cooling reservoir that were being constructed by the Saskatchewan Power Corporation near Coronach, Saskatchewan. In 1976, the ISRREB recommended an apportionment formula to the IJC for the East Poplar River. Subsequently, in 1978, the IJC recommended an apportionment formula to the governments of Canada and the United States. Environment Canada and the United States Geological Survey (USGS) have been collecting monthly water quality samples for nutrients, major ions and metals since July 1975. However, in 1977, the governments of Canada and the United States referred the issue of water quality to the IJC. The IJC Water Quality Task Force completed its report in 1981, which provided the basis for establishing flow-weighted objectives for numerous water quality parameters, including total dissolved solids (TDS) and boron. The International Air Pollution Advisory Board provided advice to the IJC regarding air pollution potential from the generating station.

The Coronach Power Station began operation in 1981. Although Canada and Saskatchewan have not accepted the IJC apportionment formula and water quality objectives, both the formula and objectives have been followed by Saskatchewan throughout the intervening years.

Bilateral Monitoring Committee

The Poplar River Bilateral Monitoring Committee was established in 1980, and is composed of government representatives from Canada and the United States, Montana, and Saskatchewan, as well as one public ex-officio member from Canada and one from the United States. The Committee's main responsibility is to oversee monitoring programs designed to evaluate the potential for transboundary impacts from the generating station and its operations. The Committee's current mandate expires in 2012.

Under the Committee's purview, surface and ground water quality and quantity data, and air quality data are collected at or near the international boundary. These monitoring programs initially included a quarterly data exchange and an annual data review and report. In September 1991, the Committee agreed that the data exchange was no longer required and that an annual data review and report would suffice.

Compliance with Apportionment and Water Quality Objectives

The water quality report for boron and TDS for 2007 was derived from the daily specific conductance data collected on the East Poplar River at the international boundary supplemented by the four monthly boron and TDS samples collected by the USGS. No exceedences of the water quality objectives were observed for the 2007 monitoring year.

Based on IJC recommendations, the United States was entitled to an on-demand release of 617 dam^3 (500 acre-feet) from Cookson Reservoir in 2007. A volume of 471 dam^3 (382 acre-feet) was delivered between May 1 and May 31, 2007. Further, in 2007, daily flows met or exceeded the minimum recommended by the IJC except on numerous occasions, daily flows were below the recommended minimum due to temporary damming of the stream by upstream beaver activity.

5.0 WATER QUALITY AT THE INTERNATIONAL BOUNDARY

The water quality of the Red River at the international boundary, as reported herein, is based on continuous monitoring and instantaneous grab samples obtained during the 2007 water year (October 1, 2006 - September 30, 2007). The collected data, carefully scrutinized, are used to determine compliance with established IJC water quality objectives at the international boundary and in meeting the provisions of the Boundary Waters Treaty of 1909. Detection of exceedences of the objectives serves as a trigger 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 are discussed below along with streamflow and *pH* characteristics for a corresponding time period.

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

***pH* and Temperature**

During the reporting period, the observed pH and temperature values for the Red River remained within the normal range.

5.01 Water Quality Objectives

As described in Appendix B, 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

Dissolved oxygen generally remained well above the objective level (5.0 mg/L).

Total Dissolved Solids and Specific Conductance

Some exceedences of the International Joint Commission (IJC) water quality objectives, and concentrations approaching the objective level for Total Dissolved Solids (TDS) were observed at the international boundary during the 2007 water year. June and July 2007 were the only months where, the *total dissolved solids* objective (500 mg/L) was not exceeded. The highest observed value of 691.0 mg/L occurred in January 2007. The trend for 2007/2008 appears to be similar to 2006/2007.

Chloride

The *chloride* objective (100 mg/L) was exceeded once during the reporting period. Other monthly values range from a high of 99.4 mg/L in November 2006 to a low of 10.4 mg/L in June 2007.

Sulphate

Similarly, the *sulphate* objective (250 mg/L) was not exceeded in any month with values ranging from a low of 82.6 mg/L in June 2007 to a high of 233.0 mg/L in May 2007. There have been no exceedances for Sulphate so far in the 2007 water year.

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. During the 2007 water year, observed *fecal coliform* bacteria were well below the IJC objective of 200 colonies/100 ml with values ranging from 6 colonies/100 ml in July 2007 to 38 colonies/100 ml in October 2006. The Bacteriological results for the 2007 water year range form less than 2 to 44 per 100 ml.

Although some exceedences of the IJC water quality objectives, and concentrations approaching the objective level for some parameters were observed, no intervention or action by the IRRB or participating agencies was required.

5.02 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, in January 1986, alert levels for the most significant water chemistry variables were developed and approved by the Pollution Board. Further, a compendium of the analytical methods used by the member agencies was prepared in 1990 and is included in Appendix B. This compendium will be reviewed and updated in the coming months by the [IRRB] Aquatic Ecosystem Committee.

Twenty four of the suites of pesticides, herbicides and metals for which alert levels were established by the former International Red River Pollution Board were detected during the reporting period (Table 2). Based on a total of 14 water samples, 12 pesticides and/or herbicides with a total aggregate of 136 exceedences (greater than detection concentration) were recorded during the October 01, 2006 - September 30, 2007 reporting period. The detection levels were below the Canadian Aquatic Guidelines. Given that the Red River basin is an agriculturally dominated region, the presence of pesticides and herbicides is expected. Cadmium and Iron exceeded the Canadian Aquatic Life Guidelines 14 out of 14 samples and 10 out of 14 samples, respectively.

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 the view to updating its assessment as new scientific information becomes available.

Table 3. Exceedences of Alert Levels, Red River at International Boundary (Emerson, Manitoba)
*DL = Detection Level NG = No Guideline Established

Exceedences of Alert Levels, Red River at International Boundary October 1, 2006 to September 30, 2007

Parameter	Units	Alert Level	Number of Samples	Number of Exceedences	Exceedence Values		Canadian Aquatic Life Guidelines
					Min	Max	
pH		6-9	38	1	9.02	9.02	6-9
Chloride	mg/L	100	38	1	108	108	NG
TDS	mg/L	500	37	24	535.5	690.8	NG
Cadmium	ug/L	Detect	14	14	0.019	0.206	0.017ug/l
Manganese Total	ug/L	50	14	14	58.9	453	NG
Iron Total	ug/L	300	14	10	471	4720	300 ug/l
2,4-D	ng/L	Detect	12	12	21.3	373	4000 ng/l
Bromoxynil	ng/L	Detect	12	4	3.05	37.9	5000 ng/l
Clopyralid	ng/L	Detect	12	12	5.02	137	NG
Dicamba	ng/L	Detect	12	8	5.75	41.9	10000 ng/l
Imazamethabenz-methyl a	ng/L	Detect	12	4	2.71	17.3	NG
Imazamethabenz-methyl b	ng/L	Detect	12	4	0.486	3.67	NG
MCPA	ng/L	Detect	12	8	1.83	209	2600 ng/l
Mecoprop	ng/L	Detect	12	6	5.96	59.7	NG
Picloram	ng/L	Detect	12	3	28.7	47.1	29000 ng/l
Aldrin	ng/L	Detect	12	2	0.26	0.55	NG
g-Benzenehexachloride	ng/L	Detect	12	4	0.27	0.73	NG
Pentachloroanisole	ng/L	Detect	12	2	0.17	0.2	NG
Atrazine	ng/L	Detect	12	12	16.2	663	1800 ng/l
Desethyl Atrazine	ng/L	Detect	12	3	64.4	190	NG
Metolachlor	ng/L	Detect	12	3	32.1	159	7800 ng/l
P,P-DDE	ng/L	Detect	12	1	0.53	0.53	NG
Alpha-Endosulfan	ng/L	Detect	12	5	0.91	8.06	20 ng/l
Beta-Endosulfan	ng/L	Detect	12	1	0.52	0.52	20 ng/l
Heptachlor Epoxide	ng/L	Detect	12	2	0.2	0.35	10 ng/l
Metribuzin	ng/L	Detect	12	1	59.5	59.5	NG
Total PCB	ng/L	Detect	12	1	0.31	0.31	NG

6.0 WATER QUALITY SURVEILLANCE PROGRAMS

As described in Chapter 5, data collected at Emerson, Manitoba, are used to determine compliance with established IJC water quality objectives at the international boundary. Chapter 6 contains basin-wide data and information contributed by IRRB member agencies to provide a more complete spatial representation of water quality and aquatic ecosystem health conditions in the Red River basin.

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

6.01 Minnesota

Minnesota Pollution Control Agency (MPCA) has two approaches to assessing water quality attainment in the Red River Basin:

Minnesota Milestone Monitoring, measures water quality at representative sites in the basin under the Clean Water Act. These sites were detailed in the 8th annual progress report.

Since 2003, the MPCA and the Red River Watershed Management Board collaborate on a comprehensive water quality monitoring program, designed to measure loading of nutrients and sediments from each

major watershed. This program is primarily designed for estimating pollutant loads, thus it is biased toward periods of high flow. Up to 20 samples were collected per year at six sites along the Red River and at 11 major Minnesota tributaries. Field measurements of (pH, dissolved oxygen, temperature, conductivity, turbidity, transparency, and stage level are collected) and water samples collected at each site for certified lab analysis of total phosphorus, ortho-phosphorus, nitrate plus nitrite nitrogen, and total suspended solids. Where possible, sample sites are located at existing U.S. Geological Survey (USGS) gauging stations. Daily average discharge from these stations was used to estimate pollutant loads. The program is working with the Minnesota Department of Natural Resources to establish flow at stations without that measure.

The six Red River sites are located at: Brushvale, Harwood, Halstad, Grand Forks, Drayton and Pembina. The tributary sites are located the mouth of the Bois De Sioux, Mustinka, Rabbit, Otter Tail, Wolverton, Buffalo, Wild Rice, Marsh, Sand Hill, Grand Marais, Red Lake, Clearwater, Thief River, Lower Red Lake Outlet, Snake River, Tamarac, Two Rivers and Roseau rivers.

Preliminary results indicate that Calendar Year 2007 was a relatively high flow year, with large amounts of suspended sediment and total phosphorus in the Red River at the sites at Brushvale, Halstad (below Fargo Moorhead) and at Pembina (Table 3 and Figures 3 & 4).

Table 4. Nutrient and Sediment Loading in the Red River Watershed

TSS Load tons

Year	2003	2004	2005	2006	2007
Brushvale	82,759	32,131	33,574	67,882	112,973
Halstad	947,370	1,430,813	601,516	715,474	355,376
Pembina	1,083,911	2,946,017	2,430,048	1,645,989	1,959,045

Total Phosphorus Load tons

Site	2003	2004	2005	2006	2007
Brushvale	127	111	344	273	454
Halstad	643	1681	1524	1545	733
Pembina	1359	4062	3100	3103	3423

