BETTER TREATMENT

'TAKING ACTION TO IMPROVE WATER QUALITY'

Report on Public Hearings

City of Winnipeg
Wastewater Collection and Treatment Systems

Presiding:

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Foreword

The United Nations *International Year of Freshwater - 2003* - serves to remind us that freshwater is precious and essential for life on our planet. It is indispensable for satisfying basic human needs and maintaining regional and global ecosystems.

In Manitoba, freshwater is vital to sustaining our natural environment, our economy and our quality of life. It is the basis for the Province's fisheries, tourism and agricultural industries and provides abundant recreational opportunities. However, there are signs on the horizon suggesting that our water resources are seriously threatened.

This report is a 'call to action' for the City of Winnipeg. It calls upon the City to do its part to improve water quality in the Red and Assiniboine rivers for the benefit of all Manitobans. It also challenges the Province and the City to work together in implementing sound and sustainable water policies and demonstrating their joint commitment to environmental stewardship. This report seeks the development of a comprehensive action plan to raise awareness, promote best water quality management practices and mobilize resources to meet the challenge of protecting and enhancing Manitoba's key waterways.

The year 2003 will mark an important milestone for all Manitobans if the City and the Province join together in response to the call for action that is outlined in this report.

Executive Summary

At the request of Manitoba's Minister of Conservation, the Manitoba Clean Environment Commission (CEC) conducted a public hearing on the City of Winnipeg's wastewater collection and treatment systems. The hearing was called partly in response to a spill of raw sewage from Winnipeg's North End Water Pollution Control Centre into the Red River on September 16, 2002. The mandate given to the Commission was to review the City's wastewater systems and related public concerns, and to provide a report to the Minister with advice and recommendations.

The Commission conducted the hearing in Winnipeg from January 20 to 22, 2003 and in Selkirk on January 27 and 28, 2003. Two motions were tabled on January 21, 2003 that called for suspension of the proceedings, further public review and preparation of an Environmental Impact Statement. On January 28, 2003, the Commission adjourned the hearing, requested that the City of Winnipeg provide additional information in an Environmental Impact Statement, advised that it would seek involvement of federal departments and committed to preparation of an interim report on the September 16, 2002 sewage spill. The City of Winnipeg submitted its Environmental Impact Statement on February 28, 2003 and, following filing of the Commission's interim report, the hearing was reconvened in Winnipeg from April 14 to 16, 2003.

Over 750 members of the public attended the hearings in Winnipeg and Selkirk. The four-member Panel heard presentations from Manitoba Conservation, the City of Winnipeg, the Department of Fisheries and Oceans, and Environment Canada, as well as groups that received participant funding assistance. Written and oral presentations were also received from 28 other organizations and individuals. The Commission registered a total of 126 exhibits during the nine days of hearings.

In response to recommendations in the Commission's 1992 public hearing report on water quality objectives and to direction provided by Manitoba Conservation, the City of Winnipeg proposed a 50-year pollution prevention plan to achieve Manitoba's *Water Quality Standards, Objectives and Guidelines.* The plan components included effluent disinfection, combined sewer overflow control, ammonia treatment, nutrient reduction, and biosolids (solid by-product of wastewater treatment) management. The City's Environmental Impact Statement also provided information on potential environmental effects of plan components, proposed measures to mitigate adverse effects and assessed the significance of residual environmental effects.

During the course of the hearing, the Commissioners heard a large number of concerns from individuals, environmental organizations, funded participants, and local and federal government officials. The concerns related to the impact of the spill of raw sewage on the environment and human health; effects of treated wastewaters and untreated sewer overflows on the Red and Assiniboine rivers; effects of nutrients and other substances on Lake Winnipeg; disposal of landfill leachate; training and certification of operators; standard operating procedures; emergency response plans; environmental management systems; consultation with the public and Aboriginal communities; and others

The Commission believes there is evidence to substantiate that Winnipeg's treated municipal wastewaters and untreated combined sewer overflows are adversely impacting the aquatic environments of the Red and Assiniboine rivers and Lake Winnipeg. While the Commission understands that Winnipeg is not the only contributor of pollutants to the Red and Assiniboine rivers or nutrients to Lake Winnipeg, the City's wastewater treatment plants and combined sewer outfalls are point sources that can be controlled. This provides the City of Winnipeg with an opportunity to take responsible action and demonstrate environmental stewardship for the benefit of all Manitobans.

The Commission is confident that, with Winnipeg's commitment to implement recommendations outlined in various investigative reports presented during the hearing and those in the Commission's interim report, the risk of future releases of raw sewage into the Red River from the North End Water Pollution Control Centre will be minimized. The Commission remains optimistic that reductions in the frequency, duration and magnitude of combined sewer overflows can be reduced to acceptable levels within a much shorter timeframe than that proposed by the City. Furthermore, the Commission believes that meaningful progress on effective management and mitigation of combined sewer overflows can be achieved within two years.

The Commission concluded that if *Environment Act* licences are issued for Winnipeg's three water pollution control centres, they should be granted on an 'interim' basis only, with a major public review on the City's evolving plan within two years. Many of the recommendations in this report can be implemented before then. The review should be conducted by the Commission based on detailed *Environment Act* licence proposals and an Environmental Impact Statement prepared in accordance with publicly reviewed guidelines issued by Manitoba Conservation. Subsequently, the Commission believes that it should be called upon to review the licences every three years until such time as the City has achieved significant, measurable progress toward

completing its long-term plan. In summary, the Commission presented the following twenty recommendations:

Wastewater Treatment Plant Licencing

1. If *Environment Act* licences are issued for Winnipeg's three water pollution control centres, these licences should be issued on an 'interim' basis only.
2. The 'interim' *Environment Act* licences for Winnipeg's three water pollution control centres should be reviewed again in two years and every three years thereafter.
3. Manitoba Conservation should establish 'interim' effluent limits for Winnipeg's three water pollution control centres in accordance with Manitoba's *Water Quality Standards, Objectives and Guidelines*.

Environmental Impact Statement

4. The City of Winnipeg should be directed to prepare a comprehensive Environmental Impact Statement prior to the review of its three water pollution control centre 'interim' *Environment Act* licenses.

Nutrient Management Strategy

5. Manitoba Conservation should accelerate the schedule to complete the Nutrient Management Strategy for Southern Manitoba by December 2004.

6. The City of Winnipeg should be directed to plan for the removal of nitrogen and phosphorus from its municipal wastewaters, and to take immediate steps in support of the nutrient reduction targets established for Lake Winnipeg. The City's nutrient removal plan should be a key element of a licence review hearing to be scheduled within two years.

Combined Sewer Overflow Reduction

7. The City of Winnipeg should be directed to shorten the timeframe to complete its combined sewer overflow plan from the proposed 50 years to a 20 to 25-year period.

8. The City of Winnipeg should be directed to take immediate action to reduce combined sewer overflows by instrumenting outfalls, adjusting weirs, accelerating combined sewer replacement, advancing the pilot retention project and undertaking other reasonable measures to reduce combined sewer overflows within two years.

Public Notification System

9. The City of Winnipeg should be directed to develop and implement a notification system to inform the public whenever there is a release of raw sewage from any source into the Red and/or Assiniboine rivers. This public notification system should be operational by the beginning of the 2004 summer recreation season.

Wastewater Treatment System

10. The City of Winnipeg should be directed to proceed with disinfection of wastewaters at the North End Water Pollution Control Centre without delay, and should routinely test for pathogens in all wastewater discharges.

11. The City of Winnipeg should be directed to complete risk and criticality assessments at Winnipeg's three water pollution control centres by April 2004 and implement recommendations arising from such assessments to minimize the risk of future spills of untreated sewage.

12. The City of Winnipeg should be directed to increase the number of parameters measured in its influent and effluent streams to include contaminants of concern such as heavy metals, organochlorines, endocrine disrupting substances and pharmaceuticals.

13. The City of Winnipeg should be directed to implement changes to Winnipeg's Sewer By-Law that would expand the list of restricted substances, prevent disposal of contaminants of concern, encourage treatment at source, improve enforcement of the By-Law and increase penalties for violations.

14. The City of Winnipeg should be directed to stop the practice of disposing of landfill leachate at its water pollution control centres within a period of eighteen months.

Financial Support

15. The City of Winnipeg should be directly assisted by the Province of Manitoba in efforts to secure financial support under existing and future infrastructure programs for upgrades to its wastewater collection and treatment systems.

Environmental Management System

16. The City of Winnipeg should be directed to immediately begin development and implementation of an Environmental Management System for Winnipeg's three water pollution control centres with a completion date of no later than April 2005 with major components of the management system implemented much sooner.

Public Education

17. The City of Winnipeg should be strongly encouraged to develop and implement a permanent public education program to improve awareness of Winnipeg's wastewater collection and treatment systems, and to foster public involvement in activities focusing on water conservation and pollution prevention at source.

Public Consultation

18. The City of Winnipeg should be directed to prepare a public consultation plan for Winnipeg's wastewater collection and treatment systems for approval by Manitoba Conservation by April 2004.

Aboriginal Consultation

19. The City of Winnipeg should be encouraged and assisted by the Province, in cooperation with the federal government, to immediately begin developing and implementing a meaningful consultation program with Aboriginal communities concerning the continued operation and future development of its wastewater collection and treatment systems.

Environmental Research and Monitoring

20. A cooperative, cost-shared environmental research and monitoring program involving the City of Winnipeg, Province of Manitoba and the federal government should be established for the Red and Assiniboine rivers and Lake Winnipeg.

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Introduction

Background

During 1980 and 1981, the Manitoba Clean Environment Commission (CEC) conducted public hearings and issued a report [(1)] on the application of water quality objectives for the Red River Basin. The hearings followed a 1978 Commission report [(2)] recommending adoption of a program to establish water quality objectives and stream classification for all watersheds in Manitoba. The Commission's 1981 report provided conclusions and recommendations on Manitoba's water quality objectives and stream classification system, and on the City of Winnipeg's wastewater treatment systems. The recommendations set out specifics relating to fecal coliform limits, effluent disinfection, dissolved oxygen levels and tertiary treatment.

The Commission conducted further public hearings in 1991 and 1992 on water quality objectives for the Red and Assiniboine rivers and tributary streams within and downstream of the City of Winnipeg. The Commission's 1992 report [(3)] detailed recommendations relating to Manitoba's proposed surface water quality objectives, ammonia and fecal coliform (combined sewer overflow) studies, public warning systems and other related matters. Reports from the recommended ammonia and fecal coliform studies were to be submitted before 1997 and a public hearing was to be held within six months after that date to establish ammonia and fecal coliform objectives.

Sewage Release

On September 16, 2002, a mechanical failure at the City of Winnipeg's North End Water Pollution Control Centre resulted in a spill of raw sewage into the Red River. The release continued over a 57-hour period during which 427 million Litres of untreated sewage were discharged. The sewage spill caused widespread public concern, particularly by downstream residents and resource users, and resulted in extensive media coverage. The spill resulted in investigative reports by the City of Winnipeg, Manitoba Conservation and Associated Engineering, an investigation by Environment Canada, a water quality assessment by Manitoba Conservation and a hearing by the Clean Environment Commission.

Public Hearing

On October 3, 2002, the Minister of Conservation requested that the Commission convene a public hearing to review the City of Winnipeg's wastewater collection and treatment systems, and receive comments and concerns from the public respecting these systems. The Commission was also requested to provide a report with advice and recommendations to the Minister.

The Commission conducted hearings in Winnipeg from January 21 to 23, 2003 and in Selkirk from January 27 to 28, 2003. A member of a funded participant group (recipient of a financial award to facilitate hearing participation) presented two motions on January 21, 2003 calling for suspension of the proceedings, further public review and preparation of an Environmental Impact Statement. On January 28, 2003, the Commission suspended the hearing, requested that the City prepare an Environmental Impact Statement to assist in the Panel's review, advised that it would seek the involvement of federal departments, and committed to filing an interim report on the sewage spill with the Minister.

The City of Winnipeg provided the requested Environmental Impact Statement to Manitoba Conservation on February 28, 2003 and, following submission of the Commission's interim report on the sewage spill on April 1, 2003, the hearing reconvened in Winnipeg from April 14 to 16, 2003.

Purpose of Report

The purpose of this report is to provide the Minister of Conservation with advice and recommendations relating to the City of Winnipeg's wastewater collection and treatment systems based upon evidence presented at the public hearing. The report also incorporates recommendations from the Commission's interim report on the September 16, 2002 sewage spill[(4)].

Report Organization

Introductory and background information is provided in the Introduction, Public Hearing Process, Wastewater Collection and Treatment Systems and Regulatory Context sections. Evidence presented at the hearing by the proponent, the regulators, the funded participant groups and the public, as well as conclusions by the Commission are summarized in the Issues section. The Observations section contains comments and suggestions for consideration by government on

matters of interest. The Recommendations section provides advice and direction to the Minister of Conservation on matters of concern directly related to the *Terms of Reference* for the hearing.

Public Hearing Process

Clean Environment Commission

The Manitoba Clean Environment Commission is an arms-length provincial agency that operates under the authority of *The Environment Act*. The Commission encourages and facilitates public involvement in environmental matters, and offers advice and recommendations to the government on sustainable development, environmental issues and licencing proposals. Its mandate is exercised through public hearings, investigations, mediation and education. Membership on the Commission includes a full-time Chairperson and fifteen part-time Commissioners appointed by Order-in-Council.

The panel of Commissioners formed for the City of Winnipeg's wastewater collection and treatment systems public hearing consisted of Mr. Terry Duguid (Chairperson), Mr. Ian Halket, Ms. Myrle Traverse and Mr. Ken Wait.

Participant Assistance Program

Manitoba Conservation announced a Participant Assistance Program for the public hearing on November 7, 2002. This Program provides financial assistance to groups or individuals participating in the public hearing process. Two applicants were awarded a combined total of $30,000 based on recommendations of a participant assistance panel consisting of Commissioners Mr. Moses Okimow (Chairperson), Mr. Wayne Sato and Mr. Ken Gibbons. One of the successful applicants later declined the award. The remaining funded participant was the "Ad Hoc Group" which consisted of five members representing various environmental interests.

A second Public Participation Program was announced for the reconvened public hearing by Manitoba Conservation on January 31, 2003. Based on recommendations from the participant assistance panel, four groups were awarded a total of approximately $20,000 to participate in the hearing. The successful participants were the Ad Hoc Group, the Winnipeg Fish and Game Association, the St. Norbert Arts Council, and Paul Clifton and Janet Vanderkruys.

Mandate and Scope

The Minster of Conservation requested that the Clean Environment Commission conduct a public hearing pursuant to clause 6(5)(b) of *The Environment Act* to review the City of Winnipeg's

wastewater collection and treatment systems, and to receive public comments and concerns respecting those systems. The Commission was also asked to provide a report with advice and recommendations to the Minister in accordance with Subsection 7(3) of *The Environment Act.*

The scope of the Commission's review included:

- Reliability of the City's systems, especially the back-up capability of the systems, to prevent a discharge of inadequately treated sewage to the rivers during malfunctions.
- Appropriate ammonia, nutrient, combined sewer overflow and microbiological limits on effluent from the City's systems necessary to protect the aquatic environment and recreational activities, including in Lake Winnipeg.
- Current and planned effectiveness of the City's wastewater treatment systems to achieve discharge limits.
- Adequacy of the City's plans and schedule for upgrading the systems.
- Adequacy of processes being followed in reviewing those plans and schedule.

The Commission was also asked to consider applicable recommendations in the Commission's 1992 report on surface water quality objectives [(3)] and the recently updated Manitoba *Water Quality Standards Objectives and Guidelines*. *Terms of Reference* for the hearing are provided in Appendix A.

Notification

Notice of the public hearing was first issued as a Manitoba Government news release on October 7, 2002. Subsequently, the Commission announced the hearing dates and locations to the news media on October 31, 2002, and placed notices in the Winnipeg Free Press, La Liberté and the Selkirk Journal beginning November 2, 2002. Notices for the reconvened hearing were placed in the same area newspapers beginning March 15, 2003.

Public hearing notices were mailed to over 700 government offices, businesses, organizations and individuals on the Commission's mailing list. Notices of the hearing were also posted on the Manitoba Conservation and Commission web sites.

Schedule and Format

The first session of the public hearing was held in Winnipeg from January 20 to 23 and in Selkirk from January 27 to 28, 2003. The reconvened hearing was held in Winnipeg from April 14 to 16, 2003.

The initial public hearing in Winnipeg consisted of opening remarks by the Commission Chair and presentations by Manitoba Conservation, the City of Winnipeg, the funded participants, Environment Canada and members of the public. In Selkirk, the Commission provided opening remarks followed by short presentations by the City of Winnipeg and Manitoba Conservation. The format for the reconvened hearing in Winnipeg consisted of opening remarks by the Commission Chair and presentations by Manitoba Conservation, the City of Winnipeg, Department of Fisheries and Oceans, Environment Canada, funded participants and members of the public. Manitoba Conservation, the City of Winnipeg and the funded participants were all subject to questioning by each other, the panel and the public. A list of registered presenters is provided in Appendix B.

The public hearing was recorded and a transcript of the proceedings was produced for the public record. Written summaries of the proceedings were prepared after the hearing and posted on the Commission's web site.