Figure 3. Red River TSS Loads 2003-2007

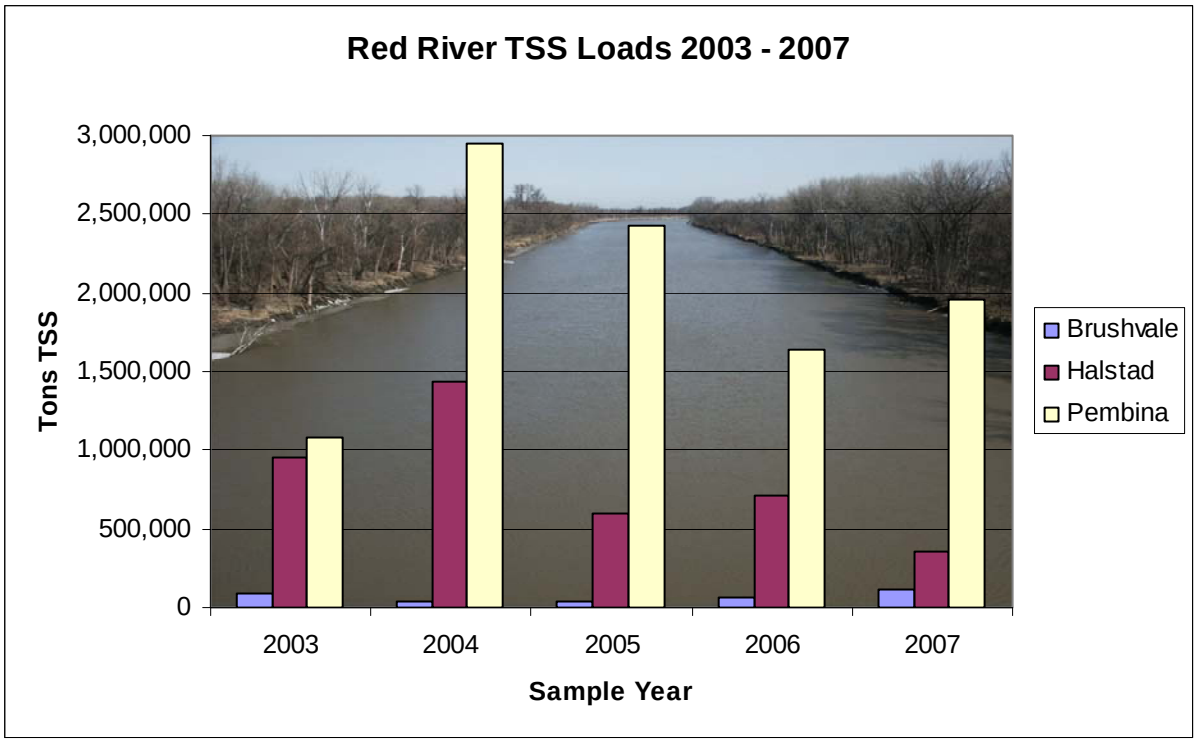
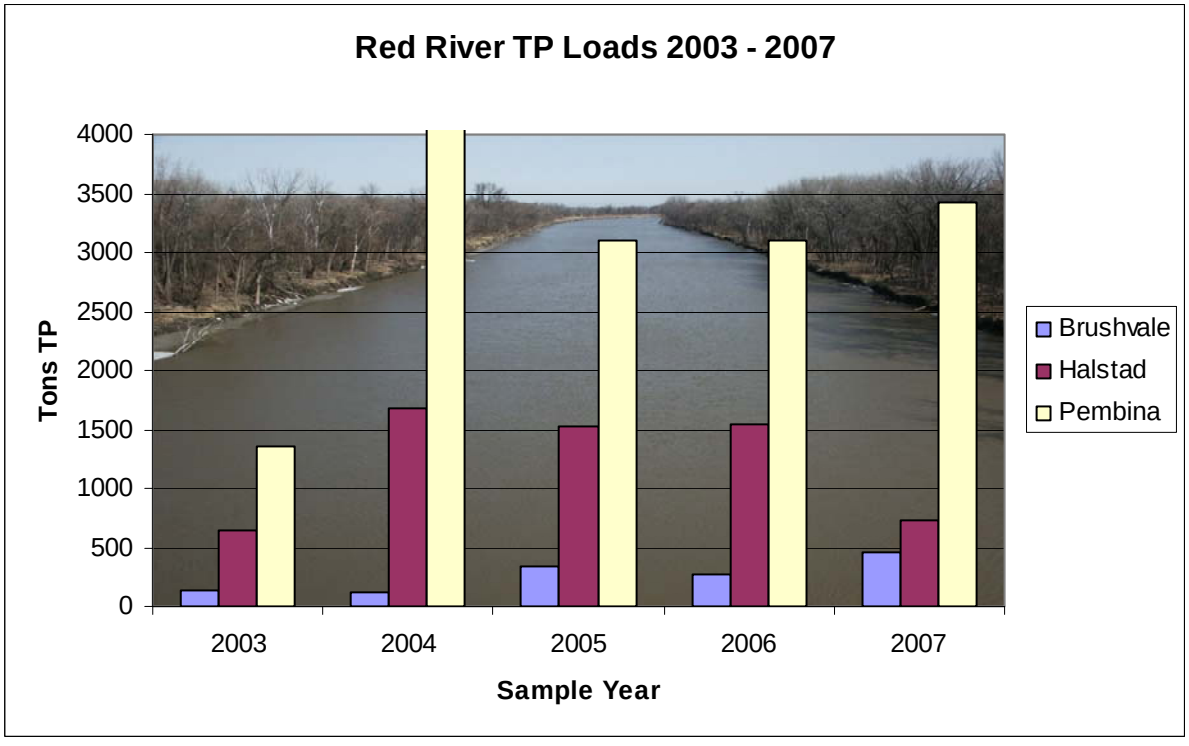


Figure 4. Red River TP Loads 2003-2007



6.02 North Dakota

Ambient Water Quality Monitoring Program

During the reporting period October 1, 2006 to September 30, 2007, the North Dakota Department of Health (department) conducted or contracted with the USGS for ambient chemical monitoring at 18 sites in the Red River basin (Table 4).

Table 5. North Dakota Department of Health Ambient Water Quality Monitoring Sites in the Red River Basin.

Station Number	Station Description
385055	Bois de Sioux near Doran, MN[1]
380083	Red River at Brushville, MN
380031	Wild Rice River near Abercrombie[1]
385414	Red River at Fargo[1,2]
385040	Red River near Harwood
380010	Sheyenne River at Warwick[1]
380009	Sheyenne River 3 mi E of 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[1,2]
380037	Turtle River at Manvel[2]
380039	Forest River at Minto[1,2]
380157	Park River at Grafton[1,2]
380158	Pembina River at Neche[1,2]
384157	Red River at Pembina[1,2]

[1]Site co-located with USGS flow gauging station.
[2] Site sampled by the USGS under cooperative agreement with the department.
Sites were sampled during the open-water period at six-week intervals beginning in April and concluding

in November. In addition, one sample was collected under ice in late January 2007. This schedule resulted in eight to nine samples collected at each site during the reporting period. Stations inaccessible due to flooding/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 and dissolved), nutrients, total suspended solids (TSS) and pathogens (Fecal coliform, E. coli and Enterococcus sp.) (Table 5). In addition, field measurements for temperature, pH, dissolved oxygen and specific conductance were taken during each site visit.

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 exported to the U.S. Environmental Protection Agency's (EPA) STOrage and RETreival (STORET) database.

Table 6. North Dakota Department of Health Water Quality Variables Analyzed.

Field Measurements	Laboratory Analysis			
	General Chemistry	**Trace Elements[1]**	**Nutrients[2]**	**Biological**
Temperature	Sodium	Aluminum	Ammonia	Fecal coliform
pH	Magnesium	Antimony	Nitrate-nitrite	E. coli
Dissolved Oxygen	Potassium	Arsenic	Total Kjeldahl Nitrogen	Enterococcus sp.
Specific Conductance	Calcium	Barium	Total Nitrogen	
	Manganese	Beryllium	Total Phosphorus	
	Iron	Boron	Organic Carbon	
	Chloride	Cadmium		
	Sulfate	Chromium		
	Carbonate	Copper		
	Bicarbonate	Lead		
	Hydroxide	Nickel		
	Alkalinity	Silver		
	Hardness	Selenium		
	Total Dissolved Solids	Thallium		
	TSS	Zinc		

[1]Department samples are analyzed for total recoverable and dissolved metals. The USGS samples are analyzed only for dissolved metals. [2]Nutrients are analyzed for both total and dissolved fractions.

Red River Basin Bioassessment Project

During the summer of 2007 the department completed sampling as part of a three year biological monitoring and assessment project for the Red River basin. The goals of this project are to: 1) assess, using biological, physical, and chemical data, the current biological condition of perennial, wadeable rivers and streams; 2) assess the current status of aquatic life use attainment of the perennial, wadeable streams of the Red River basin; 3) develop and refine indices of biological integrity for the fish and macroinvertebrate communities; and 3) investigate potential stressors to impaired aquatic life uses.

The sampling approach used for this bioassessment project is similar to that employed by the US EPA's Environmental Monitoring and Assessment Program. Through the selection and sampling of 50 randomly selected sites in the North Dakota portion of the Red River basin the Department will be able to provide unbiased estimates of biological condition across the entire Red River basin in North Dakota. The Minnesota Pollution Control Agency is conducting a similar assessment in the Minnesota portion of the basin. When completed, the results of these two projects will be combined to provide an unbiased estimate of biological condition for the entire US portion of the Red River basin.

Biological indicators used in the assessment project will be developed and refined through the selection and sampling of 20 targeted "reference" or least impacted sites and 20 targeted "trashed" sites. Each site will be sampled for fish, macroinvertebrates, water chemistry and physical habitat.

6.03 Manitoba

Ambient Water Quality monitoring Program

Water quality continues to be monitored monthly at two sites on the Red River within Manitoba by Manitoba Water Stewardship. 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 Winnipeg. Variables monitored by Winnipeg include general chemistry, plant nutrients, suspended sediment, bacteria, and chlorophyll *a*.

Routine monitoring is also conducted on five tributary streams to the Red River by Manitoba Water Stewardship. Samples are collected at minimum 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. In addition, benthic macroinvertebrates have been collected at the Red River at Emerson and Selkirk once each year.

Manitoba continues to work to achieve the targets of the Lake Winnipeg Action Plan announced on February 18, 2003. The Lake Winnipeg Action Plan is a commitment to reduce nitrogen and phosphorus loads to Lake Winnipeg to pre-1970s levels. The Lake Winnipeg Action Plan recognizes that nutrients are contributed by most activities occurring within the drainage basin and that reductions will need to occur across all sectors. Progress under the Action Plan and to reduce the nitrogen and phosphorus loads by 13 and 10 percent respectively includes:

- The work of the Lake Winnipeg Stewardship Board continues. The Board was established to help government identify further actions necessary to reduce nitrogen and phosphorous loads to

Lake Winnipeg. The Board's second report was released on February 6, 2007 by the Minister of Water Stewardship. This report contains recommendations in 38 areas that will assist to reduce nutrients to Lake Winnipeg. The province has completed or taken action on 94 per cent of the report's recommendation to address the health of Lake Winnipeg and its basins.

- In March 2008 Manitoba enacted the *Nutrient Management Regulation*. The purpose of the regulation is to protect water quality by encouraging responsible nutrient planning, regulating the application of materials containing nutrients and restricting the development of certain types of facilities in environmentally sensitive areas. The new regulation sets out restrictions on the application of nitrogen and phosphorus to all types of land in Manitoba including golf courses, municipal sludge from waste-water treatment systems, and farms. Included are buffer zones along rivers, lakes and streams where nutrients cannot be applied. The regulation also restricts the development of facilities such as sewage treatment plants and lagoons, manure storage facilities and septic fields in environmentally-sensitive areas.

- The *Nutrient Management Regulation* was amended in June 2008 to limit the phosphorus content in fertilizers used in urban and built-up areas. Effective January 1, 2009, within nutrient management zone N5 (urban and built up areas), no one shall apply a fertilizer to turf containing more than 1 per cent phosphorus by weight, expressed as P_2O_5. An exception to this restriction includes newly established turf during the year of establishment as well as the year following establishment.

- More information on the *Nutrient Management Regulation* under *The Water Protection Act* is available at http://www.gov.mb.ca/waterstewardship/wqmz/index.html.

- In addition, Manitoba implemented legislation to eliminate phosphorus from household dishwasher detergent. Bill 8 titled *The Phosphorus Reduction Act* (Water Protection Act amended) once passed, will restrict the phosphorus content in dishwashing detergents by July 1, 2010 and allow regulations to be developed to limit the phosphorus content in other cleaning products and chemical water conditioners.

- Requirements for nutrient removal at wastewater treatment facilities are in place for the City of Winnipeg and are underway for Portage la Prairie and Brandon. New wastewater treatment facilities such as those serving the food processing sector will be required to implement nutrient abatement measures. In addition, Manitoba Water Stewardship has requested that all wastewater treatment facilities in Provincial Parks be required to remove phosphorus to 1 mg/L.

- Work on integrated watershed management planning under *The Water Protection Act* also continued and included plans in two Red River tributaries: the Seine and La Salle Rivers. Integrated watershed management plans are compiled by local water planning authorities with stakeholder input and are to be implemented, monitored and updated regularly (every ten years) by these authorities. Water planning authorities are designated under *The Water Protection Act* and the development of integrated watershed management planning is guided by specifications in *The Act*. Manitoba provides financial, planning and technical assistance to the process. The integrated watershed management plans include a report on current science knowledge of the watershed environment as well as initiatives to monitor, maintain and improve environmental conditions in the watershed.

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 good and comparable to previous years. Dissolved oxygen concentrations were relatively high with an average concentration of 8.7 mg/L upstream of the City of Winnipeg and 9.4 mg/L downstream of the City of Winnipeg. The lowest value recorded of 4.2 mg/L occurred in July 2007 upstream of the City of Winnipeg.

Densities of *Escherichia coli* bacteria downstream of the City of Winnipeg were lower than the previous reporting period. Average density downstream of the City of Winnipeg was 54 organisms / 100 mL, compared to 73 organisms / 100 mL in the previous reporting period. In comparison, the average density of *Escherichia coli* bacteria in the upstream reach was 35 organisms / 100 mL, comparable to the previous years (39 organisms / 100 mL). Densities of *Escherichia coli* bacteria exceeded the Manitoba Water Quality Standards, Objectives, and Guideline for the protection of recreation of 200 organisms / 100 mL upstream of the City of Winnipeg in March and August 2007. Densities of organisms on these occasions were 220 and 240 organisms / 100 mL respectively. Meanwhile the exceedence rate of the Manitoba Water Quality Standards, Objectives, and Guidelines for the protection of recreation dropped considerably downstream of the City of Winnipeg (17 %) as compared to previous years (25 %).

During this reporting period, five pesticides out of the 50 monitored were detected upstream of the City of Winnipeg. Reduced frequency of detection of pesticides upstream of the City of Winnipeg can be attributed in part to the limited monitoring conducted during the reporting period (i.e. only three samples were obtained for pesticide analysis). Atrazine, atrazine desethyl, 2-4D, dicamba and imazamethabenz-ME were the pesticides and breakdown products detected. Maximum concentrations detected were 0.0001 mg/L, 0.00034 mg/L, 0.00006 mg/L. 0.00005 mg/L and 0.000031 mg/L for 2-4D, atrazine, atrazine desethyl, dicamba and imazamethabenz-ME, respectively.

Eight pesticides out of the 57 monitored were detected downstream of the City of Winnipeg. A total of 12 samples were analyzed for pesticides. 2-4-D, the most frequently detected pesticide at this site, was observed in five of the twelve samples (42 %) while bromoxynil was detected in four out of the twelve samples (33 %). Imazamethabenz-ME and dicamba were each detected in three of the twelve samples (25 %). MCPA was detected twice April and May 2007 (12.5 %). Atrazine, atrazine desethyl were detected in July 2007 while triclopyr was detected in November 2006.

None of the detections of 2,4-D, atrazine, dicamba, MCPA, triclopyr, imazamethabenz-ME or bromoxynil exceeded water quality guidelines for the protection of surface water used as sources of drinking water supply, habitat for aquatic life and wildlife, or livestock uses. However, all detections of dicamba, and MCPA exceeded the guidelines developed by the Canadian Council of Ministers of the Environment for protection of irrigation uses.

7.0 WATER POLLUTION CONTROL

7.01 Contingency Plan

In January 1981 a contingency plan was developed by the former International Red River Pollution Board. The purpose of the plan, which had been adopted by the IRRB, 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 wherever 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 exceedences of either water quality objectives or alert levels as described in Chapter 5 are observed at the international boundary. A current list of contacts and telephone numbers associated with the contingency plan is included in Appendix C.

The contingency plan, presently finalized, is available from the IRRB Secretariat.

7.02 Spills and Releases

Minnesota

Minnesota reported 32 spills or bypasses during water year 2007. Of these 23, were due to heavy rains in a short period of time. Cleaning or operational issues caused bypasses at an industrial facility. One municipal facility is facing enforcement action; all other issues have been resolved.

North Dakota

Most of the state received below normal precipitation while the eastern third returned to normal during this reporting period. The total number of reported spills/releases associated with excessive precipitation continued the downward trend. The North Dakota Pollutant Discharge Elimination System (NDPDES) program requires all permitted facilities, both industrial and municipal, to report spills and by-pass releases of wastewater. During this reporting period, there were 13 spills/releases reported to the department in the Red River basin. These releases were related to pipe break/mechanical failure (5) and lift station overflows/bypasses due to excessive precipitation events (8).

Manitoba

Three municipalities with populations greater than 1,000 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 have 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, 79 combined sewer outfalls, and 90 major land drainage outfalls. Most tributary streams also receive treated wastewater effluents from nearby communities.

Manitoba Water Stewardship tracks incidents that have the potential to impact water quality in Lake Winnipeg on the Department web site at www.manitoba.ca/lakewinnipeg. Five incidents that were tracked occurred in the Red River watershed and all involved discharges of domestic wastewater effluent. Of these five, two incidents occurred in tributaries of the Red River and one occurred in a tributary to the

Assiniboine River. Two incidents occurred well upstream of the Red River (Stephenfield Reservoir and Holland) given high rates of dilution and travel time, no impacts on the Red River were expected. In the case of the third incident, wastewater which spilled on the frozen surface of the La Salle River was physically removed from the site. It is unlikely that contaminated water seeped into the La Salle River and water quality impacts were expected to be negligible. Summaries of the other incidents are as follows.

On April 4, 2007, high water levels caused by ice jams in the Red River flooded sewage pumping stations in the City of Selkirk. The flooding required that all pumping stations be bypassed and that all of the City of Selkirk's wastewater flow untreated to the Red River. Untreated wastewater flowed to the Red River from April 4 until a temporary fix was put in place on April 13. Approximately 0.038 to 0.061 cubic metres of wastewater were released to the Red River per second. Flows in the Red River at Selkirk were estimated at between 1490 and 1580 cubic metres per second. Based on a sewage discharge rate of 0.061 cubic metres per second, the wastewater made up about 0.004 per cent of the flow in the Red River. Given the high rate of dilution of the wastewater in the Red River, water quality impacts were expected to be negligible. Due to safety concerns regarding fast flowing flood waters and ice, it was not possible to collect water samples during the discharge event.

On May 26, 2007, heavy rainfall overflowed the wastewater treatment system at Emerson, Manitoba causing domestic wastewater to be diverted to the Red River from the lift station and the secondary lagoon cell. Approximately 20,000 cubic metres of domestic wastewater were released to the Red River from the secondary cell while an unknown quantity of dilute wastewater was released from the lift station. Discharge from the lift station ceased on May 28 while discharge from the wastewater lagoon continued until June 4. Flows in the Red River at Emerson were 384 cubic metres per second on May 31, 2007. Based on a sewage discharge rate of 0.03 cubic metres per second, the wastewater made up about 0.006 per cent of the flow in the Red River at Emerson. Given the high rate of dilution of the wastewater with rainfall and in the Red River, water quality impacts are expected to be negligible. Water samples collected from the Red River at St. Norbert and Selkirk on June 1, 2007 were analyzed for the density of *Escherichia coli*. *Escherichia coli* densities were not elevated and were well below the recreational water quality guidelines.

7.03 Pollution Abatement and Advisories

Point sources

In Minnesota's portion of the Red River Basin, 53 permitted wastewater dischargers, either municipal or industrial facilities, received permit renewals in water year 2007.

Stormwater

Minnesota's new MS4 General Permit (MNR040000) became effective June 1, 2006.

The MPCA issued the original MS4 General Permit in June 2002. In July 2002, Minnesota Center for Environmental Advocacy (MCEA) filed an appeal of the permit. MCEA alleged several deficiencies, including: the inappropriate use of general versus individual permits, failure to address non-degradation issues, and the lack of adequate public participation and monitoring requirements.

In March 2003, over 200 owners and operators of small MS4s in urbanized areas applied for general permits, and began or expanded existing programs and practices to reduce stormwater runoff.

On May 6, 2003, the Minnesota Court of Appeals ruled that the use of general permits and best management practices was appropriate, and that the monitoring required in the permit was adequate. The court ruled that the use of general permits and best management practices was appropriate, and that the monitoring required in the permit was adequate. The court also called for the opportunity for public comment and public hearing on each permittee's proposed stormwater pollution prevention program, required the MPCA to determine if additional control measures are necessary if the permittee has new or expanded discharges, and ruled that the language of Minnesota's permit must follow federal language and require permittees to "reduce" (instead of "minimize") pollutants. The complete opinion is available on the Minnesota Court of Appeals Web site.

Revisions were made to the permit to address the courts' ruling. A draft permit was placed on a 30-day public notice comment period that began February 28, 2005. The comment period was extended until April 15, 2005. Two public information meetings on the draft permit were held during the comment period.

Numerous written comments were received during the comment period. After reviewing and considering all comments received, the MPCA made additional revisions to the draft permit to clarify permit requirements.

On February 28, 2006, the MPCA Citizens' Board denied a request for a contested case hearing and approved the revised permit. The new permit became effective June 1, 2006.

The new permit addresses the requirements of the courts' ruling and provides public notice and opportunity for hearing on each SWPPP, addresses nondegradation for all waters (permit Parts X and XI), and follows federal language to "reduce" pollutants.

MS4s have been prepared and submitted to the MPCA for the City of Detroit Lakes, the City of Moorhead, Moorhead Township, Oakport Township, the City of Dilworth and East Grand Forks.

Feedlots

Minnesota's feedlot rules state that anyone who operates a feedlot must comply with all the provisions of the regulations, whether or not they have a permit. Most feedlot owners or handlers of manure will not be required to have an operating permit. Owners with fewer than 300 animal units are not required to have a permit for the construction of a new facility or expansion of an existing facility if construction is in accordance with the technical standards. For owners with 300 animal units or more, and less than 1,000 animal units, a streamlined short-form construction permit is required for construction activities. A National Pollutant Discharge Elimination System (NPDES) permit or State Disposal System (SDS) permit is required for all feedlots with 1,000 animal units or more, or that are defined as a confined animal feeding operation (CAFO) under the federal rule.

In the current water year, Spring Prairie Colony Farm, Clay County, applied for a NPDES/SDS for multiple animal units; the permit was issued in September 2008.

North Dakota

Point Source Control Program

The North Dakota Pollutant Discharge Elimination System (NDPDES) program regulates the release of wastewater and stormwater 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 the department. The cities of Grand Forks, Fargo, and West Fargo have approved Pretreatment programs in the eastern part of the state.

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.

The Department of Health presently has 152 facilities with a NDPDES permit in the Red River basin. Of these, there are 35 industrial wastewater permits and 117 domestic/municipal wastewater permits. Most of the domestic/municipal wastewater permits are for small lagoon systems which discharge a couple times a year. Wastewater discharge data for the eleven largest permitted facilities during the reporting period October 1, 2006 to September 30, 2007 are presented in Table 6. In addition, the average BOD_5 and TSS values from permitted facilities for the years 1985 to 2007 are presented in Figure 5.

Stormwater Permits

A major portion of the NDPDES program involves permits for stormwater discharges from industrial sites, construction sites and larger municipalities. The department has issued four separate general permits for stormwater discharges. The general permits outline requirements for stormwater discharges from construction activities, industrial activities, mining operations, and municipal separate storm sewer systems (MS4's). The cities of Grand Forks, Fargo, West Fargo and their urbanized area continue to implement the MS4 permits during this reporting period.

The department remains actively involved with Phase II SW, especially issues relating small MS4s with municipalities and counties in the Red River Valley. The focus of activity with MS4s continues to be development/implementation of ordinances or other regulatory mechanisms for local construction site erosion and sediment control and post construction controls.

Animal Feeding Operations (AFOs)

The North Dakota Pollutant Discharge Elimination System (NDPDES) program regulates the animal feeding operation (livestock) program in the state. The department rules pertaining to animal feeding operations and the NDPDES program were updated and finalized January 2005 as a result of the changes to the 2003 federal CAFO rules.

The U.S. Court of Appeals for the Second Circuit vacated key portions of the CAFO rule (Waterkeeper Alliance v. EPA, 2nd Cir. 2005). In response to the court decision, EPA redrafted select portions of the rule in June 2006. These changes or amendments to the CAFO rule are to clarify which facilities must obtain permits, and if their Nutrient Management Plans are subject to public review and comment. Until the new federal rules are final and our rules are updated to incorporate any changes, the department will continue to permit animal feeding operations under its state approved permitting program.

Table 7. Waste Discharge Data for North Dakota During the Reporting Period October 1, 2006 to September 30, 2007.

Source*	Length of Discharge (days)	Total Flow (M^3)	Discharge Quality - mg/l						Average Discharge Rate (M^3/day)	Average BOD-5 Loading (kg/day)	Average TSS Loading (kg/day)	Time in Permit Compliance (Percent)
			BOD-5			TSS						
			High	Low	Ave.	High	Low	Avg.				
Drayton	13	127971	6.0	4.0	4.8	6.0	5.0	5.5	9843.9	47.3	54.1	100.0
Fargo	355	15350068	16.6	3.0	7.6	36.4	5.1	11.2	43239.6	326.5	486.0	100.0
Grafton	21	504919	7.7	2.8	5.9	70.7	5.0	18.8	24043.8	141.6	450.8	98.0
Grand Forks	112	7938281	31.0	2.8	8.6	40.6	8.0	19.0	70877.5	608.1	1344.5	100.0
Grand Forks AFB	10	242997	8.1	2.6	5.9	16.3	5.0	12.4	24299.7	142.9	300.1	100.0
Wahpeton	41	1821342	25.0	2.0	10.5	46.0	12.5	20.0	44423.0	466.4	888.5	98.0
West Fargo	86	2294089	16.0	5.8	9.6	27.9	12.5	19.0	26675.4	256.9	505.5	100.0
ACS-Drayton	91	668431	28.0	1.0	5.6	25.3	10.0	14.7	7345.4	41.1	107.8	100.0
ACS-Hillsboro	169	463663	23.0	6.0	9.3	44.4	14.4	21.7	2743.6	25.6	59.5	100.0
Minn Dak	80	1828155	61.1	9.5	25.5	44.2	9.2	25.6	22851.9	582.7	584.1	100.0
Cargill Inc	365	1421646	22.0	2.0	9.9	35.0	1.0	15.6	3894.9	38.7	60.7	100.0

* Source -- Population greater than 1,000 or population equivalent greater than 1,000.