Attendance

About 750 people including private citizens, business owners, government workers, consultants, environmental professionals and students attended the public hearing in Winnipeg and Selkirk. Most of these attendees were from the Winnipeg and Selkirk areas, with several individuals from rural Manitoba, Ontario and the United States.

Documentation

Reports produced by the City of Winnipeg's Water and Waste Department as well as related publications prepared by Manitoba Conservation were placed in the Public Registry. Documentation was also made available in electronic format on Manitoba Conservation's web site.

Exhibits

A total of 126 exhibits were recorded during the nine days of the public hearing (Appendix C).

Wastewater Collection and Treatment Systems

Wastewater Collection System

The City of Winnipeg wastewater collection system consists of combined, separate and interceptor sewers, land drainage systems, lift stations and diversion structures.

Combined Sewers

A combined sewer is a single pipe system that collects both municipal sewage and surface runoff from a defined service area. The older, central region of Winnipeg is served by 1,034 km of combined sewer (Figure 1). Prior to 1937, the collected sewage and storm runoff were discharged directly to local rivers. In 1937, an interceptor system was built to convey sewage in the combined sewer system to the North End Water Pollution Control Centre for treatment. Weirs were installed in all combined sewers near their outfalls to divert sewage to the interceptor system during low flow (dry weather) conditions but allow sewage to overflow to the river during high flow (wet weather) conditions.

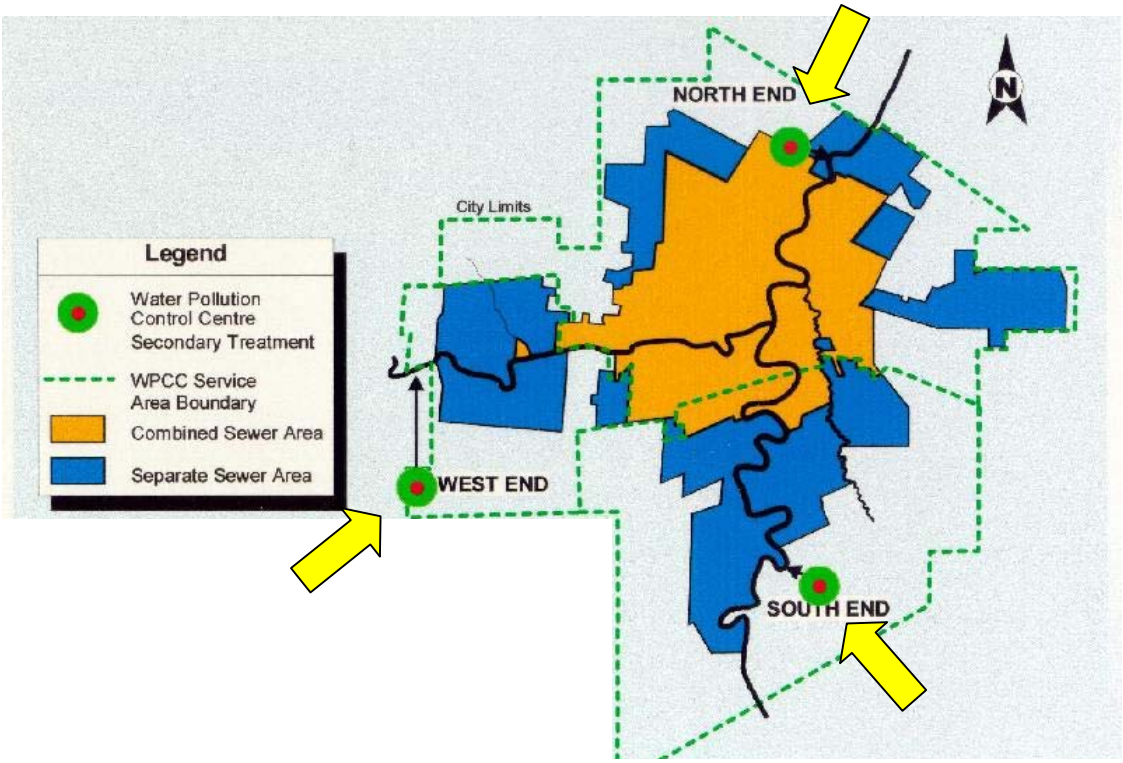

Figure 1. City of Winnipeg water pollution control centres and sewer areas

Historically, there were 43 combined sewer districts, which served approximately 10,500 ha within the City of Winnipeg. The combined sewer area has been reduced to approximately 8,700 ha or 30% of the City. Presently, there are 79 combined sewer outfalls to the rivers including relief pipes installed as part of a basement flooding relief program. Computer modelling of the combined sewer system over the past 40 years shows that combined sewer overflows occur an average of 18 times during the open water recreational season. The actual number ranges from 7 to 30 overflows depending on the combined sewer district. In a typical year, about 7.0 million m^3 of sewage is released from the combined sewer system through the outfalls into the river.

Separate Sewers

Since 1960, new developments in the City of Winnipeg have been serviced by a two-pipe system – one for sewage and the other for storm water (Figure 1). The sewage or sanitary sewer system consists of a 1,182 km dedicated piping system that is completely separated from the land drainage system. The role of the separate sanitary sewer system is to collect wastewater from domestic, commercial, institutional and industrial sources, and to convey it to a water pollution control centre for treatment.

Under normal dry weather conditions, all sanitary sewage is collected and conveyed to one of the three water pollution control centres. However, overflows from the separate sewers to the rivers is possible as a result of precipitation events or equipment malfunctions, so as to protect against wastewaters reaching levels that could result in basement flooding.

Interceptor Sewers

The interceptor sewers convey sanitary wastewater from the separate and combined sewer systems to the three water pollution control centres. There are 130 km of interceptor sewers in the City.

Land Drainage Sewers

Separate land drainage storm sewer systems have been used in new developments since the 1960s. The purpose of these systems is to carry rainfall and snowmelt runoff from urban areas to local watercourses. There are 1,372 km of land drainage sewers in Winnipeg. Total developed area with separate wastewater and land drainage areas is approximately 22,300 ha.

Lift Stations and Diversion Structures

Because of Winnipeg's relatively flat terrain it is necessary to pump wastewater using lift stations to the interceptor sewers or to the water pollution control centres, or in some cases, to trunk sewers. The primary purpose of a lift station is to raise sewage to a given elevation so that it can be discharged into a sewer system where it can flow by gravity. There are 76 wastewater pumping stations and 10 gravity-based wastewater diversion facilities distributed throughout the City.

Wastewater Treatment System

The City of Winnipeg wastewater treatment system consists of the North, West and South End Water Pollution Control Centres (Figure 1).

North End Water Pollution Control Centre

The North End Sewage Treatment Plant opened in 1937 (Figure 1). The plant has been upgraded and expanded over the past 66 years to become the North End Water Pollution Control Centre. The North End facility accepts municipal wastewaters generated from the north and central parts of Winnipeg, representing about 70% of the City or approximately 370,000 residents. The facility provides primary and secondary activated sludge treatment, and sludge processing. Treated wastewater is discharged to the Red River, which flows about 50 km north to Lake Winnipeg. It has a design population capacity of 395,000 and currently serves 374,000. The facility also accepts leachate from City landfills and septage from the Winnipeg area. Average design and actual dry weather flows are 332 and 226 million litres per day, respectively. Sewage sludge or biosolids are dewatered and are either applied to agricultural land north of Winnipeg or taken to the Brady Landfill.

West End Water Pollution Control Centre

The West End Water Pollution Control Centre is located west of Winnipeg and services the Charleswood, Assiniboia and St. James areas (Figure 1). The facility's sewage lagoons were first commissioned in 1964. A mechanical aeration plant was put into operation in 1976 and the facility upgraded to a conventional secondary treatment plant in 1994. The lagoons have been operated for effluent polishing since 1998. The facility has a design population capacity of 98,000 and currently serves 86,000. Average design and actual dry weather flows are 38 and 30 million litres

per day, respectively. Sewage sludge is transported to the North End Water Pollution Control Centre for processing.

South End Water Pollution Control Centre

The South End Water Pollution Control Centre is located south of the City and services Fort Garry, St. Vital and St. Boniface (Figure 1). The facility was constructed in 1974 with a high purity oxygen secondary treatment system. The plant was expanded in 1993 and ultraviolet effluent disinfection installed in 1999. It has a design population capacity of 169,000 and currently serves 160,000. Average design and actual dry weather flows are 70 and 60 million litres per day, respectively. Sewage sludge from the South End facility is processed at the North End Water Pollution Control Centre.

Regulatory and Policy Context

Environment Canada

Ammonia Toxicity

Toxic substances are regulated in Canada under the *Canadian Environmental Protection Act* 1999. Respecting pollution prevention, the Act provides for protection of the environment and human health in order to contribute to sustainable development. The Act provides Environment Canada with the authority to assess and manage toxic substances and prevent pollution that could harm the environment and human health.

Environment Canada also administers the pollution prevention provisions of the *Fisheries Act* that fall under Subsection 36(3) and related sections. Subsection 36(3) prohibits the deposit of deleterious substances into water frequented by fish. Deleterious substances include those that are directly toxic or harmful to fish or fish habitat, or that can break down, degrade or alter water quality so that the water is, or may become, harmful to fish and fish habitat.

Ammonia as well as other substances such as inorganic chloramines, nonylphenols and chlorinated wastewater effluents have been designated as toxic under the *Canadian Environmental Protection Act* 1999. As part of its long-term strategy, Environment Canada also intends to work with others to develop a regulation under the *Fisheries Act* for municipal wastewater effluents.

Environment Canada's risk management objective for ammonia suggests no lethality from ammonia in the receiving environment or in the discharge (end of pipe) based on a calculated site-specific discharge limit that includes effluent pH and total ammonia, and receiving water pH and temperature. With respect to exceedences of this objective, Environment Canada would expect the City of Winnipeg to prepare and implement a pollution prevention plan according to a pre-defined schedule under the *Canadian Environmental Protection Act* 1999.

Nutrient Management

Environment Canada's concerns about the effects of nutrients on the environment are summarized in its report *Nutrients and Their Impact on the Canadian Environment* [(5)]. The report concludes that nitrogen and phosphorus loadings from human activity have accelerated eutrophication of certain lakes and rivers resulting in loss of habitat, changes in biodiversity and

loss of recreational potential, and that municipal sewage is the largest point source of nitrogen and phosphorus to freshwater in Canada. The cumulative impact of various point and non-point discharges of nitrogen and phosphorus on Lake Winnipeg is of particular concern.

Environment Canada stated that it believes the stage has been set for immediate action in Manitoba on non-point sources of nutrients to the Red River and Lake Winnipeg, and it is timely to address point sources of nutrients such as City of Winnipeg municipal wastewaters when opportunities such as issuance of new licences or review of existing licences arise.

Manitoba Conservation

Licencing

The City of Winnipeg submitted *Environment Act* proposals to licence its three water pollution control centres to Manitoba Conservation in 1990. In response to the proposals, the Commission held public hearings in 1991 and 1992 to determine surface water quality objectives for the Red and Assiniboine rivers and tributaries in the Winnipeg region required for the protection of current and future uses of those waters. The Commission's 1992 report[(3)] contained fourteen recommendations including site-specific studies respecting combined sewer overflows and un-ionized ammonia. The studies were to be completed in 1997 and then be subject to a public hearing.

As a result of the September 16, 2002 spill of raw sewage at the North End Water Pollution Control Centre, the Minister of Conservation requested that the Commission conduct a public hearing to review the spill event and the City of Winnipeg's wastewater collection and treatment systems, and to provide advice and recommendations. The scope of the review is outlined in Appendix A. Following the conclusion of the hearing and receipt of a report from the Commission, Manitoba Conservation indicated that it will develop and issue *Environment Act* licences for the City's three water pollution control centers. The Department has also stated that the draft licences will be made available for public review.

Water Quality Standards, Objectives and Guidelines

Manitoba's *Water Quality Standards, Objectives and Guidelines* provide for the protection of surface and groundwater as well as overall ecosystem integrity in the Province (Exhibit 5). They have been subject to public, stakeholder and technical review, and are at the final draft stage.

Standards, objectives and guidelines are provided for over 100 substances including dissolved oxygen, bacteria, nutrients, metals, organics, etc. They are provided as Tier I Standards, Tier II Objectives and Tier III Guidelines. The three-tiered approach is used to consolidate and harmonize Manitoba's approach with that developed through other programs in Canada.

A variety of scientific tools and management strategies are used proactively to protect, maintain and rehabilitate water quality in Manitoba. Two water quality management strategies are used simultaneously. First, all activities and waste discharges are controlled to the extent that it is reasonably practical and economically feasible using a consistent technology-based approach. Second, when more stringent environmental controls are required to protect important water uses, a water quality-based approach is used. Additional environmental limits are derived to ensure that applicable water quality standards, objectives and guidelines are not exceeded.

Modifications are made to the *Water Quality Standards Objectives and Guidelines* as region-specific or site-specific objectives are developed and new principles relating to environmental protection in Canada formulated through national consultative processes (e.g. those being pursued by the Canadian Council of Ministers of the Environment).

Nutrient Management Strategy

A draft *Nutrient Management Strategy for Surface Waters in Southern Manitoba* [(6)] was released by Manitoba Conservation for public review in 2000 to address the issue of enrichment of surface waters in southern Manitoba with plant nutrients such as nitrogen and phosphorus. The draft strategy identifies the main challenges, tasks and issues that will have to be considered in developing appropriate water quality objectives for prairie streams and receiving lakes such as Lake Winnipeg. As required, this will also involve developing an implementation plan to achieve reductions of nutrient loadings. The nutrient management strategy is planned to undergo public and stakeholder review in 2003 before being finalized in 2004.

Lake Winnipeg Action Plan

A *Lake Winnipeg Action Plan* [(7)] was announced by the Minster of Conservation at the Clean Environment Commission-sponsored Freshwater Forum held in Winnipeg during February 2003. The action plan includes establishment of a Lake Winnipeg Stewardship Board to help identify further actions necessary to reduce phosphorus and nitrogen in Lake Winnipeg to pre-1970 levels by 10 and 13% or more, respectively, subject to further findings of Manitoba's nutrient

management strategy. Other actions announced include enhanced riparian protection, better programs for soil testing, tightened regulations for sewage and septic systems and additional requirements for larger treatment systems. As a result of the *Lake Winnipeg Action Plan*, the provincial priority for nutrient management has been elevated to the same as that for ammonia reduction.

Water Strategy

The *Lake Winnipeg Action Plan* was subsequently incorporated into Manitoba's *Water Strategy* announced in April 2003 [(7)]. The goal of the strategy is to develop watershed-based planning across the entire Province to ensure that future management of water-related issues is undertaken comprehensively. A sustainable approach is required to ensure that all needs are met while maintaining ecosystem protection. The strategy identifies six interrelated policy areas: water quality, conservation, use and allocation, water supply, flooding and drainage. The objective of Manitoba's water quality policies is to protect and enhance aquatic ecosystems by ensuring that surface and groundwater quality is adequate for all designated uses and ecosystem needs.

City of Winnipeg

The City of Winnipeg Sewer By-Law No. 7070/97 regulates construction and approval of sewers, discharges to sewers, sewer rates, over-strength wastewaters and other matters relating to the City's wastewater collection system. Part 5 of the By-Law provides for "Control of Discharge to Sewers" and Part 7 deals with "Over-strength Wastewaters". Disposal of over-strength wastewater or wastewater containing pollutants or having characteristics exceeding those scheduled in Section 25 of the By-Law requires a licence issued by the City of Winnipeg. Part 7 of the By-Law deals with over-strength wastewaters that are not considered to be hazardous waste.

Issues

This section presents information on environmental, social, economic and other issues raised by the public, the funded participants, the government interveners and the Commission at the public hearing on the City of Winnipeg's wastewater collection and treatment systems. The issues include matters of concern, contention or disagreement that fall within the Commission's *Terms of Reference*, and warrant further consideration and action by government. A concluding statement summarizing the Commission's opinion is highlighted at the end of each issue. The information on issues is presented as background in support of the Commission's recommendations to the Minister. There is no implied order of importance in which the sequence the issues are presented.

Purpose of Public Hearing

Based on the *Terms of Reference* for the public hearing, the Commission and many of the participants understood that the purpose of the hearing was to "review" the City of Winnipeg's wastewater systems and not to consider the question of the issuance of *Environment Act* licences for the City's water pollution control centres. Licencing was not specifically mentioned in the Terms, although a request was included for the Commission to comment on certain substance control limits (Appendix A). On the first day of the hearing a member of the Ad Hoc Group stated that correspondence had been received from the Minster of Conservation indicating that Manitoba Conservation would issue *Environment Act* licences for the City's three sewage treatment plants at the conclusion of the hearing. The Department confirmed that licences would be issued for the three water pollution control centres following receipt of the Commission's report (Exhibit 3). While agreeing with the "review" nature of the hearing, Manitoba Conservation reinforced its intention to proceed directly to licencing. The Department further asserted that the City had submitted the necessary *Environment Act* licence proposal documentation in 1990.

Participants expressed concern that proceeding directly to licencing of the City of Winnipeg's water pollution control centres would limit public input on all relevant issues. It was argued that the 1990 proposals were no longer valid as municipal wastewater technologies have evolved, and there are new and emerging issues related to contaminants in municipal wastewater. One of the participants noted that insufficient time was provided for meaningful public review of the information submitted by the City with respect to licencing. Another participant suggested that more applications for participant assistance would have been submitted and the applications would have been more focused on licencing issues if it was known that the hearing would lead directly to licencing. It was also noted that attendance at the hearing would likely have been

greater, different people may have attended, more submissions would have been registered and the participants would have been better informed and prepared had the licencing nature of the hearing been more clearly enunciated.