Figure 5. Average BOD-5 day and TSS Concentrations in the North Dakota Portion of the Red River Basin (1986-2007).

All large CAFOs are inspected annually by the department. Medium and small AFOs are inspected on an as-needed basis. There are 193 AFOs permitted by the department in the Red River basin. Of these, there are 28 designated as large CAFOs (over 1000 animals). During this reporting period, the department performed 29 inspections at the large CAFOs.

Nonpoint Source Pollution Management Program

The department's Division of Water Quality is responsible for administering the Clean Water Act Section 319 Nonpoint Source Pollution Management Program (NPS Program) in North Dakota. Section 319 of the Clean Water Act and guidance provided by EPA defines the scope of the NPS Program, while the department administers the program with input from the North Dakota Nonpoint Source Pollution Task Force. The task force is comprised of representatives from state and federal natural resource agencies, commodity/producer groups, tribal councils and private wildlife/natural resource organizations.

Each year, federal funds are appropriated by the U.S. Congress to EPA for NPS pollution management. These are Section 319 funds and are then made available to individual states based on an allocation formula. In North Dakota, funds are awarded to project sponsors (e.g., soil conservation districts, water resource boards, cities, resource conservation and development councils, nonprofit organizations) to implement a variety of NPS pollution education, assessment and NPS pollution abatement projects. Approved local projects receive 60 percent federal funds with a 40 percent local match requirement.

Through the NPS Program, the department is currently cost-sharing a variety of NPS watershed assessment and NPS pollution abatement projects in the Red River basin. The following is a summary of these projects.

- The Barnes County Soil Conservation District (SCD) has recently completed a water quality assessment for Bald Hill Creek, a tributary of the Sheyenne River. The Barnes County SCD is also implementing an NPS pollution abatement project on the Sheyenne River below Baldhill Dam (Lake Ashtabula). This project is providing technical and financial assistance to install best management practices (BMPs) necessary to reduce NPS pollution and improve water quality throughout the Sheyenne River's contributing watershed in Barnes County.

- The Cass County SCD has recently completed a three-year water quality assessment project on the Maple, Lower Sheyenne and Rush Rivers in Cass County. The purpose of the assessment project was to: (1) conduct chemical and biological monitoring to assess beneficial use attainment; (2) determine causes and sources of pollution impairing beneficial uses; and (3) determine nonpoint source pollution reductions necessary to restore documented impaired uses. Based on the results of these assessment projects, the sponsors have received Section 319 funding for a watershed implementation project for the Rush River watershed.

- The Ransom County SCD is in the forth year of a watershed restoration and NPS pollution abatement project for Dead Colt Creek Dam and for the Sheyenne River in Ransom County. A Total Maximum Daily Load (TMDL), addressing nutrient and sediment loading and low dissolved oxygen, has also been developed for Dead Colt Creek Dam. Through both watershed projects, the Ransom County SCD will provide financial and technical assistance to landowners to implement BMPs required to reduce sediment and nutrient loadings and improve water quality.

- The Richland County SCD recently completed a three year water quality assessment project focusing on the lower mainstem Wild Rice River and two tributaries to the lower Wild Rice River, Antelope Creek and Elk Creek. The purpose of the assessment project is to: (1) conduct chemical and biological monitoring to assess beneficial use attainment; (2) determine causes and sources of pollution impairing beneficial uses; and (3) determine nonpoint source pollution reductions necessary to restore documented impaired uses. The project sponsors have used the results from this assessment to develop a watershed restoration project implementation plan for Antelope Creek, a tributary to the Wild Rice River.

- The Wild Rice SCD in Sargent County continues to implement its Section 319 Watershed Restoration project on the Upper Wild Rice River and its tributaries. The goal of this project is to work with landowners to provide technical and financial assistance to install BMPs necessary to reduce NPS pollution and improve water quality in the upper Wild Rice River watershed.

- The East and West Grand Forks County SCDs recently completed a two year water quality and watershed assessment project on the lower Turtle River in Grand Forks County and Larimore Dam. The purpose of the assessment project was to: (1) conduct chemical and biological monitoring to assess beneficial use attainment; (2) determine causes and sources of pollution impairing beneficial uses; and (3) determine nonpoint source pollution reductions necessary to restore documented impaired uses. The project sponsors plan to use the results of the watershed assessment project to develop a watershed restoration project implementation plan.

- The Red River Riparian Project has recently received Section 319 funding for its Phase III project aimed at stream and riparian area protection and restoration in the lower Red River basin. The project's goals are to offer financial and technical assistance for stream restoration and for the installation of riparian area BMPs. The Red River Regional Council is the lead agency for this project.

- The Pembina River Watershed Restoration Action Strategy is a multi-county and international water quality assessment project aimed toward NPS pollution identification and beneficial use assessment for the entire Pembina River, including portions in Manitoba, Canada. The Red River Regional Council sponsors the project, but implementation of the assessment project has been delegated to each SCD and WRB in Pembina, Cavalier and Towner Counties and to several soil and water conservation districts in Manitoba. Results will be included in the Pembina River Basin Plan. Based on the water quality assessment data, watersheds will be prioritized for restoration activities.

Manitoba

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. Manitoba intends to enshrine the Manitoba Water Quality Standards, Objectives, and Guidelines into legislation under *The Water Protection Act*. All treated municipal effluents discharged to

tributary streams within the Red River basin in Manitoba are licensed under Manitoba's Environment Act. Five private facilities located within the immediate proximity of the City of Winnipeg boundary are not yet licensed (out of the original 21 facilities un-licensed when the Environment Act came into effect in 1988). The five facilities will receive licenses within the next couple of years. Disinfection with ultra-violet light technology has been installed and is operational at the City of Winnipeg's South and North End Water Pollution Control Centre. In August 2004, the City of Winnipeg introduced a web-based system to inform the public whenever there is likely to be a sewer overflow into the Red or Assiniboine Rivers. Environment Act licenses were issued to the City of Winnipeg for the West End and North End Water Pollution Control Centres in 2005 and for the South End Water Pollution Control Centre in 2006.

8.0 BIOLOGICAL MONITORING IN THE RED RIVER BASIN

8.01 Fisheries of the Red River in Manitoba

Updated mercury in fish consumption guidelines were developed and distributed to the public and stakeholders through a new brochure and the Manitoba Water Stewardship web site (http://www.gov.mb.ca/waterstewardship/fisheries/education/mercury_final_nov_2007.pdf).

Biological Information

A total of 67 fish species have been recorded in the Manitoba's portion of the Red River. Presently, bigmouth buffalo (*Ictiobus cyprinellus)*, chestnut lamprey (*Ichtyomyzon unicuspis*) and silver chub (*Macrhboposis storeriana*) are designated as Special Concern under *The Species at Risk Act.* In 2005, lake sturgeon (*Acipenser fulvescens)* were recommended for listing as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). It is expected that this species will be listed under the Species at Risk Act in 2008/09. Assessments updating the status of species were initiated in 2002 with the long-term goal to develop recovery strategies with stewardship groups for fish populations at risk.

Known aquatic invasive species that have been introduced in the Manitoba portion of the Red River include the common carp (*Cyprinus carpio),* white bass (*Morone chrysops),* rainbow smelt (*Osmerus mordax)* and Asian tapeworm (*Bothriocephalus acheilognathi).* The Asian carp tapeworm has recently been introduced and was found in emerald shiners sampled by researchers in 2006 in proximity to the mouth of the Red River upon entry into Lake Winnipeg. Further studies continued in 2007 to determine the distribution of the parasite in Red River and Lake Winnipeg emerald shiners (*Notropis atherinoides*) which are the most common cyprinid in these waterbody areas. Emerald shiners can play a major role in the transmission of the parasite because they are the major food source for other fish. Other recent introductions into the Manitoba portion of the Red River include feral gold fish (*Carassius auratus),* smallmouth bass *(Micropterus dolomieu)* and largemouth bass *(Micropterus salmoides).*

In conjunction with expansion of the Red River Floodway, studies that were initiated in 2004 on fish movements, fish passage, and fish abundance in the Red River upstream and downstream of the floodway inlet control structure continued in 2006/07. Under the direction of the Manitoba Floodway Authority, consultants have been undertaking an acoustic telemetry study of fish movements in relation to the floodway inlet control structure. Channel catfish (*Ictalurus punctatus*), northern pike (*Esox lucius*), walleye (*Sander vitreus*), and sauger (*Sander canadensis*) were tagged in 2005 and 2006 with tracking devices. Preliminary study results at the floodway control structure indicates successful upstream passage of tagged fish during the spring, summer, fall and winter periods when the floodway control structure is not in operation. However, fish passage is impeded during spring and summer high flows when the control structure is in operation.

Large fish species collected at the floodway control structure for the on-going abundance study have included bigmouth buffalo, brown bullhead (*Ameiurus nebulosus*), common carp, freshwater drum (*Aplodinotus grunniens*), goldeye (*Hiodon alosoides*), lake sturgeon, northern pike, quillback sucker (*Carpiodes cyprinus*), shorthead redhorse sucker (*Moxostoma macrolepidotum*), silver redhorse sucker

(*Moxostoma anisurum*), white sucker (*Catostomus commersoni*), stonecat (*Noturus flavus*), walleye, sauger, and channel catfish.

Results showed that catches were greater downstream of the control structure however, this may have been related to seasonal changes in abundance. Condition factors of the fish collected appeared to be similar. Preliminary results from this study also suggest upstream movement of fish is blocked by operation of the gates during high water flows. Obtaining information about seasonal fish movements is critical in understanding the importance of fish movements past control structures, and will provide valuable information in understanding the overall effects of the control structure on fish populations. The final report for this study will be presented to the Floodway Authority's Fisheries Technical Expert Committee in 2008 for review.

Also in 2006/07, a feasibility study (phase one) was initiated under the direction of the Manitoba Flood Authority to determine methods that could increase fish passage success at the floodway control structure over a range of operating conditions. A consultant was hired to do a conceptual engineering study for fish passage including background information from on-going fishery studies at the site, provide initial hydraulic assessments of flow conditions at the inlet control structure, and provide fish passage alternatives for review by the committee. The final draft report was completed in 2007 and provided recommendations for phase two of the study. Major recommendations for phase two of the study which will take place in 2008/09 included implementing three-dimensional hydraulic modeling to determine the velocity distribution through the inlet control structure for a full range of flow conditions to determine more precisely when the inlet control structure acts as a barrier to fish passage. Cost benefit analysis will also be provided for preferred fish passage alternatives presented in phase one of the study.

A creel census project proposal was developed by Manitoba Water Stewardship for the lower portion of the Red River to assess resource harvest and angling pressure. The project will be implemented in 2008 and information collected will assist in reviewing current fisheries management practices and regulations to ensure this valuable resource is sufficiently protected and sustainable for future generations. A number of enhancement programs continue on tributaries of the Red River in 2006/07. Manitoba Water Stewardship continued watershed planning initiatives on the Seine, Rat, and La Salle rivers. An instream flow study also continued on the Assiniboine River. The objective of this study is to develop appropriate instream flow recommendations to ensure healthy and sustainable aquatic ecosystem functions. This study is scheduled to be completed in Fall 2008.

8.02 Assessment of Tributary Streams

During this reporting period, water quality in the tributaries to the Red River main stem remained relatively comparable to past years. Average dissolved oxygen concentrations for each tributary ranged between 4.4 and 8.65 mg/L. On five occasions, dissolved oxygen concentrations dropped below the minimum instantaneous dissolved oxygen objective (October 2006 and January 2007 Seine River, January 2007 Boyne and La Salle River and July 2007 La Salle River). Densities of *Escherichia coli* bacteria were below the Manitoba Water Quality Objective for the protection of recreation at all five Red River basin tributaries during 2007.

Four pesticides were detected in samples collected from the five main tributaries to the Red River within Manitoba. 2, 4-D, bromoxynil, MCPA, and dicamba were detected in the La Salle River during April, May, June and July 2007. 2, 4-D was also detected in the Boyne and Roseau Rivers in April 2007 and in the Seine River in April and July 2007. Bromoxynil was detected in the Seine River in July 2007. Dicamba was detected April 2007 in the Roseau River. Concentrations of dicamba and MCPA exceeded the guideline developed by the Canadian Council of Ministers of the Environment for protection of irrigation uses.

9.0 ADDITIONAL ACTIVITIES IN THE RED RIVER BASIN

As Outlined in Appendix A – International Red Rive Board Directive, the duties of the Board include maintaining an awareness of other agencies in the basin, of developments and conditions that may effect water levels and flows, water quality and ecosystem health of the Red River and its transboundary tributaries, and activities that contribute to a better understanding of the aquatic ecosystems. Chapter 9 provides and overview of a number of relevant activities and developments in the basin.

9.01 Garrison Diversion Project

Dakota Water Resources Act

The Dakota Water Resources Act (DWRA) of December 2000 amended authorizing legislation for the Garrison Diversion Project. The legislation outlines a program to meet 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 by the Dakota Water Resources Act (DWRA), the purpose of the Red River Valley Water Supply Project is to meet the comprehensive water quality and quantity needs of the Red River Valley. The proposed project would deliver a bulk water supply to meet both short-term and long-term future water needs of the Red River Valley in North Dakota and Minnesota.

As required in DWRA, the Bureau of Reclamation prepared an 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 supply; water quality; recreation; aquatic environment; and water conservation measures. The report also identified options for meeting those needs. The draft Needs and Options Report was distributed for 120 days of public review and a final report was completed by Reclamation in November 2005.

The DWRA also required completion of an environmental impact statement (EIS) that evaluates the environmental impacts of the alternative ways to meet the water needs of the Red River Valley. As directed by the DWRA, Reclamation and the State of North Dakota jointly prepared the EIS. The Governor of North Dakota 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 were studied for inclusion in the EIS: a No Action Alternative, required by the National Environmental Policy Act (NEPA); 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. 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.

Reclamation and the State of North Dakota released a draft EIS for public review on December 30, 2005, and received 188 comment documents. Because of substantive comments related to environmental issues received on the DEIS, Reclamation and the State of North Dakota determined that additional analyses were needed. A Supplemental Draft EIS was prepared that contained additional analyses to address comments received on the DEIS. The SDEIS was released on January 31, 2007, and was available for public comment until April 25, 2007. Reclamation and the State of North Dakota received 81 documents commenting on the SDEIS. All substantive comments on the DEIS and SDEIS were responded to in the final environmental impact statement (FEIS). A FEIS was published on December 28, 2007. NEPA requires a 30 day waiting period prior to signing a Record of Decision (ROD). The 30 day waiting period ended on January 27, 2008. Reclamation is in the process of finalizing the ROD for signature.

Northwest Area Water Supply Project

The Garrison Diversion Project also includes the Northwest Area Water Supply Project (NAWS). The NAWS Project, now under construction, is designed to 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. The project is an interbasin water transfer from the Missouri River basin to the Hudson Bay watershed with potential for interbasin transfer of non-native biota.

Although reporting on the NAWS project is principally the responsibility of the International Souris River Board, the IRRB maintains an interest in the project given that the Souris River is hydrologically part of the Red River basin.

In March 2006, Reclamation initiated the preparation of an EIS. The focus of the EIS is to evaluate additional water treatment techniques that could further reduce the risks of transfer of non-native species through project facilities. Treatment would take place within the Missouri River basin and two of the four alternatives considered would meet the treatment goals recommended by the Province of Manitoba. A 60-day comment period was established for the draft EIS. The Province of Manitoba requested a 30 day extension which Reclamation granted. The public comment period ended March 26, 2008. Reclamation will consider the comments received and proceed with the preparation of a final EIS.

9.02 Devils Lake Sub-Basin

DEVILS LAKE UPDATE

Hydrology

After reaching a peak elevation, for 2007, of 1447.9 msl on June 17, Devils Lake receded slightly to an elevation of 1446.8 msl in January 2008. This level is about 0.2 feet lower than January, 2007. At its current elevation, the lake has a surface area of about 122,800 acres and is storing 2.40 million acre-feet of water.

Stump Lake peaked at an elevation of 1447.64 msl on August 11, 2007, about 3.86 feet higher than one year earlier. The elevation of Stump Lake in January 2008 was 1446.8 msl, the same elevation as Devils Lake. At that elevation, Stump Lake has a surface area of 14,830 acres and is storing 492,634 acre-feet of water.

The combined volume of Devils Lake and Stump Lake in January 2008 was 2.89 million acre-feet, covering about 137,630 acres. This is an increase of about 19,000 acre-feet from the same time the year before.

The water surface of Devils Lake and Stump Lake peaked around June 12, 2008 at about 1447.1 msl. The combined storage of Devils Lake and Stump Lake was 2.91 million acre-ft. The water elevation slowly declined during the summer, reaching a low of 1446.4 msl on September 20, 2008. Recent fall rains have prevented any further decrease in elevation, slightly rising to 1446.5 msl as of September 24, 2008. Runoff in Devils Lake major tributaries from snowmelt was lower in 2008 than the 1998-2008 average. The runoff for April 2008 had a total water volume of 3,814 acre-feet, which is the third lowest for the time period.

State Emergency Outlet Project Update:

The structure for the outlet was submerged in Round Lake on April 16, 2008. Releases from the outlet into the Sheyenne River began on April 21, 2008. Releases continued until May 5, 2008 (15 days), when low discharges and higher sulfate concentrations in the Sheyenne prevented releases. The sulfate concentration at that time for the Sheyenne at Breman showed 428 mg/L (Lab results) and the discharge was 31 cfs. Rainfall is needed in the upper Sheyenne River basin for further operation of the outlet. The total volume of water released in April was 145 acre-feet. The following table (Table 7) summarizes the extent of discharge from the outlet so far in 2008.

Table 7. North Dakota Emergency Outlet Project Discharges

Month	Dates Discharge Occurred	Range of Discharge (cfs)	Monthly Average (cfs)	Total Daily Volume (acre-feet)
April 2008	21 – 30	3.11 – 12.73	2.44	145
May	1 – 5	0.11 – 5.67	0.56	35
June	11-13; 27-30			
July	1 – 3			

The rate, and volume of discharge, had not yet been calculated for June and the first part of July. The total hours that pumping occurred during that time was 33 hours and 11 minutes.

MAPLE RIVER A-170 DAM

Dedication of the Maple River A-170 Dam was held on July 17, 2007. Construction on the flood control dam began in the fall of 2004 and was operable for the 2007 runoff. Efforts to obtain all necessary permits started many years before that time. The dam is located on the mainstem of the Maple River, about 35 miles southwest of the city of Fargo, ND. With a drainage area of 902 square miles, the purpose of the dam is to reduce the depth and duration of flooding along the Maple River, Sheyenne River, Rush River, and Red River. The reservoir has a storage capacity of 60,000 acre-feet, when at a full pool of 2,800 acres. There is no permanent pool for the dam. The structure is approximately 70 feet high. The Cass County Joint Water Resource Board was the local sponsor for the project.

FARGO SOUTHSIDE FLOOD PROTECTION PROJECT

The south side of the City of Fargo narrowly escaped major flood damage during the 1997 flood. While many residences did suffer damages, many others were protected through emergency actions and the extended cold period that occurred during the flood.

The City of Fargo has actively worked towards obtaining protection of this area, since the 1997 flood. Many of the more flood prone houses have been removed. New development has also occurred, however, as much of the land was higher than the 100-year flood elevation that existed at that time.

Five flood protection alternatives have been presented. All of the proposals include a levee located on the north side of the Wild Rice River, to prevent overflow water from entering the City of Fargo. The alternatives differ on where diversion channels would allow some of the water to flow out of the Wild Rice River and where it would flow back into the Red River. Each of these five base alternatives also includes options for channel extensions and on-site storage. The channel extensions consist of constructing a high-level cut through some of the oxbows of the Red River. The bottom of these channels would be about 25 feet above the bottom of the Red River and would remain dry until about a 2-year to 5-year flood event. The inclusion of the channel extensions and on-site storage would prevent the project from causing any increase in peak water elevation outside of the protected areas.

The City of Fargo is also working with upstream entities to determine if there is any possible detention projects further upstream in the watershed that would benefit Fargo as well as the upstream communities.

Some structures may not be able to be included in the project, as they are located too close to the river. Other rural structures would also be on the outside of the area of protection. The City of Fargo has been working with these areas, to determine other options for protection.

The cost of the project ranges from $50 million to $150 million. Various public meetings have been held to discuss the alternatives. Meetings have also been held with agencies that may have concerns and/or permitting authority. The City of Fargo is in the process of the final selection of the proposed alternative. The project design, right-of-way acquisition, and permitting is scheduled to proceed until October 2009. The preliminary schedule has some phases of construction proposed to start in June 2009. The project is expected to be functional in March 2011, with the final completion scheduled for July 2012.

9.03 U.S. Army Corps of Engineers Flood Control Activities

<u>Ada, Minnesota</u>

A Section 205 flood risk management feasibility study is under way for the city of Ada in the Marsh River watershed. Fiscal year 2008 efforts concentrated on preparing a draft feasibility report. Preliminary analyses indicate that the National Economic Development (NED) plan will be diversion of a portion of Judicial Ditch 51 combined with a levee system built to withstand the 200-year flood. The preliminary estimate of implementation cost is $8 million.

Breckenridge, Minnesota, and Wahpeton, North Dakota

Levee construction in Breckenridge and Wahpeton began in 2008. Wahpeton and Breckenridge are at the confluence of the Bois de Sioux and Otter Tail Rivers, the beginning of the Red River of the North. The flood risk management projects for these cities are treated as two separate, but dependent, projects. The levee portion of both projects must be initiated together to avoid adverse impact to the city on the other side of the river.

The Breckenridge project consists of a high-flow diversion channel north of the Otter Tail River and two separable levee reaches that would protect all of Breckenridge. The first of four stages of levee construction will begin in August 2008. The second stage is scheduled to be awarded in December 2008. Construction of the diversion was completed in 2005. The total estimated cost for the Breckenridge project is $36.4 million.

The Wahpeton project, authorized under the Corps' Section 205 Continuing Authority, consists of a permanent levee system and flood easements. The first of three stages of levee construction began in June 2008. The second stage is scheduled to be awarded in December 2008. Construction of the interior flood control features is complete. The total estimated cost for the Wahpeton project is $17.6 million.

Devils Lake Embankment, North Dakota

The Corps is developing a plan for additional flood risk management measures for the city of Devils Lake, North Dakota. Plans and specifications will be prepared for future actions so they are ready to implement should the lake continue to rise. Devils Lake reached its highest recorded level of 1449.20 feet above mean seal level (msl) in May 2006 and has caused more than $300 million in flood related damages. The Federal embankment system protecting the City of Devils Lake is about 8 miles long with a top elevation of 1460 feet msl. Although in the past they have been referred to as levees, the system was actually designed and constructed as a dam to hold back water for many decades. The project is monitored and maintained by the city with annual inspections by the Corps. Approximately $53.6 million has been spent on the embankment system to date, including the raise to elevation 1460.

Devils Lake Water Supply (North Dakota Environmental Infrastructure Program)

The Corps is assisting the City of Devils Lake with its water supply distribution and treatment systems under the North Dakota Environmental Infrastructure Program. The program authorizes the Corps to provide assistance to North Dakota public entities in the "form of design and construction assistance for water-related environmental infrastructure and resource protection and development projects in North Dakota, including projects for wastewater treatment and related facilities, combined sewer overflow, water supply, storage, treatment, and related facilities, environmental restoration, and surface water resource protection and development." The program was authorized in the Consolidated Appropriations Act of 2008 which amended Section 594 of the Water Resources Act of 1999 and established a program authorization of $100,000,000 for North Dakota.

Roads Serving as Water Barriers (Devils Lake, North Dakota)

The Corps is providing dam design expertise to the Federal Highway Administration, Bureau of Indian Affairs, and the Spirit Lake Nation. The work includes obtaining geotechnical borings and testing to support the design effort. Roads in some areas near Devils Lake are providing barriers to the rising and expanding waters of Devils Lake. Because the roads serving as water barriers were not constructed to function as dams, they pose potential safety problems to road users and to people living in the areas sheltered by the barriers. The 2006 Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) identifies the Federal Highway Administration as the agency responsible for addressing this problem.

Drayton Dam, Drayton, North Dakota

A Section 206 aquatic ecosystem restoration feasibility study of the Drayton Dam began in July 2008. The study will assess ways to provide fish passage and eliminate dangerous hydraulic conditions at the dam while maintaining the pool for water supply and bank stability.