Confusion over the purpose of the hearing led a member of the Ad Hoc Group to submit two motions for the Commission to suspend the hearing at the conclusion of the Winnipeg session and resume the hearing in Selkirk once additional documentation was provided. One of the motions called for the hearing to resume after a 90-day period so that the public would have an opportunity to review and comment on the documentation for licencing (Exhibit 50). The other motion requested that the hearing resume after the City of Winnipeg had submitted a licencing request and Environmental Impact Statement (Exhibit 49). The motions also requested that the Minster of Conservation reopen the participant assistance program to facilitate broader and more informed public participation.

The Commission responded to the two motions on January 28, 2003 by requesting that the City of Winnipeg provide an Environmental Impact Statement to Manitoba Conservation by February 28, 2003 and announcing that the public hearing would be reconvened in April 2003, to consider the Environmental Impact Statement and associated documentation. The Commission also stated that it would provide a report to the Minister of Conservation on the September 16, 2002 spill of raw sewage into the Red River by April 1, 2003.

The Commission believes that the direction given by the Minister of Conservation was to conduct a review hearing respecting the City of Winnipeg's wastewater collection and treatment systems including the September 16, 2002 sewage spill. It was believed that the three water pollution control centres would be licenced at some time in the future and that further public hearings would likely be called for that purpose.

The Commission is further of the opinion that a 12-year period between the submission of the City's original *Environment Act* proposal and the public hearing to consider the proposal is too great to consider the original documentation as adequate.

Finally, the Commission believes that the submission of a full and complete Environmental Impact Statement at the beginning of the public review process would have served to focus the proceedings on the important environmental, social and economic issues.

Environmental Impact Statement

The City of Winnipeg introduced its Environmental Impact Statement on the continued operation and future development of Winnipeg's wastewater systems at the reconvened pubic hearing in Winnipeg (Exhibits 89, 90). The City described the impact statement in terms of the benefits and adequacy of its wastewater operations and plans for the future, environmental responsibility and commitment for future improvements. The City went on to note that there was no prior indication that an environmental assessment was needed, the 30-day timeframe to complete the document was insufficient considering the scope of the assessment and, finally, noted that the 'effects assessment' was a first of its kind requested of any proponent in Manitoba.

The Ad Hoc Group strongly criticised the Environmental Impact Statement as a "repackaging of existing information" (Exhibits 95, 96, 97). The Group noted that the impact statement does not meet "best practice" standards and no scientific methods were used to identify and assess the environmental effects. They commented that the document does not include a comparison of alternatives including the *status quo*, a description of baseline or background environmental conditions or a full consideration of all environmental effects in a quantitative manner. They considered the socio-economic, health, cultural and cumulative effects components of the document to be particularly deficient. The Group also noted that the term "significance" is not defined and there is insufficient information to make a decision regarding the significance of the residual environmental effects.

The Ad Hoc Group went on to describe what is required by best practice for a cumulative effects assessment with reference to Canadian and United States sources (Exhibit 96). They advised that cumulative effects or impact was defined as the *"impact on the environment which results from the incremental impact of one action when added to other past, present and reasonably foreseeable future action regardless of which agency or person undertakes such other actions".* The Group discussed key considerations when assessing cumulative effects including issues identification, spatial and temporal scales, mitigation, follow-up and significance, and described procedural steps followed in a cumulative effects assessment. The Group recommended that the City be ordered to complete an appropriate cumulative effects assessment and submit it to Manitoba Conservation within two years after licencing.

The Ad Hoc Group concluded their review by stating that the Environmental Impact Statement was an insufficient response to the Commission's direction (Exhibit 96). The Group also

concluded that the document failed to achieve the basic requirements of an 'effects assessment' listed in the COSDI (Committee on Sustainable Development Implementation) Report [8] and noted that the City had missed the opportunity to create a model 'effects assessment' helpful to all parties in the future.

Other participants did not comment extensively on the Environmental Impact Statement. However, one participant identified a number of problems with the document including the lack of baseline data and costs to future generations, and raised a number of questions regarding ammonia reduction, combined sewer overflow mitigation and nutrient control (Exhibit 110). Deficiencies were also identified with respect to land drainage systems, water conservation strategies and the application of the principles and guidelines of sustainable development.

One of the participants presented documentation on the impact of Winnipeg's municipal wastewaters on Lake Winnipeg (Exhibit 57). The participant reported that there have been substantial shifts in species composition and abundance for all types of aquatic communities in Lake Winnipeg. Specific changes in algal species composition and increases in exotic species were mentioned, and it was noted that effects on the food web and the production of toxins is not known. It was also reported that aquatic snail communities in Lake Winnipeg are currently sparse and are dominated by a small number of tolerant species. Monitoring of aquatic communities was recommended to provide a basis ~~of~~ for future comparisons and to evaluate the impact of events such as spills.

The Department of Fisheries and Oceans presented evidence on the impact of nitrogen and phosphorus on Lake Winnipeg based on analyses of sediments, plankton communities and nutrient dynamics (Exhibit 105). Fisheries and Oceans concluded that the Lake Winnipeg ecosystem is deteriorating as a result of phosphorus inputs, and that any decline in river flows resulting from climate change and/or drought would increase the impact on the Red River and Lake Winnipeg (it was explained that the City of Winnipeg contributes to the nutrient loading of Lake Winnipeg which promotes development of blue-green algae and restructuring of the biological community). Short-term changes mentioned included impairment of water quality, fouling of commercial fishing nets and lowered recreational property values. Long-term changes included fish kills, benthic and planktonic organism declines, food web function impairment, and fish reproductive losses.

The Winnipeg Game and Fish Association reported on fish quality and abundance in Lake Winnipeg based on a survey of recreational and commercial fishers and outfitters (Exhibits 112,

116). It was reported that survey respondents indicated changes in terms of fish abundance, size and quality, and expressed a number of concerns about the fishery including phosphorus and nitrogen loadings, water flows at Lockport and at the mouth of the Red River, use of Lake Winnipeg as a reservoir and algal blooms. The Association concluded that there are many things happening on Lake Winnipeg that are not known or understood, and noted it is prudent to exercise caution and foresight when conducting activities that can affect water quality. Improved monitoring of fish stocks and regulatory enforcement were recommended.

Members of the public, particularly those living downstream from Winnipeg, expressed concern about the impact of the September 16, 2002 sewage spill on the environment, socio-economic conditions, and human heath and well-being (Exhibits 71, 72, 77). Downstream residents were concerned about potential health effects, and requested they be notified about sewage spills and releases. Several individuals commented that the sewage spill had adversely affected social and economic activities. Social activities affected included boating, recreational fishing and hunting by area residents, while economic activities included commercial fishing, guiding for sport fishing, outfitting and nature viewing as part of the regional tourism and ecotourism industry. An outfitter mentioned that reservations were cancelled and clients advised to find alternative destinations as a direct result of the sewage spill.

The Commission appreciates that the City of Winnipeg completed the requested Environmental Impact Statement within a short time period using existing information, and without the benefit of pre-planning, initial scoping and written guidelines. However, the Commission believes that the City could have used the opportunity provided more effectively to prepare a high quality environmental assessment consistent with the COSDI Report and best professional practice. As noted by members of the public, elements of an 'effects assessment' were either not addressed (e.g. description of the existing environment) or were not considered properly (e.g. alternatives, cumulative effects, sustainability).

The Commission believes that further efforts are necessary to adequately identify and assess the full range of possible environmental, socio-economic and cumulative effects of the City's wastewater systems. This effort should include meaningful consultation with interested and affected publics, and a thorough examination of the systems in relation to the principles and guidelines of sustainable development.

The Commission believes that the application of environmental assessment principles and practices to future development projects is an indication of responsible management that should be addressed in the Water and Waste Department's Environmental Management System. An internal environmental assessment process would serve to identify projects with potentially significant adverse effects, ensure meaningful public involvement, provide for effective mitigation, permit internal auditing and facilitate subsequent approvals and licencing.

Nutrient Management Strategy

During the proceedings, Manitoba Conservation discussed Manitoba's *Lake Winnipeg Action Plan*[7] that was announced by the Minister of Conservation on February 18, 2003 (Exhibit 87). The action plan includes a commitment to reduce nitrogen and phosphorus in Lake Winnipeg to levels that existed prior to the 1970s. The Department explained that pre-1970 levels of nitrogen and phosphorus are interim targets and estimated that nitrogen and phosphorus loadings will have to be reduced by 10 and 13%, respectively, to meet the targets. The Department also revealed that the provincial priorities for action by the City of Winnipeg were revised by combining ammonia reduction with nutrient management, thereby elevating nutrient management to number three in priority behind a new potable drinking water plant and wastewater effluent disinfection.

The City of Winnipeg commented that the health of Lake Winnipeg is a common concern, and that nutrient loadings originate from a variety of sources including forests, agriculture, feedlots and urban drainage (Exhibit 91). The City offered a different perspective on nutrient inputs to Lake Winnipeg based on average loadings from 1994 to 2001, and proposed that phosphorus loadings have increased by 75% since 1992. On this basis, the City considered the proposed provincial targets to be ineffective. It was argued that no data is available to determine whether nitrogen or phosphorus is the limiting factor and it is premature to impose nutrient limits on the City.

The City of Winnipeg Environmental Impact Statement (Exhibit 88) reported that the treated discharges from Winnipeg's water pollution control centres contribute about 6.3% of the phosphorus and 5.2% of the nitrogen that enter Lake Winnipeg. The impact statement noted that even with full biological nutrient control at all three treatment plants the concentration of nitrogen and phosphorus in the effluent would be 10 and 1 mg/L, respectively, and the consequential loadings to Lake Winnipeg would be reduced from 6.3 to 3.5% for phosphorus and from 5.2 to

2.1% for nitrogen. The City concluded that the ecological effects and benefits of reducing nutrients from City sources on the Red and Assiniboine rivers and Lake Winnipeg are unknown.

During the hearing, Fisheries and Oceans Canada reviewed lessons learned from the Laurentian Great Lakes and the Experimental Lakes Area of northwest Ontario regarding the role that phosphorus played in the eutrophication of these surface waters and made comparisons to Lake Winnipeg (Exhibit 105). Fisheries and Oceans went on to speak about the linkage between Lake Winnipeg water quality and phosphorus loading and predicted that if the phosphorus input to Lake Winnipeg is not reduced, the condition of the lake would continue to deteriorate.

Environment Canada reviewed material from the City's reports on ammonia and its Environmental Impact Statement (Exhibits 107, 109a). The presenter recalled a recommendation made to the Commission in November 1991 at the public hearing on Red and Assiniboine river water quality objectives that a basin-wide reduction of phosphorus from point and non-point sources is required, and a statement at the 2002 public hearing on the Simplot Canada Ltd. Potato Processing Plant proposal that the cumulative impact of various point and non-point discharges of phosphorus and nitrogen is of particular concern. Environment Canada also referred to a conclusion of a report titled *Nutrients and Their Impact on the Canadian Environment* [(5)] indicating that municipal sewage is the largest point source of phosphorus and nitrogen to freshwater, groundwater and coastal waters in Canada (Exhibit 109b). Reference was also made to the national Agricultural Policy Framework that would see implementation of Environmental Farm plans that would increase beneficial environmental management practices (Exhibit 108). Environment Canada mentioned that the stage is set for immediate action in Manitoba and it is timely to commit to addressing point sources of nutrients, such as Winnipeg's municipal wastewaters, when opportunities such as the current licencing process arise.

One of the participants expressed concern regarding Winnipeg's contention that nutrient discharges from City sources form only a small portion of the total loading to Lake Winnipeg (Exhibit 56). Concern was also expressed that the timeframe proposed by the City to reduce pollutant loadings was too long, and a recommendation made that planning begin now to eliminate the nitrogen and phosphorus contribution to Lake Winnipeg.

Another participant commented that while nutrient discharges from the City of Winnipeg appear to be small in proportion to the total load to Lake Winnipeg, they are still an important and identifiable point source (Exhibit 60). The participant went on to state that there should be no delay in eliminating these inputs given the declining health of Lake Winnipeg. It was

recommended by another participant that the City and the Province work together to immediately address the larger problem of nutrient loadings to Lake Winnipeg (Exhibit 58).

The Province of Manitoba should complete its *Nutrient Management Strategy for Southern Manitoba* as soon as possible. Implementation of the strategy is a pre-requisite to the reduction in nutrient loadings targeted for Lake Winnipeg. Water quality objectives for nitrogen and phosphorus in Manitoba's rivers and receiving lakes are required for this purpose.

The Commission is concerned that only limited progress has been made by the City of Winnipeg toward nutrient reduction in its wastewaters and that, until recently, Manitoba Conservation has not provided adequate direction in this regard. It is noted that other upstream municipalities along the Red and Assiniboine rivers in Canada and the United States have already, or are in the process of, implementing phosphorus or total nutrient removal from their wastewaters.

Based on the evidence presented at the public hearing, the Commission concludes that the City of Winnipeg must begin the process of removing nutrients from its municipal wastewaters in the near future. Nutrient removal should include both technological changes to the wastewater treatment processes and control measures to limit nutrients from other sources. The priority for nutrient removal is phosphorus followed by nitrogen. The testimony of Environment Canada and the Department of Fisheries and Oceans supports this conclusion.

The Commission also notes that Manitoba's *Water Quality Standards, Objectives and Guidelines* do not provide sufficient guidance for nitrogen and phosphorus levels in wastewaters or receiving environments.

Combined Sewer Overflow Mitigation

The Commission's 1992 report[3] on water quality objectives for the Red and Assiniboine rivers recommended that site-specific studies be undertaken to determine water quality impacts of the combined sewer system on the river systems. The studies were to include an inventory of the combined sewer system, a project schedule to ensure that a sufficient number of flow events are monitored, an understanding of routing through the sewer system, flow monitoring, rainfall monitoring network, water quality monitoring during overflow events, and the establishment of

parameters concerning fecal coliform levels correlated to storm frequency and duration. Manitoba Conservation reported that the Commission's recommendation was adopted but the City of Winnipeg report on combined sewer overflows was not finalized until November 2002 (Exhibit 3). The Department noted that the City's combined sewer overflow report was under review, and subsequent actions will be taken in consideration of the comments received during the review.

The City proposed that a long-term combined sewer overflow program be adopted as described in the *Combined Sewer Overflow Management Study* report (Exhibits 33, 34). The City outlined a long-term program that would reduce overflow events on a City-wide basis to an average of four events per summer recreation season (May 15 to September 30, inclusive) within a 50-year timeframe at a cost of $270M. The proposed program included four components: 1) data acquisition systems, increase weir height, demonstration project and studies 2002-05: $14M); 2) integration with basement flooding relief and sewer rehabilitation programs (2005-43: $26M); 3) assessment of latent and available in-line storage (2028-33: $50M); and 4) additional storage to meet four events per season (2034-50: $180M).

The City of Winnipeg Environmental Impact Statement (Exhibit 88) concluded that the frequency of exceedences of surface water recreation objectives downstream from Winnipeg would be reduced by the proposed controls. It also concluded that the remaining four (average) combined sewer overflow events would not be stored and their impact zones would not be reduced. The projected total sewage discharged was calculated to be about 4 million m^3, or 1 million m^3 per event. The impact statement further concluded that wet weather events would result in non-compliance with Manitoba's surface fecal coliform objectives under wet weather events due to the four residual combined sewer overflows and land drainage.

To place the proposed combined sewer overflow mitigation plan into perspective with the September 16, 2002 sewage spill, the City advised that the remaining four combined sewer overflow events will discharge approximately 4 million m^3 or an average of about 1 million m^3 (or 1,000 Megalitres) of untreated sewage per overflow event into the Red and Assiniboine rivers (Exhibit 34). In comparison, the spill event discharged a total volume of 427,000 m^3 (or 427 Megalitres) of sewage to the Red River. Although the combined sewer overflow is expected to be more dilute than the dry weather discharge, contaminant loading to the river is expected to be more than 1.5 times more than that during the sewage spill.

One of the participants expressed concern that the timelines for the combined sewer overflow program were both too short and too long (Exhibit 58); too short with respect to looking down the road to assess the cumulative impact and too long in not proposing timely solutions. The participant commented that by 2060 it may be intolerable to discharge treated human waste into freshwater, and by then composting toilets may be a standard feature in all dwellings. The participant further recommended the Province provide funding so that the required work can be undertaken and completed in a more reasonable timeframe of 10 to 15 years.

Another participant expressed concern that the City's combined sewer overflow program did not include measures to reduce water consumption, increase soil infiltration or use of water for other purposes (Exhibit 60). The participant urged that the issue of water conservation be addressed and that a program to promote stormwater retention, collect rainwater and reduce concrete be implemented. It was further noted that little attention had been paid to the effects of land drainage systems on the environment and requested that the City be required to assess the impact of drainage systems on the environment (Exhibit 110).

Other participants mentioned that the City of Winnipeg should not propose a 50-year timeframe to address combined sewer overflows based on cost implications (Exhibit 81), expressed frustration over the City's proposal to minimize combined sewer overflows (Exhibit 71), described Winnipeg's wastewater systems as antiquated (Exhibit 117), and suggested measures to conserve water, stabilize wastewater production, manage sewage surges and enhance treatment performance (Exhibit 123).