Fargo-Moorhead Metropolitan Area, North Dakota and Minnesota

A reconnaissance study of flood risk management measures in the Fargo-Moorhead metropolitan area was approved in April 2008. Scoping is under way for a feasibility study to reduce flood risk in the study area using a variety of measures, including floodwalls, levees, diversion channels, and flood storage.

Fargo-Moorhead and Upstream Area, North Dakota, South Dakota and Minnesota

This feasibility study is looking for opportunities to reduce flood damages and restore aquatic ecosystems in the entire watershed upstream of Fargo-Moorhead. The study began in August 2004. Phase 1a was completed in June 2005 and concluded that a system of impoundments could reduce the 1-percent-chance flood stage in Fargo-Moorhead up to 1.6 feet. Phase 1b began in April 2008 to develop hydrologic and hydraulic models of the Wild Rice River in North Dakota to assess specific potential storage sites. Scoping for Phase 2 of the study is under way and will include more detailed investigations looking at environmental benefits and site-specific economic benefits.

Fargo, North Dakota (Ridgewood Addition)

Construction of a floodwall at the Department of Veterans Affairs hospital is substantially complete. Levee and floodwall construction upstream of the hospital is scheduled to begin in fall 2008 and will be cost-shared with the city of Fargo under the Section 205 Continuing Authority. The project will reduce flood risk for the Department of Veterans Affairs hospital and the portion of Fargo between 15th Avenue North and 22nd Avenue North.

Grand Forks, North Dakota, and East Grand Forks, Minnesota

Construction of the flood risk management project for the cities of Grand Forks and East Grand Forks is nearing completion. The project has been certified as providing a 100-year level of flood protection in accordance with the Federal Emergency Management Agency's national flood insurance program. When construction is complete, scheduled for fall 2008, the project will provide a 250-year level of protection. The project consists of 30 miles of levees and 3 miles of floodwall set back from the river. The levees and floodwalls form rings around the communities. The project also includes stabilization of an existing dam, removal of a former railroad bridge, construction of interior flood control features, 24 pump stations, numerous road and railroad closures, and two diversion channels. The project was also authorized to provide recreational features including 24 miles of trails and seven trailheads constructed in the new river greenway. The design level of protection is equivalent to the peak discharge experienced during the 1997 flood. Total estimated project cost is $409,300,000.

Lake Traverse

Lake Traverse is a Corps reservoir located along the boundary of western Minnesota and northeastern South Dakota. Fiscal year 2008 funds will be used to design and construct slope repairs and armoring for the Browns Valley dike to address erosion resulting from extended high water on the Lake Traverse pool.

Pembina River Basin, North Dakota

The Corps and the State of North Dakota began a study of the Pembina River in August 2008 under the Section 22 Planning Assistance to States program. The study will develop a HEC-RAS unsteady flow model of the lower Pembina River and the Red River of the North from Drayton to the international border.

A reconnaissance study of the Pembina River basin is under way but on hold pending identification of a non-Federal sponsor for the feasibility phase of study. The draft report identified flooding in the lower Pembina valley from Walhalla, North Dakota, to Pembina, North Dakota, as the primary problem in the study area. An existing road/dike along the international border is the subject of ongoing litigation; uncertainty regarding the future of that dispute has complicated the study efforts. The Corps reconnaissance study focuses on potential solutions that lie within the United States, but it appears that more creative and beneficial solutions to flooding in the lower Pembina River basin would be possible with a cooperative United States-Canadian planning effort.

Red River Basin Watershed Study

The Corps began a basin-wide watershed study in June 2008. The first phase of study will use LIDAR to collect detailed topographic information and develop a digital elevation model of the entire watershed in cooperation with the International Water Institute. Subsequent phases will be pursued to build and refine basin-wide hydraulic and hydrologic models, develop a decision support system, and prepare a Comprehensive Watershed Management Plan.

Roseau, Minnesota

The Corps is preparing plans and specifications for a flood risk management project for the Roseau River in the city of Roseau. The project was authorized in the Water Resources Development Act of 2007. The recommended plan is the 150-foot East Diversion Plan with associated recreational features. The estimated project cost is $27.5 million.

Sheyenne River, West Fargo, North Dakota

Construction to repair the diversion channel that was damaged by erosion and sloughing in 2005 is scheduled to be complete in fall 2008. Construction of the West Fargo project was essentially completed in 1994.

Stream Gauging

In 2008, the Corps provided approximately $200,000 for stream gages in the Red River and Souris River watersheds. The Corps maintains river gages at several locations including Wahpeton, Valley City and Minot, North Dakota. These gages provide critical information related to flood forecasting, drought management and the overall health of the watersheds.

Wild Rice River Basin, Minnesota

A feasibility study for flood risk management and ecosystem restoration in the Wild Rice River watershed is under way. Measures that are being investigated include setback levees along the Wild Rice River, restoration of the Wild Rice River, and off-channel storage. Fiscal year 2008 study efforts concentrated on examining measures to offset induced flooding from proposed project features and completing a sedimentation analysis necessary for design of the river channel and riparian corridor restoration.

For Additional Information:
More detailed information may be obtained from the USACE website: http://www.mvp.usace.army.mil/

9.04 USGS Water Resource Investigations and Activities

Supporting Project for the Bureau of Reclamation's Red River Valley Water Supply Project

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 conducting several projects to provide information that the Bureau of Reclamation needs to evaluate water delivery options. The final two reports were completed this fiscal year.

The report "Estimated Ground-Water Use in Becker, Clay, Douglas, Grant, Otter Tail, and Wilkin Counties, Minnesota, for 2030 and 2050" describes the methods used to estimate ground-water use for the years 2030 and 2050 for six Minnesota counties, presents the estimated ground-water use, and compares the estimated

ground-water use with published estimates. The report "simulation of Constituent Transport in the Red River of the North Basin, North Dakota and Minnesota, During Unsteady Flow Conditions, 1977 and 2003-04" describe the simulation of constituent transport in the Red River and the Sheyenne River during unsteady-flow conditions and to document the effect of six proposed water-supply alternatives on water quality in the rivers. Development of and calibration of the Red River model also are documented.

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 final interpretive report is in review, and will be published by December 31, 2007.

Real-time water quality monitoring station

A continuous real-time water quality monitoring station has been operated at the U.S. Geological Survey gauging station Red River at Fargo since March 2003. The water quality monitor measures specific conductance, water temperature, pH, dissolved oxygen, and turbidity. Regression analysis of water-quality data collected in 2003-05 was used to estimate concentrations and loads for alkalinity, dissolved solids, sulfate, chloride, total nitrite plus nitrate, total nitrogen, total phosphorus, and suspended sediment.

A continuous real-time water quality monitoring station was installed at the U.S. Geological Survey gauging station Red River at Grand Forks. A water-quality monitor with probes to measure specific conductance, water temperature, pH, dissolved oxygen, and turbidity was installed in March 2007. Water-quality samples will be used along with continuously-recorded data to develop statistical regression relations between properties of water that can be measured continuously in real time and chemical constituents of concern, such as total nitrogen, and sediment.

Water-Quality Summary for the Red River Basin

The report "Nutrients, Suspended Sediment, and Pesticides in Water of the Red River of the North Basin, Minnesota and North Dakota, 1990-2004" describes nutrient, suspended sediment, and pesticide data compiled, summarized for the period 1990 through 2004, and compared to other historical data.

Water-Quality Modeling of the Red River in the Fargo Area

A USGS study developed a water-quality model for the 30.8 mile reach in the Fargo area. Data used to calibrate and verify the model were collected during flows that ranged form 150 to 250 cubic feet per second. The models ability to accurately predict constituent concentrations in the river at low flow is questionable. From September 24 through 27, 2003, velocity information, re-aeration information and water-quality samples were collected. The streamflow was 60 cubic feet per second during this period. The data is being analyzed and a model is being calibrated using the low-flow data.

Blank Page

APPENDIX A

DIRECTIVES TO THE INTERNATIONAL RED RIVER BOARD

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 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 modeling 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.

Blank Page

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 at the international boundary 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 International Red River Board identifies major water quality issues to the IJC.

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 IRRB 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 exceedances and subsequent investigations, the IRRB 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 and provincial revisions. The IRRB Aquatic Ecosystem Committee established by the IRRB in June 2001 will be reviewing the issue of objectives and alert levels with respect to monitoring requirements, analytical methodologies, and reporting protocols.

COMPARISON OF WATER QUALITY ALERT LEVEL STANDARDS AND OBJECTIVES - August 20, 1990

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Fecal Coliform	200/100 ml geometric mean 10% of samples not to exceed 2,000 based on a minimum of 5 samples in a 30 day period from Mar. 1 – Oct. 31. HH*	200 fecal coliforms per 100 ml. This standard shall apply only during the recreation season, May 1 to September 30. HH	100/100 ml. At least 90% of samples in any consecutive 30 day period should have a fecal coliform density of less than 100 per 100 ml. HH	200/100 ml geometric mean with 10% of samples not to exceed 400 based on min. 5 samples – 30 day period – May 1 – Oct. 31 and for the balance of year not to exceed 1000/100 ml. Current IJC objective.	Minnesota and North Dakota based on primary body contact recreation.
Chloride	100 mg/l (total) ID	100 mg/l (total) ID	100 mg/l (soluble) ID	100 mg/l (dissolved) Current IJC Objective	All agencies based on industrial consumption.
Sulfate	250 mg/l (total) DW	250 mg/l (total) DW	250 mg/l (dissolved) DW	250 mg/l (total) Current IJC Objective	All agencies based on domestic consumption.
TDS	500 mg/l DW	None	500 mg/l DW	500 mg/l Current IJC Objective	All agencies, excluding North Dakota based on domestic consumption.
Dissolved Oxygen	5 mg/l (minimum)	5 mg/l (minimum)	47% saturation or more.	5 mg/l (minimum) Current IJC Objective	All agencies for the protection of aquatic life.
Chemical Characteristics					
pH	6.5 - 9.0 AL	7.0 - 9.0 AL	6.5 – 9.0 AL	6.5 - 9.0	All agencies based on protection of aquatic life.

- DW – Drinking Water
- HH – Human Health
- AL – Aquatic Life
- ID – Industrial Consumption
- IR - Irrigation