The Commission is of the opinion that the proposed 50-year timeframe to reduce combined sewer overflows to an average of four during the recreational season is too long. The Commission believes the City of Winnipeg should prepare a plan that reduces this projection to a 20 to 25-year timeframe. At the same time, the Commission believes the City should be able to undertake immediate action to reduce combined sewer overflows over the next three years. Such measures include proceeding with the pilot retention project earlier in the plan, instrumenting the outfalls and monitoring rainfall events, adjusting the weirs for maximum effectiveness and accelerating combined sewer replacement in high discharge and industrial districts. The City is encouraged to redesign its combined sewer overflow management plan with these measures in mind.

The Commission understands that combined sewer overflows have been managed primarily to address public health concerns during the recreational season. However, based on concerns expressed during the public hearing and current initiatives to limit nutrient loadings to Lake Winnipeg, consideration of the impacts only as they may relate to the recreational season is insufficient. Combined sewer overflows should therefore be managed on an annual basis and not just during the summer months.

The Commission notes that the target of four combined sewer overflow events per year may not result in a significant improvement over the present situation if the remaining four events produce the highest volumes of wastewater (these four events can be expected to carry more than 1.5 times the contaminant load to the river than the September 16, 2002 sewage spill). The City is therefore encouraged to target combined sewer overflow districts on a priority basis considering both wastewater volumes and industrial use.

Ammonia Reduction

The 1992 Commission public hearing report [(3)] concerning application of water quality objectives for the Red and Assiniboine rivers recommended that detailed site-specific studies should be undertaken to determine both the acute toxicity and chronic effects of un-ionized ammonia from wastewater effluent on the cool water aquatic life of the rivers. Members of the scientific community were to be invited to collaborate in the study design. Recommendations were to be available before July 1997 on requirements to deal with un-ionized ammonia in wastewaters from the City's water pollution control centres. The study results were to be utilized to establish an un-ionized ammonia objective, and a public hearing was to be held on the matter within six months after completion of the study.

Manitoba Conservation reported that the Commission's 1992 recommendation on ammonia was adopted, but completion of the study was delayed and the City's ammonia report was not finalized until November 2002 (Exhibit 3). Although the site-specific studies have not been completed to the satisfaction of Manitoba Conservation, it was reported that the Department believes that the results will be in accordance with the ammonia objective in Manitoba's *Water Quality Standards, Objectives and Guidelines*. The Department noted that the objective may be modified based on advice from the Commission and upon completion of additional studies.

The City of Winnipeg proposed that a long-term ammonia reduction strategy be implemented as described in the City's *Red and Assiniboine Ammonia Criteria Study* report (Exhibits 11, 12). The City's ammonia reduction strategy includes: 1) regulation of discharges from the City's wastewater treatment plants on a site-specific basis; 2) control of ammonia to protect the aquatic environment including treatment of centrate (liquid remaining after dewatering biosolids) at the North End Water Pollution Control Centre; and 3) additional studies, monitoring programs and testing of ammonia toxicity to expand the site-specific knowledge of the effects of ammonia.

The City of Winnipeg explained that application of ammonia criteria involves several science-based and site-specific considerations including allowable ammonia concentration, exposures, design flow period of record and flow allocation (Exhibit 78). It was argued that mixing zones are required since it was not considered reasonable for all objectives to be met at the end of the effluent pipe. The City went on to propose that ammonia loadings be based on the lower of chronic in-stream criteria and no lethality in the mixing zone (acute criteria with 5:1 dilution ratio). The proposed chronic in-stream criteria would involve 90% flow allocation for the Red River, 75% flow allocation for the Assiniboine River and a 40-year period of record for river flows.

The City of Winnipeg Environmental Impact Statement (Exhibit 88) presented information on the effects of ammonia from Winnipeg's sewage treatment plants including acute and chronic effects on aquatic biota. The City reported that, with the exception of the North End Water Pollution Control Centre under low flow conditions, the discharges do influence ammonia concentrations in the rivers but not to the extent that they represent a toxicity concern. It was proposed to treat liquid centrate from centrifuging biosolids at the North End plant to be in compliance with site-specific criteria for ammonia. The impact statement concluded that, while the current and proposed operations will continue to result in ammonia discharges from the three water pollution control centres, the discharges would not cause a significant impact on aquatic life.

Environment Canada outlined its proposed risk management strategy to address ammonia, inorganic chloramines and chlorinated wastewater effluents (Exhibit 63) and explained that assessment reports have been completed for these substances. It has been concluded by Environment Canada that they are all considered "toxic" under Section 64 of the *Canadian Environmental Protection Act* 1999 and that municipal wastewater effluents are the primary sources of these substances. The approach being followed by Environment Canada includes pollution prevention planning and development of a long-term strategy for wastewater effluents considering both the *Canadian Environmental Protection Act* 1999 and the *Fisheries Act*.

Environment Canada observed that there is generally a high level of treatment in Manitoba and that treatment in the prairies is better than in other parts of the country. It was also noted that there are still local issues related to ammonia toxicity and compliance with the *Fisheries Act,* and that some facilities are not operating to design standards.

Environment Canada indicated that the City's plan to address ammonia toxicity solely through centrate treatment appears to be inadequate. Environment Canada went on to state that, without nitrification at all three sewage treatment plants, it is likely that effluents would not be in compliance with Subsection 36(3) of the *Fisheries Act* based on the expected high levels of un-ionized ammonia alone. Given pH and temperature ranges in the Red River of approximately 7.7-8.5 and 1-23^{o}C, respectively, it was expected that the effluents would be acutely toxic using a standard bioassay test. Environment Canada concluded that, while adoption of centrate treatment is an important first step towards ammonia control, a more rigorous and timely reduction of ammonia is required.

Environment Canada provided subsequent clarification and supporting information on a statement made at the public hearing concerning the toxicity of ammonia in wastewaters from the City of Winnipeg's sewage treatment plants to fish [(9)]. It was confirmed that the City would have to consider additional measures, beyond centrate treatment at the North End plant and maintaining the status quo at the other plants, to achieve compliance with the *Fisheries Act*.

One of the participants urged the Commission to pay particular attention to the processes that the City is proposing to reduce ammonia (Exhibit 56) and noted that converting ammonia to nitrate will increase algal growth. It was noted that effective ammonia treatment would serve to reduce nutrients thereby solving two problems with one solution. The participant proposed wetlands as a means to remove both nitrogen and phosphorus at a fraction of the cost of alternatives being proposed by the City. Another participant commented that the most reasonable option to treat ammonia is to modify the North End sewage plant to treat the biosolids centrate side-stream (Exhibit 58).

Based upon the statements made by Environment Canada, the Commission believes the City of Winnipeg must now develop pollution prevention and compliance strategies to adhere to the regulatory and policy provisions of the *Canadian Environmental Protection Act* 1999 and the *Fisheries Act* with respect to ammonia. While the timeframe to complete a pollution prevention plan and to achieve compliance is to be

worked out with Environment Canada, the provincial priority placed on protecting Lake Winnipeg should also be recognized. The Commission believes that the regulatory requirement to reduce ammonia provides an opportunity for the City to reduce nutrient levels at the same time, and encourages Manitoba Conservation to support that direction.

The Environment Canada requirement for Winnipeg to prepare pollution prevention plans for its three water pollution control centres provides a balanced approach to ammonia reduction including the prevention of pollution at source and the virtual elimination of ammonia in municipal wastewaters. This approach will facilitate protection of the downstream environment including Lake Winnipeg and resource users including recreational and commercial fishers, Aboriginal communities, tourism outfitters and the general public.

Proposed Effluent Limits

The City of Winnipeg proposed that effluent discharge limits for its three water pollution control centres be based on existing secondary treatment performance and that limits for fecal coliforms be established to protect the Red and Assiniboine rivers for recreational use during the summer recreation season (Exhibits 36). The City's proposed licence limits and conditions for treated effluent are as follows:

City of Winnipeg Proposed Effluent Limits	
Parameter	**Licence Limit/Conditions**
Carbonaceous BOD_5 (CBOD)	• Standard, Tier 1 • Based on protecting river dissolved oxygen content • Monthly average to achieve 25 mg/L with exceedences to be addressed
Total Suspended Solids (TSS)	• Objective, Tier 2 • Monthly average to achieve target of 30 m/L • Exceedences in accordance with Manitoba's *Water Quality Standards, Objectives and Guidelines* (+/- 25 mg/L) • Exclude algae from ponds
Fecal Coliforms (FC)	• Generally consistent with current South End sewage treatment plant licence conditions • Specifics to be reviewed as part of disinfection for North End

	sewage treatment plant
Total Coliforms (TC)	• No requirement
Ammonia	• Site-specific ammonia criteria to be determined • 90% allocation of assimilative capacity for Red River • 75% allocation of assimilative capacity for Assiniboine River • 1962-present flow record period • No lethality in mixing zone (acute criteria with 5:1 dilution ratio)
Nutrients (N and P)	• Premature to establish limits at this time

Manitoba Conservation recommended that effluent discharge limits be established to protect the Red and Assiniboine rivers for the uses recommended by the Clean Environment Commission in 1992 [(3)] and subsequently adopted by Manitoba Conservation (Exhibit 3). The Department explained that technology limits such as BOD, CBOD and total suspended solids would be applicable to all three water pollution control centres while water quality limits would be specific to each facility. The Department went on to note that the proposed limits represent a starting point and need further refinement. A second review of river flow data, effluent discharge data and treatment plant capacities would need to be undertaken before licence limits are finalized. The recommendations outlined by Manitoba Conservation are as follows (Exhibit 37, 38):

Manitoba Conservation Recommended Effluent Limits	
Parameter	**Licence Limit/Conditions**
BOD_5	• Not to exceed 30 mg/L
$CBOD_5$	• Not to exceed 25 mg/L provided that an ammonia limit is applied
Total Suspended Solids	• Not to exceed 30 mg/L
Fecal Coliforms	• Not to exceed 200 Colony Forming Units/100 mL • Application during summer recreation season • Monthly mean of 1 grab sample on each of a minimum of 3 consecutive days per week
Total Coliform	• Not to exceed 1500 Colony Forming Units/100 mL • Application similar to Fecal Coliform
Ammonia	• *Water Quality Standards, Objectives and Guidelines* • 75% allocation of assimilative capacity of Red and Assiniboine rivers • 1913-2002 flow record period

	• Available effluent discharge data
Nutrients	• Water quality objectives for nutrients by 2004

The Commission supports the effluent limits recommended by Manitoba Conservation and not those proposed by the City of Winnipeg. The Commission also believes that interim direction should be established for nitrogen and phosphorus that is consistent with limits for other jurisdictions in Canada and achievable through best practical and available treatment technology.

Wastewater Disinfection

The City of Winnipeg's pollution prevention plan proposes to disinfect wastewaters from the North End Water Pollution Control Centre using ultraviolet radiation by 2004 (Exhibit 9). Disinfection is not considered necessary at present for the West End plant as the effluent leaving the polishing ponds complies with provincial standards. Ultraviolet disinfection is already in place at the South End plant. The City's proposal is for effluent discharge limits for pathogens to be based on fecal coliform levels established to protect the Red and Assiniboine rivers for recreational use during the summer recreation season (Exhibit 9).

The City of Winnipeg presented a health risk assessment based on a formula developed from Canadian and United States studies linking receiving bacterial water quality and the incidence of secondary infections for recreational activities. Their assessment suggested that about 20 health cases per year could be attributed to river water quality based on the target fecal coliform level in the Red River with disinfection at the North End plant. The City did not look at the health risk of combined sewer overflows.

The Commission supports the City of Winnipeg proposal for effluent disinfection at the North End Water Pollution Control Centre, re-assessment of the West End facility and ongoing monitoring of fecal coliforms and *E. coli* in its wastewaters. The West End facility should be re-examined periodically, particularly if development increases in that part of the city. The Commission also believes that the City should include *E. coli* in all of their bacterial analyses and verify the effectiveness of disinfection at the three treatment plants on removing *Cryptosporidium* and *Giardia.*

Public Notification System

The Commission's 1992 report [3] on water quality objectives for the Red and Assiniboine rivers recommended that the then-provincial Minister of Environment, in conjunction with other departments and the City of Winnipeg, should research and develop a high fecal coliform level public warning system for operation during the recreation season. The warning system was to alert river users within the classification area when the fecal coliform standard was exceeded. It was also recommended that the warning system be operational during the recreational season following attainment of compliance with fecal coliform objectives. A separate recommendation called for posting rivers with precautionary notices regarding the safety of primary recreation following rainfall events of sufficient volume to cause combined sewer overflows to the rivers.

During the proceedings, Manitoba Conservation stated that the warning system was not implemented (Exhibit 3). The Department explained that routine exceedences of the fecal coliform objectives can be expected to occur until disinfection is implemented at the North End Water Pollution Control Centre, and the general advice provided through warning signs posted in 1998 would be adequate to protect users of the river. Once disinfection is implemented, the Department indicated it would consider providing a public warning system for high fecal coliform densities. An approach similar to the system presently used by Manitoba Conservation for approximately 50 recreational beaches in Manitoba each summer could be considered.

The City's report on the shutdown of the North End Water Pollution Control Centre describes communications following the incident (Exhibit 40). The City reported the mechanical failure and shutdown within an hour to the Director, Environmental Approvals Branch, Manitoba Conservation; The Chief Medical Officer of Health, Winnipeg Regional Health Authority; Director of Operations, City of Selkirk; and, Chief Administrative Officer, Rural Municipality of St. Andrews. Mayor Glen Murray of the City of Winnipeg and others were also advised about the incident. A telephone message was also left for Environment Canada concerning the plant shutdown.

Significant public concern was expressed at the hearing about the lack of notification of downstream residents after the September 16, 2002 sewage spill. The concerns were particularly strong at the Selkirk hearing where the participants asked why the Rural Municipality of St. Clements was not immediately advised about the spill and why some residents along the Red River were not informed. Several participants were particularly concerned that First Nation

communities downstream from Winnipeg and around Lake Winnipeg were not notified about the sewage spill and the safety precautions they should have taken in response to the spill.

People living along the Red River downstream from the City of Winnipeg commented that they know when there has been a sewage release or combined sewer overflow by the odours and floating debris. They mentioned that they have to cease activities near the river, clean up their equipment and wash their clothes. Downstream residents noted that they were affected by both sewage spills and combined sewer overflows, and requested that they be notified every time sewage is released or discharged into the river.

A presenter at the Selkirk hearing recommended that the City of Winnipeg install a 24-hour automated pollution monitoring station on the bridge north of Selkirk and provide the public with continuous information on water speed, water current, water level and water quality through the Internet (Exhibit 72). It was also suggested that warning flags be flown at all boat launches along the rivers indicating when there is a high fecal coliform count (Exhibit 58). The colour of the flag would indicate whether Manitoba's *Water Quality Standards, Objectives and Guidelines* for primary or secondary recreation are exceeded. The warning system could also serve to raise the level of public awareness about water quality of the Red River.

The Commission believes the City of Winnipeg and the Province of Manitoba have not lived up to the spirit of the Commission's 1992 recommendation that a warning system be put into place for Winnipeg's rivers to advise the public about raw sewage discharge events. The public, particularly downstream residents and resource users, has a right to know when sewage spills occur, whether they are accidental releases or combined sewer overflows. A notification system should therefore be developed by the City of Winnipeg in consultation with Manitoba Conservation and Manitoba Health. The public should be involved in the design of the notification system to ensure that it is practical and effective. The system should also be developed as a procedure within the framework of the Water and Wastewater Department's Environmental Management System.

Sewage Spill Prevention

The City of Winnipeg's internal review of the September 16, 2002 shutdown of the North End Water Pollution Control Centre included descriptions of the treatment facility, equipment maintenance histories, events before and after the shutdown, communications with regulatory authorities and the public, and water quality impacts (Exhibit 40). The report presented conclusions dealing with operational procedures, facility design and emergency response. Recommendations included preparing procedures for isolating pumps, altering the main building pumps, preparing procedures for other key activities, placing external marking on valve stems, reviewing training procedures, and identifying and mitigating risks of future spills.

The City-commissioned Associated Engineering's review of the North End sewage treatment plant failure consisted of visual inspections, interviews with City staff and examinations of background information and current regulations (Exhibit 41). The review focused on the influent (inflow) pumping area of the plant and included related operating and maintenance procedures. The report presented recommendations on the design of the pumping system, conduct of a hazard and risk assessment, preparation of safe work procedures, upgrade of pump isolation and training procedures, drafting of an emergency response plan, compliance with workplace safety and health legislation, and development of a performance system.

Manitoba Conservation's investigation of the sewage spill at the North End plant consisted of observing remedial work and interviewing City staff (Exhibits 42, 43). The report concluded that flooding of the pump wells resulted in an inability to pump sewage through the treatment plant. Conclusions and recommendations from Manitoba Conservation's report included isolation of pump wells, design of a pump drainage system, installation of monitoring devices, and implementation of programs to investigate problems and to test valves.

Members of the public articulated numerous concerns regarding the effects of the September 16, 2002 spill of sewage on the environment, human health, economic activities and recreational pursuits. This was particularly evident at the Selkirk hearing where concerns were also expressed about municipal wastewater effluents (wastewater discharges) and combined sewer overflows.

The Commission believes that spills of raw sewage into the Red and Assiniboine rivers can be prevented by proper engineering design, routine maintenance practices and standard operating procedures. The investigation reports by Associated Engineering,

Manitoba Conservation and the City of Winnipeg outlined many technical, procedural, policy and other recommendations aimed at preventing future spills. The Commission notes that the City has committed to implementing recommendations in the investigation reports.

The Commission is confident that development and implementation of an ISO 14001 registered Environmental Management System for the Winnipeg's wastewater treatment facilities will further serve to prevent future spills of sewage.

Wastewater Systems Reliability

The Commission heard testimony from the City of Winnipeg regarding the reliability of its wastewater systems and of the back-up capabilities in place (Exhibit 39). The City made specific reference to design and operational features of its collection systems that include gravity flow in collection sewers and interceptors, redundant pumping units in lift stations, power interruption to lift stations, and monitoring and alarm systems. With respect to treatment systems the City noted that reliability, redundancy, standardization are integral to their design and that vital components are designed to allow for repair or replacement without interrupting treatment.

The City of Winnipeg proposes to undertake a risk and criticality assessment at Winnipeg's three water pollution control centres (Exhibits 9, 39, 46). The proposed assessment would characterize the systems, determine critical assets, identify potential failures and adverse consequences, assess the likelihood of failure, evaluate existing countermeasures, estimate mitigation costs and develop a risk reduction plan. Subject to City Council approval, the City proposed to undertake the assessment over a 12-month period at a cost of $750K and to complete the assessment in 2004.

The Associated Engineering review of the North End plant shutdown (Exhibit 41) recommended changes to operating and maintenance procedures, and modifications to reduce the possibility of a future failure. The review report noted that failure of influent pumping system components including suction valves can be expected to occur. The report's recommendations included a plant-wide assessment to identify hazards and risks including condition appraisal of equipment, safe job procedures and options for managing and mitigating risks.

The Commission also heard testimony from a member of the public regarding the reliability of Winnipeg's permanent sewage lift stations (Exhibit 74). It was explained that lift stations are used to raise the elevation of sewage so it can flow by gravity to the treatment plants. Concern was expressed that failure of the lift pumps during critical spring and summer periods could result in basement flooding and subsequent release of sewage into the Red River. It was recommended that the City of Winnipeg upgrade the reliability and capacity of lift station pumps, and adopt a minimum standard for all operating lift stations during the summer months.

The Commission recognizes the need to undertake risk management at Winnipeg's three wastewater treatment plants and supports the City of Winnipeg's proposed course of action. The completion date of December 31, 2003 recommended by Manitoba Conservation for the risk and criticality assessment is also supported. However, the Commission believes the proposed assessment would be more effective if it is implemented within the framework of an Environmental Management System.

Non-conventional Contaminants

The Ad Hoc Group provided an overview of the City of Winnipeg's wastewater collection system and described the various constituents of the influent stream that originate from domestic, commercial, industrial and stormwater sources (Exhibits 51, 53). Residential sewage was described to contain a variety of household cleaners and detergents, oil, grease and solvents, food wastes, pharmaceuticals, cosmetics and enteric bacteria, while commercial and industrial wastes includes oil and grease, metals, solvents and a variety of synthetic organic substances.

The Ad Hoc Group discussed various contaminants of concern that are contained in the influent stream such as persistent and bioaccumulative chemicals, endocrine disrupting substances and biological agents. The substances described included polybrominated diphenyl esthers (PBDEs), nonylphenols, pharmaceuticals and mercury. The Group noted that there are 23,000 chemicals on the Domestic Substances List [(10)] and 58,000 on the Non-Domestic Substances List [(11)] and that 2,000 to 3,000 new chemicals are introduced each year. Concern was expressed that little is known about the vast majority of these chemicals, comparing this knowledge to the tip of the "toxic iceberg". Particular attention was paid to pollutants of emerging concern that are not routinely tested for including persistent/bioaccumulative chemicals, endocrine disrupting substances and biological agents.

The Ad Hoc Group made suggestions as to what can be done to alleviate concerns about the lack of information about toxic and chronic effects of chemicals. These included identifying sources of contaminants in wastewaters, expanding local and provincial lists of pollutants of concern, addressing pollutants from upstream sources and moving from an acceptable risk assessment or pollution control approach to a primary prevention approach. Examples of proactive, forward-looking policies to prevent contamination of surface waters included product labelling and the right to know, mandatory pollution prevention planning for facilities and products releasing toxic chemicals into the environment, adopting a "green chemistry" approach, extended producer responsibility, mandatory environmental and health impact statements and integrated pest management.

The Ad Hoc Group provided recommendations for both the City of Winnipeg and Province of Manitoba regarding influent wastewaters. Such recommendations included the City moving to a primary pollution prevention approach, expanding the list of pollutants of concern, systematically documenting influents and effluents, monitoring dischargers more aggressively, enforcing new regulations and prosecuting violators, providing incentives to industry to comply, educating the public about household hazardous wastes and making information transparent. Recommendations for Manitoba Conservation included working towards consistent water pollution control programs among all jurisdictions, adopting a pollution prevention approach instead of an end-of-pipe control approach, issuing licences for the City's wastewater treatment plants and requiring that the City issue an annual compliance report.

Based upon the evidence presented at the hearing, it appears that insufficient attention has been given to the ongoing characterization of influent and effluent streams at Winnipeg's three water pollution control centres. An increasing number of chemicals including toxic substances, endocrine disrupting compounds, pharmaceuticals and other substances are discharged into the City's sewer system. Most of the chemicals are passed through the water pollution control centres untreated and end up in the Red and Assiniboine rivers. Those chemicals that are removed during the treatment process are largely deposited on agricultural land as biosolids. Routine monitoring of influent and effluent streams for all major contaminants of concern is therefore required.

Pollution Prevention

The Ad Hoc Group referenced the Canadian Council of Ministers of the Environment definition of pollution prevention: "*The use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and wastes at source*" (Exhibits 51, 53). The Group commented that this definition of pollution prevention has been adopted by the Government of Canada, the *Canadian Environmental Protection Act*, the Province of Manitoba, the Federation of Canadian Municipalities and the Canadian Centre for Pollution Prevention. It was noted that the City's pollution prevention plan is not consistent with the accepted definition of pollution prevention.

The Ad Hoc Group went on to discuss why the City of Winnipeg should adopt a pollution prevention approach. The Group explained that municipal wastewater effluents constitute the largest pollution source to surface and groundwater in Canada, and wastewater treatment plants are not designed to treat the full range of chemicals contained in the influent stream. They argued that if the treatment plants cannot deal with all of the substances, the logical solution is to prevent these chemicals from entering the waste stream. Winnipeg's Sewer By-Law [(15)] was mentioned by the Ad Hoc Group as an effective mechanism to control the type and amount of chemicals discharged into the municipal wastewater system.

The Ad Hoc Group described various pollution prevention initiatives that have been or could be implemented by the City of Winnipeg and its residents. The initiatives included materials substitution, waste minimization, household hazardous waste management, storm sewer markings and public education. The Group recommended the City use the Sewer By-Law to improve influent quality by requiring that businesses and industries improve the quality and reduce the quantity of their wastewaters. They also recommended that Manitoba's plan to manage household hazardous waste (Exhibit 54) be adopted, and that the public be informed about pollution prevention in the home.

One of the participants expressed concern about the various chemicals entering the municipal wastewater system, and suggested the City of Winnipeg and the Province of Manitoba jointly develop plans to deal with persistent toxic substances and pharmaceuticals (Exhibit 58). Another participant asked about the effects of orthophosphates, metabolites from drugs and hormones, triahalomethanes or haloacetic acids from chlorination, and requested that the Commission ensure that dialogue occurs on these concerns before licences for the pollution control centres are considered (Exhibit 56). Concern was also expressed over the City's "end of pipe" solutions

and the general lack of attention being paid to innovative approaches to reduce inputs to the wastewater system (Exhibit 60). Banning the use of pesticides within City limits was also proposed as a means to reduce chemical and nutrient inputs to the sewage system.

Other participants reviewed the City of Winnipeg's municipal wastewater systems and provided sustainable proposals and solutions for the short and long-term (Exhibit 118), suggested that Winnipeg do its utmost to minimize water pollution (Exhibit 111), and provided a series of recommendations to improve the City's wastewater collection and treatment systems (Exhibit 123).

The Commission heard substantial testimony and received considerable evidence concerning the benefits of pollution prevention and other initiatives that have been implemented at municipal wastewater treatment facilities elsewhere in North America. The Commission believes the City of Winnipeg could be doing much more to prevent pollution at source by enhancing the Sewer By-Law, enforcing its provisions and expanding the list of restricted substances

Landfill Leachate Disposal

During the public hearing it was determined that leachate from City of Winnipeg landfills is being disposed of at the North End Water Pollution Control Centre. Manitoba Conservation advised that leachate disposal at the North End plant is carried out under approval from the Department. Information on leachate disposal was not included in the City's pollution prevention plan and leachate was not assessed in the City of Winnipeg Environmental Impact Statement.

A member of the Ad Hoc Group explained that municipal wastewater treatment plants are designed to handle sewage and were never meant to treat leachate from landfills. Consequently, sewage treatment plants are not efficient at treating leachate and its many toxic constituents, which pass through the treatment process and end up in the wastewater or the sludge (biosolids). Some of the constituents break down during the treatment process into other toxic substances.

Information on the quantity and quality of leachate disposed of at the North End Water Pollution Control Centre in 2002 was provided by the City (Exhibits 92, 93). In 2002, 12,063 Kilolitres of leachate were received from the Brady Road Landfill while 31,050 Kilolitres of leachate were

received from the Summit Road Landfill. In addition, 2,370 and 900 Kilolitres of leachate were received from the Kil-Cona Park and Westview Park landfills, respectively in 2002.

The Ad Hoc Group discussed leachate disposed of at the North End Water Pollution Control Centre (Exhibits 96, 98) and observed that many of the 108 chemicals identified in the leachate analysis (Exhibit 93) are persistent and bioaccumulative in the environment. The chemicals include DDT and p-DDE, benzene, toluene, phenolic compounds, lead, molybdenum, and 2,4,5-T and 2,4-D (Agent Orange herbicide). It was also noted that some of the chemicals in the leachate are prohibited in many other jurisdictions.

The Commission views disposal of leachate at the North End Water Pollution Control Centre as an unacceptable practice that should cease as soon as possible. The City of Winnipeg should be advised to explore other treatment and disposal alternatives including treatment at source. Manitoba Conservation should address leachate disposal in any future licencing of the North End facility in such a manner as to preclude the practice entirely.

Environmental Management System

The Ad Hoc Group (Exhibits 51 and 53) and other participants (Exhibit 79) commented on the need for an Environmental Management System for Winnipeg's Water and Waste Department. Examples of other municipalities in Canada were cited where Environmental Management Systems or similar environmental management plans were implemented (e.g. Vancouver, Calgary, Edmonton, Toronto, Ottawa and Hamilton). The International Standards Organization (ISO) 14001 Environmental Management Standard entitled "Environmental Management Systems – Specification with Guidance for Use" was recommended for implementation. This Standard specifies requirements for a management system to enable an organization to formulate policy, objectives and targets, taking into account legislative requirements and information about significant environmental impacts.

The Ad Hoc Group commented that no City of Winnipeg department or agency has an environmental management plan or system in place (Exhibit 51). It was further noted that Plan Winnipeg 2020 Vision (Exhibit 55) promotes environmentally responsible decision-making for the broad community and within its own operations, and that there is policy level support for

environmentally responsible procedures such as an Environmental Management System. The Group suggested that the City put an Environmental Management System in place within Winnipeg's Water and Waste Department and that a corporate-level Environmental Management System be considered for all Winnipeg departments and operating agencies.

Members of the public expressed concerns during the public hearing regarding the need for documented procedures, staff training, emergency planning and due diligence (Exhibits 51, 53, 57, 79). One of the participants noted that due diligence is achievable through the implementation of environmental policies, environmental management plans, management systems, audits and inspections (internal and external), and planning (back-up systems, scheduled maintenance, staff training). An Environmental Management System was advocated as an effective management tool for organizations to assess and control the environmental impacts of their operations and activities.

The Associated Engineering review of the North End Water Pollution Control Centre failure recommended that performance indicators and critical success factors be developed. These indicators and factors would enable the City to measure its performance and ensure that continuous improvement is achieved (Exhibit 41). An Environmental Management System provides for measurement of environmental performance in relation to its environmental policy, objectives and targets.

Other evidence presented during the public hearing discussed how an ISO 14001 Environmental Management System would improve operation of the North End sewage treatment facility and prevent future raw sewage discharges (Exhibit 79). The management system would provide the framework and establish formal procedures that define the organization's environmental policy, identify environmental aspects and impacts, and establish priorities, objectives and targets for environmental performance as well as other matters covered by the ISO 14001 Standard.

The Commission believes that a formal Environmental Management System is an effective means to ensure that Winnipeg's wastewater collection and treatment systems operate in a safe and reliable manner, and serve to protect human health and the environment. An Environmental Management System would integrate environmental requirements into operational procedures and practices, allow for continual improvement of environmental performance, and provide for due diligence in the event of any future accident or malfunction. To be fully effective, the Environmental

Management System should adhere to the ISO 14001 Standard and it should be registered and audited in accordance with other applicable ISO 14000 Standards. The environmental policy adopted by Winnipeg's Water and Waste Department as part of the Environmental Management System should be consistent with the environmental policy frameworks of the City of Winnipeg and the Province of Manitoba. The Commission further believes that involvement of the Winnipeg's Civic Environment Committee would be beneficial in developing an Environmental Management System for Winnipeg's three water pollution control centers.

Employee Training and Certification

The Associated Engineering review of the sewage spill (Exhibit 41) noted that management responsible for the North End Water Pollution Control Centre has since made a commitment to training, and commented that an extensive and complete training program appears to be in the early stages of development. The report recommended that training resources be assigned to update and facilitate employee awareness, skills and safe work practices, and that training include the regular review of, and revision to, operating and maintenance procedures.

Several participants at the public hearing commented on the need for an appropriate level of training for wastewater treatment plant operators (Exhibits 51, 53, 79) and made reference to other jurisdictions in Canada that have implemented mandatory operator training and certification as part of environmental management planning initiatives. Training was described by one of the presenters as an example of due diligence behaviour.

The Commission recognizes the importance of providing required training to Winnipeg's Water and Waste Department staff so that they can perform their assigned duties in a safe and effective manner. The Commission believes that a formally approved training plan and an operator certification program are required for sewage treatment plant operators. The training plan and certification program should be developed within the framework of an Environmental Management System. Provincial regulations would serve to ensure that plant operators are trained, certified and upgraded in a consistent manner.

Operating Procedures

The Associated Engineering review of the September 16, 2002 sewage spill (Exhibit 41) reported that documentation on standard operating and safe working procedures does not exist for the North End Water Pollution Control Centre, and that work performed at the facility has not been analyzed on the basis of risk, hazards and best practice. Only significant projects such as disaster maintenance and boiler cleaning have written guidelines. The lack of safe work procedures was determined to be a major contributing factor in the flooding of the pump wells. This fact underscores the need to conduct safety audits to review and assess all work procedures, and to review the personal protection policy.

The City of Winnipeg's spill report (Exhibit 40) recognized the need for prescriptive procedures to deal with critical operations. The report identified requirements for written procedures that identify hazards and assign responsibilities, and listed the steps for isolating critical equipment. Recommendations were provided in the report that included preparation of written procedures to isolate pumps and other activities, and review of training for all procedures.

A participant at the hearing accepted the fact that valves "break and jam", but expressed concern that there are no regular testing procedures or a manual checklist for valves and sensors at the North End treatment facility (Exhibit 59). Another participant explained that development and implementation of an Environmental Management System would improve the operation of the North End facility and help to prevent future sewage spills (Exhibit 79). The management system would establish a formal set of procedures consistent with the ISO 14001 Standard including environmental aspects and impacts, legal and other requirements, objectives and targets, and an environmental management program.

Based on the public testimony and the assembled evidence, the Commission concludes that a formal system of operating procedures might have prevented the September 16, 2002 spill of raw sewage into the Red River. Improved operating procedures are required for a large number of operation and maintenance activities at Winnipeg's three water pollution control centres. To be effective, these procedures should be identified and documentation should be prepared within the framework of an Environmental Management System. Best practice procedures from other jurisdictions should be adopted or adapted whenever possible.

Emergency Response Planning

Participants at the public hearing spoke about emergency response planning or emergency preparedness for wastewater treatment plants and discussed the benefits to municipalities, businesses, human health and the environment. References were made to other municipalities across Canada that have implemented or are in the process of implementing emergency response plans and procedures (e.g. Calgary, Edmonton, Toronto). The Ad Hoc Group suggested that the City should prepare a comprehensive emergency response plan for each water pollution control centre, and that the plans be implemented within a City-wide emergency response plan with coordination among government, industry and the public (Exhibits 51, 53).

The Associated Engineering review of the September 16, 2002 failure (Exhibit 41) commented that there are no established procedures at the North End Water Pollution Control Centre for responding to emergencies, and recommended an emergency response plan be drafted for the facility. The report went on to state that flooding, fires, chemical spills and environmental threats are more effectively managed with a structured and rehearsed plan.