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Dissolved Gas					
Ammonia-N	.04 mg/l as N unionized (warm water) Al	Unionized as N (dissolved). Calculation from standards. See page 8-10. AL	Variable, ranging from 0.0184 to 0.050 mg/l ammonia as NH_3.*		Minnesota and North Dakota for the protection of aquatic life.
Metals (Total)					
Aluminum	Total 125 µg/l AL	None	None	None	Minnesota for the protection of aquatic life.
Cadmium	Total The chronic standard shall not exceed: $_e$ [0.7852 {ln (total hardness mg/l)} – 3.49]. For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Cadmium standards in µg/l at various hardness values: 50 mg/l hardness = 0.66 µg/l, 100 mg/l hardness = 1.1 µg/l, 200 mg/l hardness = 2.0 µg/l AL	Total The one-hour average, concentration in µg/l cannot exceed the numerical value given by $_e$ [1.128{ln(hardness as mg/l)} –3.828] more than once every 3 years on the average. AL The four day average concentration in µg/l cannot exceed the numerical value given by $_e$ [.7852{ln(hardness as mg/l)} –3.490] more than once every 3 years on the average.	$_e$ [0.7852 {ln(hardness as mg/l)} –3.49], where hardness is expressed in mg/l $CaCO_3$ and the resultant objective is expressed in µg/l. (e.g.) 50 mg/l $CaCO_3$ = 0.66 µg/l, 100 mg/l $CaCO_3$ = 1.1µg/l, 200 mg/l $CaCO_3$ = 2.0 µg/l. AL	Less than detection.	Minnesota and Manitoba for the protection of aquatic life and wildlife.
Chromium	None	Total 50 µg/l DW	$_e$ [0.8190 {ln (hardness)} +1.561], where hardness is expressed in mg/l $CaCO_3$ and the resultant objectives is expressed in µg/l. (e.g.) 50 mg/l $CaCO_3$ = 120 µg/l, 100 mg/l $CaCO_3$ = 210	50 µg/l	North Dakota based on domestic consumption.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
			µg/l, 200 mg/l $CaCO_3$ = 370 µg/l.		
Chromium, Trivalent	Total The chronic standard shall not exceed: exp. [0.819{ln (total hardness mg/l}+ 1.561]. For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Chromium +3 standards in µg/l at various hardness values: 50 mg/l hardness = 117 µg/l, 100 mg/l hardness = 207 µg/l, 200 mg/l hardness = 365 µg/l. AL	None	$_e$ [0.8190 {ln (hardness)} +1.561], where hardness is expressed in mg/l $CaCO_3$ and the resultant objectives is expressed in µg/l. (e.g.) 50 mg/l $CaCO_3$ = 120 µg/l, 100 mg/l $CaCO_3$ = 210 µg/l, 200 mg/l $CaCO_3$ = 370 µg/l.. AL	None	Manitoba and Minnesota for the protection of aquatic life.
Chromium, Hexavalent	Total The chronic standard is 11 µg/l AL	None	11 µg/l AL	None	Manitoba and Minnesota for the protection of aquatic life.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Copper	Total The chronic standard shall not exceed: exp. [0.62 {ln (total hardness mg/l}) -0.57]. For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Copper standards in µg/l at various harness values: 50 mg/l hardness = 6.4 µg/l, 100 mg/l hardness = 9.8 µg/l, 200 mg/l hardness = 15 µg/l . AL	Total The one-hour average concentration in µg/l cannot exceed the numerical value given by $_{e}$[.9422{1n (hardness as mg/l})-1.464] more than once every 3 years on the average. The four-day average concentration in µg/l cannot exceed the numerical value given by $_{e}$ [8545{ln (hardness as mg/l)} –1.465] more than once every 3 years on the average. AL	$_{e}$[0.8545{ln(hardness)}-1.465], where hardness is expressed in mg/l $CaCO_3$ and the resultant objective is expressed in µg/l. (e.g.) 50 mg/l $CaCO_3$ = 6.5 µg/l., 100 mg/l $CaCO_3$ = 12 µg/l, 200 mg/l $CaCO_3$ = 21 µg/l.		Minnesota and Manitoba for the protection of aquatic life.
Iron	300 µg/l DW	None	300 µg/l DW	300 µg/l	Minnesota, Manitoba based on domestic consumption.
Lead	Total The chronic standard shall not exceed: exp. [1.273{ln (total hardness mg/l)}-4.705]. For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Lead standards in µg/l at various hardness values: 50 mg/l hardness = 1.3 µg/l 100 mg/l hardness = 3.2 µg/l 200 mg/l hardness = 7.7 µg/l AL	Total The one-hour average concentration in µg/l cannot exceed the numerical value given by $_{e}$ [1.266{In (hardness as mg/l) - 1.416] more than once every 3 years on the average. The four-day average concentration in µg/l cannot exceed the numerical value given by $_{e}$ (1.266{ln (hardness as mg/l) - 4.661) more than once every 3 years on the average. AL	$_{e}$ [1.273{ln (hardness)} - 4.705], where hardness is expressed in µg/l $CaCO_3$ and the resultant objective is expressed in µg/l. (e.g.) 50 mg/l $CaCO_3$ = 1.3 µg/l, 100 mg/l $CaCO_3$ = 3.2 µg/l, 200 mg/l $CaCO_3$ = 7.7 µg/l,		Manitoba, Minnesota and North Dakota for the protection of aquatic life and wildlife.
Manganese	50 µg/l DW	None	50 µg/l DW	50 µg/l	Minnesota and Manitoba based on domestic consumption.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Mercury	Total 0.0069 µg/l AL	Total Acute 2.4 µg/l Chronic 0.012 µg/l AL	Acid soluble mercury 0.006 µg/l	Less than detection in water. 0.5 micrograms per gram in fish fillets.	Minnesota, North Dakota and Manitoba for protection of aquatic life, animal life and humans as a result of bioconcentrations in tissue in the food chain.
Nickel	Total The chronic standard (CS) shall not exceed the human health-based criterion of 88 µg/l. For waters with total hardness values less than 50 mg/l, the CS shall not exceed: exp. [0.846{ln(total hardness mg/l)} + 1.1645]. AL and HH	None	$_{e}$ [0.76{ln(hardness)} None +1.06], where hardness is expressed in mg/l) $CaCO_3$ and the resultant objective is expressed in µg/l (e.g.) 50 mg/l $CaCO_3$ = 56 µg/l, 100 mg/l $CaCO_3$ = 96 µg/l, 200 mg/l $CaCO_3$ = 160 µg/l, AL	None	Minnesota for the protection of aquatic life and human health. Manitoba for the protection of aquatic life.
Selenium	Total 5 µg/l AL	10 µg/l DW	10 µg/l DW	10 µg/l	Manitoba and North Dakota based on domestic consumption. Minnesota for the protection of aquatic life.
Silver	Total The chronic standard shall not exceed 1.0 µg/l. AL	The one-hour average concentration in µg/l cannot exceed the numerical value given by $_{e}$ [1.72{ln(hardness)} as mg/l)}-6.52] more than once every three years on the average. AL	0.1 µg/l AL	None	Manitoba, Minnesota and North Dakota for protection of aquatic life.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Zinc	Total The chronic standard shall not exceed: exp. [0.8473{ln(total hardness mg/l)} + 0.7615], For hardness values greater than 400 mg/l, 400 mg/l shall be used in the calculation of the standard. Zinc standards in µg/l at various hardness values: 50 mg/l hardness = 59 µg/l 100 mg/l hardness = 106 µg/l 200 mg/l hardness = 191 µg/l AL	Total The one-hour average concentration in µg/l cannot exceed the numerical value given by e [.8473{ln(hardness as mg/l)} +.8604] more than one every 3 years on the average. The four-day average concentration in µg/l cannot exceed the numerical value given by e [.8473 {ln(hardness as mg/l})+.7614] more than once every 3 years on the average. AL	47 µg/l AL	47 µg/l	Minnesota, North Dakota and Manitoba for the protection of aquatic life.
Nutrients					
Nitrates (N)	Total 10 mg/l DW	Dissolved 1.0 mg/l DW	Total 10 mg/l DW	Total 10 mg/l	Minnesota and Manitoba based on domestic consumption.
Toxic Substances					
Arsenic	Total 50 µg/l DW and AL	Total 50 µg/l DW	Acid soluble arsenic 50 µg/l DW	Total 10 µg/l (under review)	Minnesota based on domestic consumption and for protection of aquatic life.
Boron	500 µg/l IR	750 µg/l IR	500 µg/l IR	Total 500 µg/l	Minnesota, Manitoba based on irrigation water.
Chlorine	Total residual 6 µg/l	None	None	None	Minnesota for protection of aquatic life.
Cyanide	Free cyanide 5.2 µg/l AL	Total 5 µg/l AL	Free cyanide 5.2 µg/l cyanide AL	Total 5 µg/l	Minnesota and North Dakota for protection of aquatic life.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
Dioxin	None	None	None	Not detectable in any media analyzing to parts per trillion.	Task Force
PCBs	Total 0.000029 µg/l AL and HH	Total Acute 2.0 µg/l Chronic 0.014 µg/l AL	.014 µg/l AL	Not detectable in water, in fish total PCBs not exceeding 2 micrograms per gram in fillets.	Body burden: Manitoba, North Dakota and Minnesota for protection of aquatic life, animal life and human life.
Phenolics	None	None	1 µg/l DW	10 µg/l	North Dakota to protect against taste and odor in water and fish.
Phenol	123 µg/l AL	Total 10 µg/l DW	1.0 µg/l 2.0 AL	None	North Dakota to protect against taste and odor in water and fish.
Pentachlorophenol	The chronic standard shall not exceed: exp.[1.005{pH} – 5 .290]. Pentachlorophenol standards in µg/l at, various pH values: pH 7.0 = 5.7 µg/l, pH 7.5 = 9.5 µg/l, pH 8.0 = 16 µg/l. AL	Acute 20.0 µg/l Chronic 13.0 µg/l AL	0.06 mg/l DW	None	Minnesota and North Dakota for the protection of aquatic life. Manitoba based on domestic consumption.
Pesticides and Volatile Hydrocarbons	Acenapthene 12 µg/l Acrylonitrile 0.38 µg/l Anthracene 0.029 µg/l Benzene 6.9 µg/l Bromoform 128 µg/l Carbon Tetrachloride	Aldrin (total) Acute 3.0 µg/l Chlordane (total) Acute 2.4 µg/l Chronic 0.0043 µg/l Dieldrin (total)	Aldicarb 0.009 mg/l Aldrin + Dieldrin 0.0007 mg/l Atrazine 0.06 mg/l	Not detectable in water**	All agencies for the protection of aquatic life, animal life domestic consumption and human health.

** Limits in fish tissue are being researched by the Task Force.
Tissue samples have been collected by North Dakota and Manitoba.

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
	1.9 µg/l Chlordane 0.00029 µg/l Chlorobenzene 10 µg/l Chloroform 55 µg/l Chlorpyrifos 0.041 µg/l DDT 0.0017 µg/l 1,2-Dichloroethane 3.8 µg/l Dieldrin 0.000026 µg/l Di-2-Ethylhexyl phthalate 1.9 µg/l Di-n-Octyl phthalate 30 µg/l Endosulfan 0.15 µg/l Endrin 0.016 µg/l Ethylbenzene 68 µg/l Fluoranthene 4.1 µg/l Heptachlor 0.00039 µg/l Heptachlor epoxide 0.00048 µg/l Hexachlorobenzene 0.00022 µg/l Lindane 0.032 µg/l Methylene chloride 46 µg/l Parathion 0.013 µg/l Phenanthrene 2.1 µg/l 1,1,2,2-Tetrachloroethane 1.54 µg/l Tetrachloroethylene 3.8 µg/l 1,1,1-Trichloroethane 263µg/l 1,1,2-Trichloroethylene25µg/l 2,4,6-Trichlorophenol 2.0µg/l Toluene 253 µg/l Toxaphene 0.0013 µg/l Vinyl Chloride 0.15 µg/l Xylene(total m, p and o)	Acute 2.5 µg/l Chronic .002 µg/l Endosulfan (total) Acute .22 µg/l Chronic .06 µg/l (continued) Endrin (total) Acute .18 µg/l Chronic .0023 µg/l Heptachlor (total) Acute .52 µg/l Chronic .004 µg/l Lindane (Hexachlorocyclohexane) Acute 2.0 µg/l Chronic .06 µg/l Toxaphene (total) Acute .73 µg/l Chronic .0002 µg/l AL	Azinphos-methyl 0.02 mg/l Bendiocarb 0.04 mg/l Benzene 0.005 mg/l Benzo (a) pyrene 0.00001 mg/l Bromoxynil 0.005 mg/l Carbaryl 0.09 mg/l Carbofuran 0.09 mg/l Carbon tetrachloride 0.005 mg/l Chlordane 0.0043 µg/l Chlorpyrifos 0.09 mg/l Cyanazine 0.01 mg/l Diazinon 0.02 mg/l Dicamba 0.12 mg/l 1,2-Dichlorobenzene 0.2 mg/l 1,4-Dichlorobenzene 0.005 mg/l DDT and metabolites 0.001 µg/l 1,2-Dichloroethane 0.005 mg/l Dichloromethane		

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
	166 µg/l		0.05 mg/l 2,4-Dichlorophenol 0.9 mg/l 2,4-D – 0.9 mg/l (continued) Diclofop-methyl 0.009 mg/l Dieldrin – 0.0019 µg/l Dimethoate – 0.02 mg/l Diquat – 0.07 mg/l Diuron – 0.15 mg/l Endosulfan – 0.056 µg/l Endrin – 0.0023 µg/l Glyphosate – 0.18 mg/l Heptachlor and heptachlor epoxides – 0.0038 µg/l Hexachlorobutadiene 0.1 µg/l Lindane – 0.080 µg/l Malathion – 0.19 mg/l Methoxychlor – 0.9 mg/l Metribuzin – 0.08 mg/l Monochlorobenzene 0.08 mg/l Nitrilotriacetic acid 0.05 mg/l Paraquat – 0.01 mg/l Parathion – 0.05 mg/l Phthalic acid esters: Dibutylphthalate–4.0 µg/l Dii-(2-ethylhexyl) phthalate 0.6 µg/l other phthalates –0.2 µg/l Phorate – 0.002 mg/l Picloram – 0.19 mg/l Polychlorinated biphenyls 0.014 µg/l Simazine – 0.01 mg/l Temephos – 0.28 mg/l Terbufos – 0.001 mg/l		

Parameter	Minnesota Standards	North Dakota Standards	Manitoba Objectives	Red River Pollution Board Objectives	Origin/ Rational
			(continued) 2,3,4,6- Tetrachlorophenol 0.1mg/l Toxaphene – 0.013 µg/l Triallate – 0.23 mg/l Trichloroethylene 0.05 mg/l 2,4,6-Trichlorophenol 0.005 mg/l 2,4,5-T – 0.28 mg/l Trifluralin – 0.045 mg/l Trihalomethanes 0.35 mg/l DW and AL		
Oil and Grease	500 µg/l HH	No visible film or sheen upon the waters.	Free from oil and grease residues which cause a visible film or sheen upon the waters or any discolouration of the surface of adjoining shorelines, or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.	No visible sheen on the surface.	All agencies based on aesthetics, taste and odor in water and fish, and bathing.