The Commission observed that the City's Water and Wastewater Department officials demonstrated responsibility by taking immediate action after the September 16, 2002 sewage spill, providing timely information to the public, and cooperating with regulatory authorities. The City's spill report (Exhibit 40) noted that an emergency response plan was developed early after the incident, and that planning decisions were made on a timely basis. A plan to re-establish the wastewater treatment processes was formulated in the hour immediately after the event. Daily briefings took place with key staff including the City’s public information staff and representatives from Manitoba Conservation.

The Commission supports recommendations made by the City of Winnipeg and its consultants calling for the preparation of emergency response plans for Winnipeg’s three wastewater treatment facilities and integration of the plans into a City-wide response plan. The City-wide plan should involve cooperative planning and implementation by government, industry and the public. To be effective, emergency response planning should be undertaken within the framework of an Environmental Management System for the City's Water and Waste Department. Further, emergency response plans should be prepared in accordance with accepted Manitoba and Canadian standards for emergency preparedness by industry.

Public Consultation

The City of Winnipeg discussed the public consultations undertaken for the combined sewer overflow management strategy (Exhibit 31) at the hearing. The consultations included open houses, presentations for special interest groups, and displays at malls, workshops, trade shows and professional meetings. The City also described a multi-disciplinary advisory committee formed to review information and reports and provide guidance. It was noted that future public consultations on the proposed pollution prevention plan were put on hold after the Minister of Conservation announced that the Clean Environment Commission would hold a public hearing.

The Ad Hoc Group reviewed the City of Winnipeg's policy on public involvement, discussed common difficulties with public involvement and described what other jurisdictions are doing (Exhibits 51, 53). Reference was made to the City's policy guidelines for citizen participation in public works projects and the requirements of Plan Winnipeg 2020. The Group went on to review and discuss public consultations undertaken by the City in terms of scope, coverage and status. Public consultation approaches by Toronto, Edmonton and Waterloo in Canada, and Los Angeles and Palo-Alto in the United States were also reviewed. The Group summarized key principles in designing participatory programs as a meaningful two-way exchange, involvement of multiple publics, degrees of participation, early public involvement, variety of engagement types, and balanced facilitation and reporting. It was suggested that the City have an ongoing, proactive public participation program that considers these principles and is driven by a staff member dedicated to public consultation.

The Ad Hoc Group also reviewed public participation requirements under Manitoba's *Environment Act* and the COSDI Report [(8)] (Exhibits 96, 98) and spoke about the benefits of involving the public. The Group went on to discuss public participation in relation to the City of Winnipeg Environmental Impact Statement. Recommendations presented by the Group on public participation included forming a citizen advisory committee, maintaining a scientific advisory committee, initiating neighbourhood advisory committees and hiring a public consultation coordinator for the City's Water and Waste Department.

The City of Winnipeg Environmental Impact Statement (Exhibit 88) summarized consultations carried out with the public for the combined sewer management study. The Impact Statement was not subject to public review and did not present new information on public consultation.

At the conclusion of the public hearing the City committed to continued and expanded efforts to share information with the public through the City of Winnipeg's web site, and creation of more frequent and earlier opportunities for public involvement in decision making (Exhibit 125).

The Commission notes that limited public consultation appears to have been carried out for the City of Winnipeg's pollution prevention plan as well as other matters related to municipal wastewater collection and treatment. It is also noted that there is no evidence to demonstrate how the public's input was used in ongoing planning and decision making.

The Commission appreciates that public consultation can be costly and time-consuming. It also acknowledges that the City's consultation plans were interrupted with the call for the current round of public hearings. However, the Commission still believes that the City of Winnipeg should be doing a better job of consulting with the public. A professionally designed public consultation plan is required to engage the public and stakeholders in meaningful two-way dialogue. Public consultation planning and procedures should also be developed and implemented within the framework of an Environmental Management System.

Aboriginal Consultation

Based on information contained in the City's reports on combined sewer overflows (Exhibits 33, 34) and ammonia reduction (Exhibits 11, 12), as well as information presented at the public hearing, it is evident that First Nation and Métis communities were not consulted on the continued operation and future development of Winnipeg's wastewater collection and treatment systems. The City of Winnipeg Environmental Impact Statement (Exhibit 88) also does not include any reference to consultation with Aboriginal communities.

The Ad Hoc Group presented information at the hearing relating to Aboriginal involvement, and discussed constitutional responsibilities of the federal and provincial governments to consult with First Nation and Métis communities that may be affected by decisions regarding effluent quality and setting effluent limits, setting limits regarding other chemicals of concern, wastewater system reliability planning and sewage spills (Exhibits 51, 53). The Group went on to discuss the meaning of Aboriginal involvement that includes consultation, public participation and relationship building, and provided examples of meaningful involvement with particular reference to municipal

jurisdictions in Canada. Specific reference was made to provisions in Plan Winnipeg 2020 (Exhibit 55) and the draft discussion document titled, "*Strengthening Manitoba's Capital Region*" [(12)]. With respect to Aboriginal involvement, the Group recommended that consultation policies should be developed for all levels of government.

The Ad Hoc Group discussed the concerns of Aboriginal communities regarding Winnipeg's municipal wastewaters and the September 16, 2002 sewage spill (Exhibits 96, 98). Aboriginal community concerns included the health of Lake Winnipeg, viability of fisheries, loss of recreational uses, impact on future development plans, lack of information on monitoring efforts and potable well water contamination. The Group recommended that governments discharge their responsibility to consult with Aboriginal peoples regarding potential impacts on their rights from government decisions such as licencing sewage treatment plants, discharging effluent into waterways, setting water quality guidelines, and managing and planning wastewater systems.

After reviewing the evidence submitted at the public hearing regarding Aboriginal consultation, the Commission is of the opinion that the City of Winnipeg has not initiated meaningful contacts with Aboriginal communities regarding the City's wastewater collection and treatment systems. The Commission believes that the City, with the advice and support of provincial and federal governments, should commence a process leading to full and complete consultations with Aboriginal communities downstream from Winnipeg and those around Lake Winnipeg respecting current and future operation of its wastewater collection and treatment systems.

Sustainability

The City stated that its pollution prevention plan was sustainable as it offers improved protection of public health, property and heritage resources (Exhibit 90). The City also stated the plan is consistent with the principles and guidelines of sustainable development but did not explain how. In terms of economic sustainability, the City noted the plan is consistent with the City's water management priorities and achievable within existing fiscal allocations.

The City's Environmental Impact Statement (Exhibit 88) commented on system sustainability in economic terms but biophysical, social and other components of sustainable development were not addressed. The City explained that the Environmental Projects Reserve would be used to

finance proposed improvements to the City's wastewater collection and treatment systems. At present, the contribution to the Reserve fund is approximately $7 million per year. Increases to the Reserve fund will be required after 10 years to $14 million and after 20 years to $21 million, which would require increases to the sewer rates.

The Ad Hoc Group spoke about project sustainability in relation to the COSDI Report[8] (Exhibits 96, 98). The Group described sustainability as the balance between the biophysical, social and economic, cultural and human health benefits and impacts of a project. The Group criticized the City's Environmental Impact Statement by commenting that it does not define sustainability, analyse economics of other options or describe the long-term sustainability of environmental and socio-cultural factors. The Group went on to recommend that the City engage the citizens of Winnipeg and Selkirk/Lockport as well as Aboriginal communities and other stakeholders to develop a shared vision of sustainability, establish baseline stability parameters, and communicate with stakeholders to achieve a shared vision.

After reviewing the evidence presented at the public hearing, the Commission has concluded that a more in-depth analysis of the sustainability of the City's pollution prevention plan is required. The Commission believes that this analysis should form part of a comprehensive Environmental Impact Statement to be prepared by the City when licencing conditions for the pollution control centres are reviewed (see Recommendations section of this Report). The Commission suggests that this analysis should be carried out using the definition of sustainability and principles and guidelines of sustainable development prescribed by Manitoba's *Sustainable Development Act*.

Environmental Research and Monitoring

The City of Winnipeg provided information during the public hearing relating to the monitoring of influent and effluent streams at Winnipeg's three water pollution control centres. Parameters monitored in the influent stream include conventional measures (pH, total suspended solids, bacteriological oxygen demand, total organic carbon, total nitrogen and total phosphorus) and heavy metals (copper, cadmium, chromium, nickel, lead and zinc). The effluent stream is also monitored for total solids, turbidity, carbonaceous bacteriological oxygen demand, ammonia, nitrite and fecal coliform. The City reported that it has conducted a monitoring program for a full range of water quality parameters at 11 bridge locations on the Red and Assiniboine rivers since

1977. Limited monitoring of wastewaters is also conducted during combined sewer overflow events.

The City of Winnipeg Environmental Impact Statement (Exhibit 88) lists follow-up monitoring activities to be carried out as part of its pollution prevention plan. Monitoring relative to the combined sewer overflow control program includes determining changes in the magnitude, frequency and duration of combined sewer overflows, quality of wastewater stored in-line and off-line and the overall success of temporary storage during wet weather, and improvements in water quality in the rivers. Monitoring proposed for the ammonia reduction program includes determining baseline information on fish species potentially affected by ammonia, and distribution of ammonia concentrations during low flow conditions. No other environmental monitoring is proposed in the impact statement.

Manitoba Conservation reported on water quality monitoring carried out by the Water Quality Management Section of the Water Branch on the Red and Assiniboine rivers and Lake Winnipeg (Exhibit 4), and by the Environmental Approvals Branch on municipal effluents and other wastewaters (Exhibit 42). The Water Branch presented water quality information for a number of regulated parameters including bacteria, dissolved oxygen, ammonia and nutrients from monitoring sites on the Red River and Lake Winnipeg (Exhibit 4) and discussed results of water quality assessment following the September 16, 2002 sewage spill (Exhibits 44, 45).

The Ad Hoc Group (Exhibits 51, 53) discussed monitoring carried out on influent and effluent streams at Winnipeg's wastewater treatment plants. The Group went on to describe the biological, chemical and physical constituents of municipal wastewaters, and human health impacts associated with toxic metals, synthetic organic chemicals and human pathogens. It was noted that some of the toxic substances on the *Canadian Environmental Protection Act* 1999 Priority Substance Lists [13, 14] are not monitored by the City, and many more contaminants are discharged into the environment without adequate screening.

One of the participants provided information on the effects of pollution sources such as Winnipeg's municipal wastewaters on the aquatic environment with particular reference to Lake Winnipeg (Exhibit 57). Changes in species composition and abundance, and eradication of certain invertebrates in Lake Winnipeg were attributed, in part, to municipal wastewaters. The participant recommended that programs for routine monitoring and assessment should include ammonia, total nitrogen, total phosphorus, dissolved oxygen and total suspended solids, and that

programs for biological assessment of aquatic communities should be in place to provide a basis for future comparisons or to evaluate the impacts of major events such as sewage spills.

Another participant expressed concern that baseline information relating to the Red and Assiniboine rivers and Lake Winnipeg is not adequate for the kinds of decisions being made on the future use and enjoyment of these waterbodies (Exhibit 56). He went on to recommended that existing monitoring and testing programs be expanded to include the effects on aquatic life from all known pollutants, and suggested that the results of these programs be published regularly so the public can remain informed.

A participant also commented that it would be wise to spend more money on monitoring and protecting the "13th largest lake in the world" which sustains the most valuable inland subsistence, commercial and recreational fisheries in Canada west of Lake Superior (Exhibit 80). The participant went on to ask why the necessary steps have not been taken to monitor and protect Lake Winnipeg from situations like the sewage spill given its economic, cultural and historic importance to all Manitobans and Canadians.

The Commission observed that there does not appear to be an integrated water quality monitoring network for the Red and Assiniboine rivers and Lake Winnipeg. Such a network is required to identify baseline or background water quality conditions, detect trends or changes due to pollutant sources or spill events, and provide a basis for regional planning and effective decision making. It was also noted that the City of Winnipeg Environmental Impact Statement did not provide an adequate description of baseline or background conditions, an essential requirement of an environmental assessment.

The Commission notes that the City's current river monitoring programs do not measure dissolved oxygen levels during the day and at night. Also, the Commission observed that limited sampling for benthic invertebrates was carried out. No information was provided at the hearing on sediments and invertebrates immediately downstream from the three sewage treatment plants. Permanent monitoring stations should be established and monitored regularly throughout the year for water quality parameters as well as for benthic invertebrates and sediment contaminants.

The Commission believes that separate federal, provincial and municipal research and

monitoring programs may not be the most cost-efficient and effective approach to environmental protection and management for the Red and Assiniboine rivers and Lake Winnipeg. A cooperative, cost-shared monitoring program is required to define baseline conditions, address information deficiencies and provide answers to questions about the impact of municipal wastewaters and other sources of pollution on the environment and human health.

Observations

The following observations are provided as general comments or suggestions to government regarding the City of Winnipeg's wastewater collection and treatment systems. They are presented as matters of importance or concern, which warrant consideration by government.

Wastewater Treatment Technology

During the course of the public hearing the Commission heard from a number of participants concerning alternative wastewater treatment technologies. A participant at the Winnipeg hearing spoke about industrial pre-treatment processes and suggested various measures to reduce water consumption and wastewater production (Exhibit 123). Another participant discussed new and emerging approaches to wastewater treatment and described a "water soft path" approach involving a combination of treatment strategies (Exhibit 117). One of the funded participants (Exhibit 124) advanced a "living system solution" or bioreactor system being proposed for the St. Norbert Arts Centre that also has wider applications.

The Commission supports innovative sewage treatment processes that serve as alternatives to the conventional technologies traditionally used by municipalities. The City of Winnipeg is encouraged to pursue new approaches along with proposed upgrades to its existing wastewater systems. As municipal wastewater treatment impacts the environment, human health, fisheries and a host of other inter-related jurisdictional responsibilities, funding for research and development should be available from both the federal and provincial levels of government. In addition, opportunities to partner with the private sector, universities, and/or not-for-profit organizations in research and development activities should also be explored.

Biosolids Management

The management of biosolids or the solid fraction of the waste stream produced by sewage treatment facilities was not specifically included in the Commission's *Terms of Reference* for the review of the City of Winnipeg's wastewater collection and treatment systems (Exhibit 2; Appendix A). The City's biosolids management program is regulated by an existing *Environment Act* licence which is currently under review. Manitoba Conservation views the priority for biosolids

management to be lower than for potable water treatment, effluent disinfection and ammonia reduction/nutrient management, and higher than for combined sewer overflow mitigation.

During the course of the public hearing, the funded participants and members of the public expressed concern about the management of biosolids. Biosolids were also referenced as an important ($50 million) component of the City's pollution prevention plan, and were addressed in the City of Winnipeg Environmental Impact Statement. Accordingly, the Commission received sufficient information about biosolids to form an opinion about its future management.

The Commission believes that municipal wastewaters should be managed in their entirety including both solid (biosolids) and liquid (effluent) wastes. Pollution control measures aimed at improving effluent quality should not result in the transfer of contaminants to the biosolids side of the equation. Instead, pollution prevention measures aimed at improving both the liquid and solid fractions of the waste stream should be considered. Accordingly, the treatment and disposal of biosolids should be included in future *Environment Act* licences issued to the City of Winnipeg for the North End Pollution Control Centre and not licenced separately.

Environmental Assessment Process

The Commission was provided with extensive documentation relating to the City of Winnipeg's wastewater collection and treatment systems, and the potential environmental effects associated with their operation on the environment and human health. Stemming from recommendations in the Commission's 1992 report and direction by Manitoba Conservation, this documentation related mainly to ammonia, combined sewer overflows and selected pathogens. The effects of nutrients and other constituents of wastewater on the receiving environment were considered to a lesser extent. This was particularly evident in the City of Winnipeg Environmental Impact Statement where a full range of environmental effects on biophysical, social, economic, cultural and other components of the environment were not considered.

The Commission believes that the City of Winnipeg should establish an environmental assessment process to screen development proposals and conduct environmental assessments on projects with the potential to cause adverse environmental effects. Projects with properly conducted environmental assessments will likely increase public

acceptance, and facilitate provincial and federal licences and approvals. Plan Winnipeg's Vision provides for implementing a civic environmental impact review and monitoring process, which is compatible with Manitoba's *Environment Act*.

Cumulative Effects Assessment

The COSDI Report[8] lists elements that are to be considered in an 'effects assessment' of proposed developments in Manitoba. While an 'effects assessment' is not currently a regulated requirement in Manitoba, the COSDI Report has been adopted as provincial government policy. One of the elements of an 'effects assessment' is a description of cumulative and interdependent effects. Cumulative effects are changes to the environment caused by an action in combination with the effects of other past, present and reasonably foreseeable future human actions.

The City of Winnipeg Environmental Impact Statement (Exhibit 88) includes a general assessment of cumulative environmental effects resulting from the continued operation and future development of the City's wastewater collection and treatment systems. This assessment was strongly criticized and challenged at the public hearing by the Ad Hoc Group (Exhibit 96, 97). The Group noted that there was no assessment of the cumulative effects of the system.

The Commission agrees with the Ad Hoc Group's criticism of the City's Environmental Impact Statement in terms of its adequacy with respect to cumulative effects. Based on evidence provided by Fisheries and Oceans Canada and other participants, the combined effects of various pollutants from Winnipeg, other municipal and industrial developments, rural agricultural runoff, the United States and other sources may have already resulted in a significant cumulative impact on Lake Winnipeg. Given the nature, complexity and geographic extent of the issue the Commission believes a regional management approach to cumulative effects to be necessary. Both the Red River Basin Commission and the recently announced Lake Winnipeg Stewardship Board appear to be well-suited to taking on this responsibility.

Precautionary Principle

The precautionary principle was mentioned by several members of the public during the public hearing. The principle originates from the United Nations Conference on the Environment and

Development in 1992 and states that, "*Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation*". The Commission notes that it has been over a decade since the last public hearing involving the City of Winnipeg's wastewaters and only limited progress has been made on certain issues such as ammonia toxicity and nutrient enrichment. Application of the precautionary principle would serve to accelerate action by the City and Manitoba on these important issues.

Based on the evidence presented at the public hearing the Commission believes that the precautionary principle should be applied to the City of Winnipeg's wastewater collection and treatment systems "sooner rather than later". The City is in a position to take responsible action and demonstrate leadership by reducing ammonia and nutrient levels in wastewaters and mitigating combined sewer overflow events. Furthermore, emerging issues relating to endocrine disrupting substances, pharmaceuticals and nonylphenols as well as toxic, carcinogenic, persistent and bioaccumulative substances in wastewaters should be addressed using the precautionary principle.

Recommendations

Wastewater Treatment Plant Licencing

1. If *Environment Act licences are issued for Winnipeg's three water pollution control centres, they should be issued on an 'interim' basis only.*

The Commission maintains its position that the public hearing and review that is the subject of this report was not specifically directed to consider the question of *Environment Act* licensing for the City's water pollution control centres. This recommendation is offered in response to evidence presented at the hearing indicating that Manitoba Conservation contemplates proceeding to licencing of the City's water pollution control centres following the issuance of this report. The issuance of 'interim' *Environment Act* licenses would provide for the creation of an appropriate instrument through which the other recommendations contained in this report might be implemented.

2. *The 'interim' Environment Act licences for Winnipeg's three water pollution control centres should be reviewed again in two years and every three years thereafter.*

Licenses for the City's three water pollution control centres should be the subject of a major public review within two years to ensure public accountability. This review should be conducted by the Commission based on detailed *Environment Act* licence proposals and an Environmental Impact Statement prepared in accordance with publicly reviewed guidelines issued by Manitoba Conservation. Subsequently, the licences should be reviewed by the Commission every three years until such time as the City has substantially completed the upgrading of its wastewater collection and treatment systems as proposed in 2003.

3. *Manitoba Conservation should establish 'interim' effluent limits for Winnipeg's three water pollution control centres in accordance with Manitoba's Water Quality Standards, Objectives and Guidelines.*

The Commission supports the effluent limits proposed by the Environmental Approvals Branch as follows:

- Biological Oxygen Demand (BOD_5) – 30 mg/L
- Total Suspended Solids – 30 mg/L
- Fecal Coliform – 200 Colony Forming Units/100 mL

- Total Coliform – 1,500 Colony Forming Units/100 mL
- Ammonia based on 75% assimilative capacity using the 1913 to 2002 flow record

Given the evidence that the proposed treatment of centrate at the North End Water Pollution Control Centre will not result in compliance with the *Canadian Environmental Protection Act* 1999, an alternative technological solution appears to be required. Until site-specific studies are complete, the licences should reflect Manitoba's water quality objective for ammonia.

Environmental Impact Statement

4. The City of Winnipeg should be directed to prepare a comprehensive Environmental Impact Statement prior to the review of its three water pollution control centre 'interim' Environment Act licenses.

Specific guidelines for preparation of a comprehensive Environmental Impact Statement are required. The guidelines should incorporate best professional practice and prescribe the scope, methodology and public consultation for the environmental assessment. Further, the public should be given the opportunity to review the draft guidelines for the Environmental Impact Statement.

Nutrient Management Strategy

5. Manitoba Conservation should accelerate the schedule to complete the Nutrient Management Strategy for Southern Manitoba by December 2004.

Identification and implementation of actions necessary to reduce nitrogen and phosphorus levels in Lake Winnipeg to pre-1970 levels will be subject to direction provided by Manitoba's nutrient management strategy. The deteriorating condition of Lake Winnipeg reported during the hearing illustrates the nature and extent of the "nutrient" problem. Reducing nutrients from point and area sources in southern Manitoba should commence much sooner than presently contemplated.

6. The City of Winnipeg should be directed to plan for the removal of nitrogen and phosphorus from its municipal wastewaters, and to take immediate steps in support of the nutrient reduction targets established for Lake Winnipeg. The City's nutrient removal plan should be a key element of a licence review hearing to be scheduled within two years.

The City of Winnipeg should develop a plan to remove nutrients from its municipal wastewaters rather than deferring this until completion of Manitoba's nutrient management strategy. Priority should be placed on phosphorus. Other municipal jurisdictions in the Red and Assiniboine rivers

basin have already implemented phosphorus removal, with effluent limits of 1 to 2 mg/L total phosphorus, and are also moving towards nitrogen removal. The City should also take immediate steps to reduce nutrients by accelerating the implementation of technological solutions at one or more of its water pollution control centres and controlling other point and area sources. Targets of 10 per cent for phosphorus and 13 per cent for nitrogen should be achievable within a two-year period.

Combined Sewer Overflow Reduction

7. The City of Winnipeg should be directed to shorten the timeframe to complete it's combined sewer overflow plan from the proposed 50 years to a 20 to 25-year period.

The shorter timeframe is necessary to address public concerns over the effects of sewage from combined sewer overflows on public health, recreation, tourism and aesthetics, and to further reduce nutrient loadings to Lake Winnipeg.

8. The City of Winnipeg should be directed to take immediate action to reduce combined sewer overflows by instrumenting outfalls, adjusting weirs, accelerating combined sewer replacement, advancing the pilot retention project and undertaking other reasonable measures to reduce combined sewer overflows within two years.

The City of Winnipeg should install instruments at combined sewer outfalls, collect required monitoring data and conduct necessary studies to verify the accuracy of modeling to predict overflow events. The City should determine actual volume of wastewaters entering the rivers from combined sewer overflows during the entire calendar year. Contributions of ammonia, nutrients, pathogens, metals and other parameters of concern from combined sewer overflows to the Red and Assiniboine rivers and Lake Winnipeg can then be determined and used to assess the impact on the aquatic environment, social and economic conditions, and human health. Information from monitoring combined sewer overflows can also be used to identify districts where sewers are to be replaced on a priority basis. The City should further target combined sewer overflow mitigation through replacement and other means in districts with high volumes of wastewater and heavy industrial and commercial use.

Public Notification System

9. The City of Winnipeg should be directed to develop and implement a notification system to inform the public whenever there is a release of raw sewage from any source into the Red and/or Assiniboine rivers. The public notification system should be operational by the beginning of the 2004 summer recreation season.

The public notification system should be developed in consultation with appropriate civic and provincial departments, and regional health authorities. The system should take advantage of existing notification mechanisms for air quality and public health emergencies. The public should be notified whenever there is an accidental sewage spill, combined sewer overflow or sanitary sewer malfunction. The publics to be notified should include Winnipeg and downstream municipalities and communities, including Aboriginal communities. They should be informed about the nature of the release, the potential health risk and the personal protection procedures to follow.

Wastewater Treatment System

10. The City of Winnipeg should be directed to proceed with disinfection of wastewaters at the North End Water Pollution Control Centre without delay and should routinely test for pathogens in all wastewater discharges.

The City of Winnipeg has indicated it is proceeding to install ultraviolet disinfection equipment at the North End Water Pollution Control Centre to control pathogens. In addition, the City should undertake a full characterization of an expanded range of pathogens contained in all of Winnipeg's municipal wastewater discharges including combined sewer overflows. The characterization should be repeated annually and the results made available to the public. In addition, the public should be notified immediately when pathogen levels in receiving waters pose a risk to human health.

11. The City of Winnipeg should be directed to complete risk and criticality assessments at Winnipeg's three water pollution control centres by April 2004 and implement recommendations to minimize the risk of future spills of untreated sewage.

Recommendations from the risk and criticality assessments should be used to establish on-site back-up equipment and capability including replacement equipment and redundancy for critical equipment at Winnipeg's three water pollution control centres. In addition, the results of the

assessments should be implemented within the framework of an Environmental Management System to ensure ongoing monitoring for effectiveness and continual improvement.

12. The City of Winnipeg should be directed to increase the number of parameters measured in the influent and effluent streams to include contaminants of concern such as heavy metals, organochlorines, endocrine disrupting substances and pharmaceuticals.

Manitoba Conservation should use the *Canadian Environmental Protection Act* 1999 Priority Substance Lists to screen Winnipeg's municipal wastewaters for contaminants of concern. Increasing the number of parameters tested on a routine basis will provide an improved safety net for the environment and the public.

13. The City of Winnipeg should be directed to implement changes to Winnipeg's Sewer By-Law that would expand the list of restricted substances, prevent disposal of contaminants of concern, encourage treatment at source, improve enforcement of the By-Law and increase penalties for violations.

The City of Winnipeg Sewer By-Law provides an excellent opportunity to prevent pollution at source, limit demands on wastewater treatment facilities, reduce pollution control costs, and improve wastewater quality. To be more effective, the list of restricted materials should be expanded to increase the number of heavy metals of concern and to include persistent organic pollutants and other contaminants. Improved enforcement is required to discourage misuse of the sewage system.

14. The City of Winnipeg should be directed to stop the practice of disposing of landfill leachate at its water pollution control centres within a period of eighteen months.

Disposal of leachate from the City's landfills at the North End Water Pollution Control Centre is an unacceptable practice. Leachate contains many contaminants of concern that are on the *Canadian Environmental Protection Act* 1999 Priority Substances Lists. These substances are toxic to aquatic life, persistent and bioaccumulative in the environment and prohibited by other jurisdictions. Municipal wastewater treatment facilities are not designed to remove these contaminants and only serve to dilute them before they are released into the environment. Many of the contaminants in leachate end up in the biosolids, which are then applied to agricultural land.

Financial Support

15. The City of Winnipeg should be directly assisted by the Province of Manitoba in efforts to secure financial support under existing and future infrastructure programs for upgrades to its wastewater collection and treatment systems.

The estimated costs to upgrade Winnipeg's wastewater collection and treatment systems to achieve a better level of treatment and thereby improve water quality constitute a significant cost burden to a municipal level of government. Municipal governments have many competing priorities for funding and do not have access to the growth revenues of provincial and federal governments. Both the provincial and federal governments have placed significant emphasis on nutrient management with a strong focus on reducing nutrients in municipal wastewaters. The Commission believes that the senior levels of government should assist with the cost of achieving improved nutrient management and other water quality enhancement measures. Ideally, the funding formula of one-third municipal, one-third provincial and one-third federal should be used.

Environmental Management System

16. The City of Winnipeg should be directed to immediately begin development and implementation of an Environmental Management System for Winnipeg's three water pollution control centres with a completion date of no later than April 2005 with major components of the management system implemented much sooner.

The City of Winnipeg should adopt the appropriate ISO I4000 Environmental Management System standards, and the Environmental Management System should be registered and audited in accordance with those standards. The Environmental Management System should incorporate training and certification requirements, standard operating procedures and emergency response planning. A program of internal and external auditing should be implemented and the results should be considered during annual management reviews. A full-time staff member should be dedicated to the development and implementation of the management system. The City should begin this initiative with preparation of an Environmental Policy incorporating pollution prevention, the precautionary principle and sustainability provisions. The policy should be submitted to Manitoba Conservation by September 2003. Winnipeg's Civic Environment Committee should assist in developing and implementing the Environmental Management System.

Public Education

17. The City of Winnipeg should be strongly encouraged to develop and implement a permanent public education program to improve awareness of Winnipeg's wastewater collection and treatment systems and to foster public involvement in activities that focus on water conservation and pollution prevention at source.

A long-term public education program is required to improve citizen awareness of the City's wastewater collection and treatment systems, results from ongoing studies and monitoring programs, and responsibilities for water conservation and pollution prevention in the home and at work. The City should partner with industry to develop and deliver pollution prevention and other programs aimed at the private sector.

Public Consultation

18. The City of Winnipeg should be directed to prepare a public consultation plan for Winnipeg's wastewater collection and treatment systems for approval by Manitoba Conservation by April 2004.

The City should consider retaining the services of a professional public consultation specialist to assist in preparing and implementing the public consultation plan. The plan should include provisions to inform the public about municipal wastewater operations, programs and policies, and to involve the public in identifying and addressing issues and concerns. A regional stakeholder advisory group should be established to ensure meaningful two-way dialogue with the interested and affected public, particularly downstream communities. The City should also consult with the Lake Winnipeg Stewardship Board and the Lake Winnipeg Research Consortium, and actively support Manitoba's nutrient management strategy. Consideration should also be given to issuing an annual report card to the public on the operation of Winnipeg's wastewater systems through the City's Civic Environment Committee.

Aboriginal Consultation

19. The City of Winnipeg should be encouraged and assisted by the Province, in cooperation with the federal government, to immediately begin developing and implementing a meaningful consultation program with Aboriginal communities concerning the continued operation and future development of its wastewater collection and treatment systems.

The City of Winnipeg should work with the provincial and federal governments to create a communications strategy to support regular and ongoing dialogue with First Nation and Métis

communities. The requirement and strategy for communication with Aboriginal communities should also be incorporated into the City's public consultation plan.

Environmental Research and Monitoring

20. A cooperative, cost-shared environmental research and monitoring program involving the City of Winnipeg, Province of Manitoba and the Government of Canada should be established for the Red and Assiniboine rivers and Lake Winnipeg.

Current environmental research and monitoring programs by the City of Winnipeg, Manitoba Conservation and Fisheries and Oceans Canada do not appear to be adequate for the long-term protection and management of the Red and Assiniboine rivers and Lake Winnipeg. Each program has a different purpose and together they are not sufficiently integrated to comprehensively address all potential environmental issues. A more integrated approach is required with common objectives, shared resources and joint problem solving to establish baseline conditions, address information deficiencies and provide environmental information for decision-making. Additional funding is necessary to support this initiative.

Final Words

The spill of raw sewage into the Red River on September 16, 2002 was a significant event that resulted in a number of major responses by government, including a Clean Environment Commission public hearing. The hearing served to inform the public about water quality problems affecting Manitoba's freshwater resources, focus attention on the impact of nutrients entering our waterways, particularly Lake Winnipeg, and spark public debate on actions required to address these matters.

The recommendations detailed in this report call for immediate action to upgrade Winnipeg's wastewater collection and treatment systems, improve the quality of its wastewaters, limit nutrient loadings to Lake Winnipeg, and educate and involve the public. The report challenges the City of Winnipeg to demonstrate responsible leadership and environmental stewardship, and thereby help to ensure the sustainability of our freshwater resources for generations to come. The Province of Manitoba also needs to respond by demanding improved wastewater treatment performance and accelerating its nutrient management strategy. The provincial and federal governments must both come to the table with funds to help the City meet its responsibilities.

The public also has an important role to play in improving water quality in Manitoba. Citizens must become informed about water quality issues that affect them, participate in water quality initiatives such as Manitoba's nutrient management strategy and hold their elected officials accountable for the implementation of sustainable water policies.

With governments working together, and our citizens engaged, Manitoba's precious waterways will benefit from "better treatment" for generations to come.

References

(1) Manitoba Clean Environment Commission. 1981. Report on a Proposal for the Classification of Manitoba's Surface Water, Red River Principal Watershed Division. Prepared by Manitoba Clean Environment Commission, Winnipeg, Manitoba. 194p.

(2) Manitoba Clean Environment Commission. 1978. Report on a Proposal Concerning Surface Water Quality Objectives and Stream Classification for the Province of Manitoba. Prepared by Manitoba Clean Environment Commission, Winnipeg, Manitoba.

(3) Manitoba Clean Environment Commission. 1992. Report on Public Hearings, Application of Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers and Tributaries Within and Downstream of the City of Winnipeg. Prepared by Manitoba Clean Environment Commission, Winnipeg, Manitoba. 83p.

(4) Manitoba Clean Environment Commission. 2003. Interim Report on Public Hearings: City of Winnipeg Wastewater Collection and Treatment Systems – "Sewage Spill". Prepared by Manitoba Clean Environment Commission, Winnipeg, Manitoba. 27p.

(5) Chambers, P.A., M. Guy, E.S. Roberts, M.N. Charlton, R. Kent, C. Gagnon, G. Grove and N. Foster. 2001. Nutrients and Their Impact on the Canadian Environment. Agriculture and Agri-Food Canada, Environment Canada, Fisheries and Oceans Canada, Health Canada and Natural Resources Canada, Ottawa, Ontario. 241p.

(6) Manitoba Conservation. 2000. Development of a Nutrient Management Strategy for Surface Waters in Southern Manitoba. Manitoba Conservation Information Bulletin 2000-02E:10p.

(7) Manitoba Government News Release. Province Announces Lake Winnipeg Action Plan. February 18, 2003.

(8) Manitoba. 1999. Report on the Consultation on Sustainable Development Implementation (COSDI). Report of the Core Group. 47p.

(9) Letter from B. Briscoe, Environment Canada to T. Duguid, Clean Environment Commission dated April 24, 2003 regarding Environment Canada's submission on the continued operation of the City of Winnipeg's wastewater treatment plants.

(10) Canada, *Canadian Environmental Protection Act,* Domestic Substances List.

(11) Canada, *Canadian Environmental Protection Act,* Non-Domestic Substances List.