Blank Page

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

Will Haapala
(218) 856-0730 office
(218) 846-0719 Fax
1-800-422-0798 (24hr)

Molly MacGregor
(218) 846-0494 office
(218) 846-0719 Fax
1-800-422-0798

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

Henry Drews
(208) 755-3959 office
1-800- 422-0798 (24hr)

North Dakota Health Department – Bismark, ND

Dennis Fewless
(701) 328-5210 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

Bert Garcia
(303) 312-6670 office
(303) 312-7206
Fax 1-800-8802 (24hr National Response Center

Canada:

Manitoba Water Stewardship – Winnipeg, MB

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

Environment Canada – Regina, SK

David Donald
(306) 780-6723 office
(306) 780-5311
(306) 586-1468 res.

Girma A. Sahlu
(306) 780-6425 office
(306) 780-6810 fax
(306) 757-2892

APPENDIX D

HYDROLOGY COMMITTEE & AQUATIC ECOSYSTEM COMMITTEE
MEMBERSHIP LIST

International Red River Board
Hydrology Committee
Membership:

Name	Organization	Phone	E-mail
Vacant (Chair) Steve Topping (Alt.)	Manitoba Water Stewardship, Winnipeg	(204) 945-6398	stopping@gov.mb.ca
Steve Robinson (Chair) Gregg Wiche (Alt.)	USGS, Bismark	(701) 775-7221 (701) 250-7400	Smrobins@usgs.gov gjwiche@usgs.gov
Girma A. Sahlu	Environment Canada, Secretary IRRB, Regina, Sask	(306) 780-6425	Girma.Sahlu@EC.GC.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
Randy Gjestvang	N.D. State Water Commission, West Fargo	(701) 282-2318	rgjest@water.swc.state.nd.us
Chuck Fritz	International Water Institute, Fargo	(701) 231-9747	charles.fritz@ndsu.nodak.edu
Ron Harnack Al Kean (Alt.)	Minnesota Board of Water and Soil Resources,	(651) 296-0878	Ronald.harnack@bwsr.state.mn.us Al.kean@bwsr.state.mn.us
Vacant	Minnesota DNR, Bemidji		
Kip Gjerde Amy Ambuehl (Alt.)	U.S. Bureau of Reclamation, Billings	(406) 247-7813 (701) 250-4242 ext. 3615	jgjerde@gp.usbr.gov aambuehl@gp.usbr.gov

International Red River Board
Aquatic Ecosystem Committee
Membership:

Name	Organization	Phone	E-mail
John Giedt (Sec.)	EPA/Denver	(303) 312-6550	giedt.john@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	RRBB/Moorhead	(218) 291-0422	lancer2b2@corpcomm.net
Chuck Fritz	Int'l Water Institute, Fargo	(701) 231-9747	charles.fritz@ndsu.nodak.edu
Bethany Bolles	EERC, Grand Forks	(701) 777-5050	bbolles@undeerc.org
David Donald (Chair)	Environment Canada/ Regina	(306) 780-6723	david.donald@ec.gc.ca
Dwight Williamson	Manitoba Water Stewardship, Winnipeg	(204) 945-7030	dwilliamso@gov.mb.ca
Joe O'Connor	Manitoba Water Stewardship, 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

APPENDIX E

IRRB MULTI-YEAR WORK PLAN: (2008-2012)

International Red River Board (IRBB) Multi-Year Work Plan: 2008-2012
Mandate 1
To assist the International Joint Commission in preventing and resolving transboundary disputes regarding the waters and aquatic ecosystems 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 (Directive to the International Red River Board from the IJC, February 7th, 2001, Item 3)
Geographical Scope of Mandate
The geographical scope of the IRRB is the Red River basin, excluding the Assiniboine and Souris Rivers (IJC Directive, Item 4). The mandate of the IRRB also includes the non-Red River geographic areas under the responsibility of the former International Souris-Red Rivers Engineering Board, including the Poplar and Big Muddy River basins, but excluding the Souris River basin (IJC Directive, Item 6)
Focus of Activities
Those factors that affect the Red River's water quality, water quantity, levels and ecological integrity (IJC Directive, Item 4)
Approach2
As an International Watershed Board, the IRRB: • Follows an integrated, ecosystem approach to issues arising in transboundary waters of the Red River Basin. • Promotes partnerships and improved collaboration, information sharing and coordination among stakeholders in the Red River Basin. • Works with and through existing institutions and organizations to strengthen local capacity and expand scientific knowledge of the watershed to address transboundary environmental challenges. • Strives to uphold the IJC's principles of independence, impartiality, openness and equal binational participation in search of consensus solutions based on the best available scientific data, taking into account existing statutory responsibilities of federal, provincial/state authorities, First Nations/tribes, and local authorities.

1 For the detailed mandate of the International Red River Board, see Directive to the International Red River Board from the International Joint Commission, February 7th, 2001, attached as Appendix 1 and available online: International Joint Commission <http://www.ijc.org/conseil_board/red_river/en/irrb_mandate_mandat.htm>.

2 Derived from International Joint Commission, *Draft Guiding Principles for the International Watersheds Initiative*, December 2007, online: International Joint Commission <http://www.ijc.org/php/publications/html/guiding_principles_e.htm>.

Strategic Objective: FLOOD PREPAREDNESS AND MITIGATION
The human and economic impacts of flooding in the Red River Basin are minimized.

Goals:

- Information is exchanged on an ongoing basis about flood planning and preparedness and mitigation activities in the basin and about accidental discharges, spills and droughts.
- A Comprehensive Flood Mitigation Strategy (CFMS) for the Red River is adopted by federal, state and provincial agencies and is fully implemented.
- Flooding and drainage concerns with respect to the Lower Pembina River are resolved.

Measures:

- Number of elements of CFMS that have been implemented.
- Frequency of flooding on the lower Pembina River.
- Number and severity of concerns expressed by governments, non-government groups and individuals with respect to flooding of the lower Pembina River.

Major activities for 2008-2012:

- Develop and implement the Comprehensive Flood Mitigation Strategy (targeted completion date: 2012)
- Develop a detailed hydraulic model to improve analysis of flow characteristics for existing and natural conditions on the lower portion of the Pembina River (model to be used to design a floodway or other flood damage reduction structure) (targeted completion date: xx).

Proposed Work plan activities for 2008-2009

Development of Comprehensive Flood Mitigation Strategy (CFMS)	Committee on Hydrology	Cost: Completion Date:
Complete Inventory of Flood Mitigation Activities in the Basin	Committee on Hydrology	Cost: Completion Date:
Lower Pembina River Hydraulic Modeling Project: Enhance the MIKE 11 Model for the Lower Pembina River. Available data to be included: • Ortho Photos for the Lower Pembina River to the confluence with the Red River from NDSWC, • Pembina River Structure Crossing Inventory (2006) from the RRBC, • 2006 LiDAR data for the Lower Pembina River from PFRA, • HEC-RAS model data, including: bridge cross-sections, culvert locations, and information on County Road #55 and the border dike from NDSWC	Committee on Hydrology (Lower Pembina Task Team):	Cost : $25K Completion Date: March 31, 2008
Lower Pembina - -continued	Lower Pembina Task Team	Cost: Completion Date:

Strategic Objective: WATER QUALITY
Water quality at the international boundary is at an acceptable level so that international disputes with respect to water quality in the Red River Basin are avoided and resolved.

Goals:

- Information is exchanged on an ongoing basis about activities affecting water quality in the basin.
- Existing water quality objectives are routinely met.
- "Alert levels" of other measured parameters are not exceeded.
- New water quality objectives for nutrients at the International Boundary are in place and are being met.
- A contingency plan is in effect for unplanned discharge of pollutants within the basin and excedences of either water quality objectives or alert levels are observed at the international boundary.

Measures:

- The extent to which and frequency with which existing IJC Water Quality Objectives are met (Total Dissolved Solids, Chloride, Sulphate, Dissolved Oxygen and Fecal Coliform).
- The extent to which and frequency with which other measured parameters exceed "alert levels" at the International Boundary (e.g. herbicides and pesticides).
- Progress in developing new agreed-upon nutrient objectives.
- Progress toward establishing an integrated water quality database for the basin.

Major activities for 2008-2012:

- Monitor water quality and report results (ongoing).
- Establish water quality objectives for nutrients for the Red River at the international boundary (nitrogen and phosphorus) (target completion date: xx)
- Put in place an integrated water quality data base for the basin (targeted completion date: xx)
- Develop and implement integrated monitoring program (biological and water quality) to assess the ecosystem health of the watershed(targeted completion date: xx)
- Update IRRB Contingency Plan (?) (targeted completion date: review plan in 20xx).

Proposed Work plan activities for 2008-2009

Monitoring Workshop with agencies responsible for water quality monitoring in the basin.	Aquatic Ecosystem Committee	Cost: $25,000 Completion Date:

Strategic Objective: AQUATIC ECOSYSTEM HEALTH **Water resources of the Red River of the North Basin support and maintain a balanced community of organisms with species composition, diversity and functional organization comparable to the natural habitats within the Basin without regard to political boundaries so that disputes with respect to aquatic ecosystem health are avoided.**		
Goals: • Information is exchanged on an ongoing basis about aquatic ecosystem health in the basin. • A system is in place to monitor the species composition, diversity and functional organization of aquatic organisms in the Basin and regular reporting has begun. • The presence and prevalence of pathogens and parasites in fish are well understood.		
Measures: • Progress toward developing new biological and non-native aquatic species monitoring programs for the basin. • Progress toward establishing an integrated water quality database for the basin.		
Major activities for 2008-2012: • Finalize and fully implement an ongoing biological monitoring program in the watershed (targeted completion date:) • Finalize and fully implement an ongoing monitoring program for non-native aquatic species in the watershed (target date:) • Complete comprehensive study of presence and prevalence of pathogens and parasites in fish from Devils Lake, Sheyenne River, Red River and Lake Winnipeg (targeted completion date: 2010)		
Proposed Work plan activities for 2008-2009		
Biological Monitoring Program: Study on Impacts of Human Settlement • Historical summary and synthesis of urban and rural settlement and expansion in the Basin. • Forecast of near and long-term population trends and potential impacts on aquatic ecosystems.	Aquatic Ecosystem Committee	Cost: $10,000* Completion Date: January 2009
Pathogens and Parasites Study, Year 2 of three-year comprehensive survey. • Collect and analyze data samples	Aquatic Ecosystem Committee	Cost: $ Completion Date: December 2009
* Item carried forward from 2005-2008 work plan.		

Strategic Objective: WATER QUANTITY
International disputes with respect to water quantity in the Red River Basin are avoided and resolved.

Goals:

- Information is exchanged on an ongoing basis about activities affecting water quantity in the basin.
- Agreement is reached with respect to procedures for the apportionment of the waters of the Red River basin at the International Boundary.

Measures:

- Progress toward adoption of a framework procedure for water quantity apportionment.

Major activities for 2008-2012:

- Develop a framework procedure for water quality apportionment, including a mutually acceptable method for computing the natural flow of waters in the U.S. portion of the Red River basin (targeted completion date: xx)

Proposed Work plan activities for 2008-2009

Apportionment Project: Year I of multi-phase strategy for establishing apportionment procedures [need details]	Committee on Hydrology	Cost: Completion Date:

Strategic Objective: OUTREACH AND ENGAGEMENT
The IRBB's work is enhanced by its relationships with key stakeholders and interested members of the public.

Goals:

- Strong working relationships are developed and maintained with local and regional water and watershed organizations.
- Strong working relationships are developed and maintained with First Nations and Native Americans in the basin.
- The IRRB's experiences and knowledge are shared with other organizations.
- A high level of public interest is maintained in the activities of the IRRB.

Measures:

- Extent to which organizations and individuals participate in IRRB meetings and provide input to projects and initiatives.

Major activities for 2008-2012:

- Participate in water-related conferences, workshops and forums, providing input and status reports on the work of the IRBB.
- Develop, update and distribute public display, fact sheets and information bulletins.

Proposed Work plan activities for 2008-2009

International Symposium on flood Disaster Prevention, Toronto, May 2008 • IRRB to lead two-hour session on Red River Basin, 10 Years after flood of 1997	Committee on Hydrology	Cost: Completion Date: May 2008

Blank Page