(12) Regional Planning Advisory Committee for Manitoba's Capital Region. 2002. Strengthening Manitoba's Capital Region: General Principles and Policy Directions – A Public Discussion Paper. 40p.

(13) Canada, *Canadian Environmental Protection Act,* Priority Substance List 1.

(14) Canada, *Canadian Environmental Protection Act,* Priority Substance List 2.

(15) City of Winnipeg Sewer By-Law No. 7070/97. Updated December 11, 2002. 54p.

Appendix A

Terms of Reference

Background

In June of 1992, the Clean Environment Commission issued a report titled, "Report on Public ~~h~~Hearings. Application of Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers and Tributaries Within and Downstream of the City of Winnipeg." That report contained a number of recommendations that related to the City of Winnipeg's wastewater collection and treatment systems. The Manitoba government accepted those recommendations. Subsequently, the City, in consultation with Manitoba Conservation and the scientific community, has implemented upgrades, undertaken studies and prepared plans to improve its systems.

A serious malfunction occurred at the North End Sewage Treatment Plant on September 16, 2002 resulting in the discharge of untreated wastewater into the Red River and raising concerns with respect to the back-up capability of the systems.

Mandate of the Hearings

The Clean Environment Commission shall, pursuant to clause 6(5)(b) of *The Environment Act,* conduct public hearings to review the City of Winnipeg's wastewater collection and treatment systems and to receive public comments and concerns respecting the systems. Following the hearings, the Commission shall provide a report, with advice and recommendations, to the Minister in accordance with subsection 7(3) of *The Environment Act.* The Commission shall provide the report within 6 months of the date of the Minister's request to hold hearings. The Commission may at any time request that the Minister of Conservation review or clarify these Terms of Reference.

Scope of the Review

The Clean Environment Commission shall review the City of Winnipeg's wastewater collection and treatment systems and related public concerns and provide advice and recommendations on:

- The reliability of The City's systems, especially the back-up capability of the systems to prevent a discharge of inadequately treated sewage to the rivers during malfunctions.
- The appropriate ammonia, nutrient, combined sewer overflow and microbiological limits on effluent from the City's systems necessary to protect the aquatic environment and recreational activities, including in Lake Winnipeg.
- The current and planned effectiveness of the City's systems in treating wastewater to achieve the discharge limits.
- The adequacy of the City's plans and schedule for upgrading its systems.
- The adequacy of processes being followed in reviewing those plans and schedules.

In doing so, the CEC should consider the applicable recommendations in the 1992 Commission report and the recently updated Manitoba *Water Quality Standards, Objectives and Guidelines*.

Appendix B

List of Registered Presenters

Name	Organization
Larry Strachan	Environmental Approvals Branch, Manitoba Conservation
Barry MacBride	Water and Waste Department, City of Winnipeg
Mike Shkolny	Water and Waste Department, City of Winnipeg
George Rempel	TetrES Consultants Inc.
David Morgan	TetrES Consultants Inc.
Ron Dalmyn	The Organization
Dwight Williamson	Water Resources Branch, Manitoba Conservation
Merrell-Ann Phare	The Ad Hoc Group
Laura Orlando	The Ad Hoc Group
Kenton Lobe	The Ad Hoc Group
Rodney McDonald	The Ad Hoc Group
Mike Stainton	Freshwater Institute, Fisheries and Oceans Canada
Alex Salki	Freshwater Institute, Fisheries and Oceans Canada
Len Hendzel	Freshwater Institute, Fisheries and Oceans Canada
Hedy Kling	Freshwater Institute, Fisheries and Oceans Canada
Barry Briscoe	Environment Canada
Scott Kidd	Private Representation
Al Mackling	Winnipeg Game and Fish Association
Joletta Brown	Winnipeg Game and Fish Association
Eva Pip	University of Winnipeg
Paul MacKenzie	Private Representation
Jack Jonasson	Coalition for Flood Protection North of Winnipeg
Jesus Miguel-Garcia	Private Representation
Paul Clifton	Private Representation
Reg Gallop	Private Representation
Len Van Roon	Private Representation
Louise May	St. Norbert Arts Centre
Tang Lee	St. Norbert Arts Centre

Appendix C

List of Exhibits

No.	Exhibit
1.	*Letter* dated October 03, 2002 from the Hon. Steve Ashton, Minster of Conservation, to Terry Duguid, Chairman of the Clean Environment Commission.
2.	Terms of Reference for Clean Environment Commission Hearings into The City of Winnipeg's Wastewater Collection and Treatment Systems.
3.	"Environmental Approvals Branch, Manitoba Conservation Clean Environment Commission Public Hearings City of Winnipeg Sewage Investigation January 20, 2003: Opening Comments by Larry Strachan, Director, Environmental Approvals Branch." Submitted by Larry Strachan, Manitoba Conservation.
4.	*Visual Projections*: "Manitoba Water Quality Standards, Objectives, and Guidelines 2002". Submitted by Dwight Williamson, Manitoba Conservation.
5.	"Final Draft – For Additional Review and Comment – Manitoba Water Quality Standards, Objectives, and Guidelines". Manitoba Conservation. November 22, 2002. Submitted by Dwight Williamson, Manitoba Conservation.
6.	*Visual Projections*: "Manitoba's Nutrient Management Strategy". Submitted by Dwight Williamson, Manitoba Conservation.
7.	"A Preliminary Estimate of Total Nitrogen and Total Phosphorus Loading to Streams in Manitoba Canada". Water Quality Management Section, Water Branch, Manitoba Conservation. November 2002. Submitted by Dwight Williamson, Manitoba Conservation.
8.	"Long-Term Trends in Total Nitrogen and Total Phosphorus Concentrations in Manitoba Streams". Water Quality Section, Water Branch, Manitoba Conservation. December 2001. Submitted by Dwight Williamson, Manitoba Conservation.
9.	*Visual Projections*: "Overview Presentation Winnipeg's Wastewater Pollution Prevention Plan: Presented to the Clean Environment Commission January 20, 2003 City of Winnipeg – Water and Waste Department". Submitted by Barry MacBride, City of Winnipeg.
10.	*Visual Projections*: "Ammonia Reduction in City of Winnipeg Wastewater Effluents: Ammonia Criteria Study". Submitted by George Rempel, TetrES Consultants Inc., Mike Shkolny, City of Winnipeg.
11.	"Summary: Ammonia Reduction in City of Winnipeg Wastewater Effluents". December 2002. Submitted by Mike Shkolny, City of Winnipeg.
12.	"Red and Assiniboine Ammonia Criteria Study: Final Technical Report". November 2002. Submitted by Mike Shkolny, City of Winnipeg.
13.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Population Technical Memorandum #FP01: The Occurrence of External Deformities, Erosion, Lesions, and Tumours (Delts) on Fish from the Red and Assiniboine Rivers, 1999". Submitted by Mike Shkolny, City of Winnipeg.
14.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Technical Memorandum # T1.0: Phase 2 Toxicity Workstream: Ammonia Toxicity-Testing Program in 1999 and 2000." March 2001. Submitted by Mike Shkolny, City of Winnipeg.
15.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Technical Memorandum #RC2.0: River Conditions". January 2001. Submitted by Mike Shkolny, City of Winnipeg.
16.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Behaviour Technical Memorandum #FB04: Movements of 10 Northern Pike Tagged with

No.	Exhibit
	Acoustic Transmitters in the Red River in the Vicinity of NEWPCC Effluent Plume, February-March, 2000". November 2000. Submitted by Mike Shkolny, City of Winnipeg.
17.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Populations Technical Memorandum #FP02: Species Composition, Abundance, and Distribution of Fish in the Red and Assiniboine Rivers within the City of Winnipeg Ammonia Criteria Study Area, 1999". November 2000". Submitted by Mike Shkolny, City of Winnipeg.
18.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Other Stressors; Physical Constraints Memorandum # OSPC01: Other Stressors; Physical Constraints to Fish Populations in the Red and Assiniboine Rivers". September 2000. Submitted by Mike Shkolny, City of Winnipeg.
19.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Population Technical Memorandum #FP03: Abundance, Composition, and Distribution of Benthic Invertebrates in the Red and Assiniboine Rivers Within the City of Winnipeg, 1999". July 2000. Submitted by Mike Shkolny, City of Winnipeg.
20.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Technical Memorandum #RH2.0: Phase 2 Other Stressors Workstream: Resource Harvesting Program Report for 1999". May 2000. Submitted by Mike Shkolny, City of Winnipeg.
21.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Behaviour Technical Memorandum #FB02: Biological and Environmental Data from Experimental Netting in the Vicinity of the NEWPCC Outfall, October, 1999". February 2000. Submitted by Mike Shkolny, City of Winnipeg.
22.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Habitat Technical Memorandum #FH03: Water Chemistry Data to Characterize Fish Habitat in the Red and Assiniboine Rivers". January 2000. Submitted by Mike Shkolny, City of Winnipeg.
23.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Habitat Technical Memorandum #FH02: Benthic Invertebrate and Sediment Data to Characterize Fish Habitat in the Red and Assiniboine Rivers". January 2000. Submitted by Mike Shkolny, City of Winnipeg.
24.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Habitat Technical Memorandum #FH01: Physical Data to Characterize Fish Habitat in the Red and Assiniboine Rivers". January 2000. Submitted by Mike Shkolny, City of Winnipeg
25.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Behaviour Technical Memorandum #FB03: Movements of Fish Tagged with Acoustic Transmitters in the Vicinity of the City of Winnipeg's Water Pollution Control Centres, 1999 – 2000". Submitted by Mike Shkolny, City of Winnipeg.
26.	"Phase 2 Technical Memorandum for Red and Assiniboine Ammonia Criteria Study: Fish Behaviour Technical Memorandum #FB01: Biological and Environmental Data from Experimental Gillnetting in the Vicinity of the NEWPCC Outfall, March, 1999". August 1999. Submitted by Mike Shkolny, City of Winnipeg.
27.	*Visual Projections*: "Nutrient Characterization of Discharges from Winnipeg". Submitted by Nick Szoke, City of Winnipeg.
28.	"City of Winnipeg Water and Waste Department Nitrification Study: Preliminary Design Report". November 2002. Submitted by Mike Shkolny, City of Winnipeg.
29.	"City of Winnipeg Water and Waste Department Nitrification Study: Conceptual Design Report". November 2002. Submitted by Mike Shkolny, City of Winnipeg.
30.	*Drawings*: "City of Winnipeg Water and Waste Department Nitrification Study: Conceptual

No.	Exhibit
	Design Report". Submitted by Mike Shkolny, City of Winnipeg.
31.	*Visual Projections*: "Combined Sewer Overflow Management Study". Submitted by George Rempel, TetrES Consultants Inc., and Mike Shkolny, City of Winnipeg.
32.	*Letter*, dated September 11, 2002 from Chris Leach, CSO Advisory Committee to Nicolas T. Szoke, City of Winnipeg.
33.	"Executive Summary: Combined Sewer Overflow Management Study". Submitted by Mike Shkolny, City of Winnipeg.
34.	"Final Report: Combined Sewer Overflow Management Study". Submitted by Mike Shkolny, City of Winnipeg.
35.	"Report to City of Winnipeg Water and Waste Department: Combined Sewer Overflow Management Study: Volume 1, 2, 3, 4 (of 4)". Wardrop Engineering Inc. and TetrES Consultants Inc. Submitted by Mike Shkolny, City of Winnipeg.
36.	*Visual Projections*: "Wastewater Effluent License Limits." Submitted by Nick Szoke, and J. Oleszkiewicz, City of Winnipeg.
37.	*Visual Projections*: "Proposed Effluent Limits for City of Winnipeg Sewage Treatment Plants". Submitted by Mike Van Den Bosch, Manitoba Conservation.
38.	"Environmental Approvals Branch, Manitoba Conservation - Clean Environment Commission Public Hearings City of Winnipeg Sewage Investigation – January 2003: Recommended Effluent Discharge Limits for City of Winnipeg Sewage Treatment Plants" Mike Van Den Bosch, A/Manager, Municipal, Industrial and Hazardous Waste Approvals Section. Submitted by Mike Van Den Bosch, Manitoba Conservation.
39.	*Visual Projections*: "Wastewater Systems Reliability by City of Winnipeg, Water and Waste Department for Clean Environment Commission Hearings, January 2003". Submitted by Mike Shkolny, City of Winnipeg.
40.	"Report on the Shutdown of the North End Water Pollution Control Centre on September 16, 2002". Winnipeg Water and Waste Department. December 19, 2002. Submitted by Mike Shkolny, City of Winnipeg.
41.	"Final Summary Report: City of Winnipeg North End Water Pollution Control Centre Review of Failure". Associated Engineering. January 2003. Submitted by Mike Shkolny, City of Winnipeg.
42.	*Visual Projections*: "Investigation Report: Raw Sewage Discharge to The Red River – City of Winnipeg North End Sewage Treatment Plant". Submitted by Mike Van Den Bosch and Brian Konzelman, Manitoba Conservation.
43.	"Investigation Report Raw Sewage Discharge to the Red River – City of Winnipeg North End Sewage Treatment Plant". Manitoba Conservation. January 2003. Submitted by Mike Van Den Bosch, Manitoba Conservation.
44.	*Visual Projections*: Water Quality Assessment Following Release of Raw Sewage from the City of Winnipeg, September 2002". Submitted by Dwight Williamson, Manitoba Conservation.
45.	"Water Quality Assessment of the Red River and Lake Winnipeg Following Release of Raw Sewage from The City of Winnipeg, September 2002". Water Quality Management Section, Water Branch, Manitoba Conservation. November 2002. Submitted by Dwight Williamson, Manitoba Conservation.
46.	*Visual Projections*: "Summary of Winnipeg's Plan to Improve Wastewater Treatment". Submitted by Mike Shkolny, City of Winnipeg.
47.	*Visual Projections*: "Environmental Approvals Branch (EAB) Comments on City of Winnipeg Recommendations". Submitted by Larry Strachan, Manitoba Conservation.
48.	"Environmental Approvals Branch (EAB) Comments on City of Winnipeg Recommendations to the Clean Environment Commission Public Hearings – January 20,

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	2003". Larry Strachan, Director, Environmental Approvals Branch, Manitoba Conservation. Submitted by Larry Strachan, Manitoba Conservation.
49.	*Motion:* #1 [Respecting Hearing Suspension]. Submitted by John Sinclair, Ad ~~h~~Hoc Group.
50.	*Motion: #2* [Respecting Hearing Suspension]. Submitted by John Sinclair, Ad ~~h~~Hoc Group.
51.	*Visual Projections*: "Manitoba Clean Environment Commission Public Hearing: City of Winnipeg Wastewater Collection and Treatment System – Winnipeg, Manitoba, 21 January 2003: Presenters: Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe. Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
52.	Biographies of Funded Participants Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
53.	*Appendices*: "Manitoba Clean Environment Commission Public Hearing: City of Winnipeg Wastewater Collection and Treatment System – Winnipeg, Manitoba, 21 January 2003: Presenters: Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe". Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
54.	"A Plan to Manage Household Hazardous Waste in Manitoba". Manitoba Conservation. July 2001. Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
55.	"Plan Winnipeg 2020 Vision". City of Winnipeg. Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
56.	*Brief*: "Prepared for Manitoba Clean Environment Commission Hearings By Winnipeg Game and Fish Association – January 21, 2003. Submitted by Al Mackling, Winnipeg Game and Fish Association.
57.	*Brief*: "A Brief on the Downstream Impacts of The City of Winnipeg Wastewater Treatment Plant Effluents". Submitted by Eva Pip.
58.	*Brief*: "Brief to the Clean Environment Commission Hearing on Winnipeg's Waste Water Collection and Treatment Systems – January 21, 2003". Submitted by Carolyn Garlich, Council of Women of Winnipeg.
59.	*Brief*: "Lake Winnipeg & Winnipeg's S.T.P. Spill January 21/2003". Submitted by Ron Dalmyn, The Organization.
60.	*Brief*: "Presentation to the Manitoba Clean Environment Commission regarding the City of Winnipeg's Wastewater Collection and Treatment Systems". Submitted by Scott Kidd.
61.	*Visual Projections*: "Proposed Risk Management Strategy Addressing Ammonia, Inorganic Chloramines and Chlorinated Wastewater Effluents – Winnipeg, Manitoba January 21, 2003". Environment Canada. Submitted by Barrie Briscoe and Claude Fortin, Environment Canada.
62.	"Pollution Prevention Planning for Ammonia, Inorganic Chloramines and Chlorinated Wastewater Effluents in Municipal Wastewater Effluents: Working Document: Part 4 of the *Canadian Environmental Protection Act* 1999". Environment Canada. July 2002. Submitted by Claude Fortin, Environment Canada.
63.	"Proposed Risk Management Strategy addressing Ammonia, Inorganic Chloramines and Chlorinated Wastewater Effluents under CEPA 1999: Pollution Prevention Planning as a Fist Step Toward a Long-term Strategy for Managing Wastewater Effluents". Environment Canada. August 2002. Submitted by Barrie Briscoe and Claude Fortin, Environment Canada.
64.	"Proposed Risk Management Strategy addressing Ammonia, Inorganic Chloramines and Chlorinated Wastewater Effluents under CEPA 1999: Report of Consultation Sessions August 20th to November 4th, 2002: Summary of Input from Participants". Environment

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	Canada. December 2002. Submitted by Barrie Briscoe and Claude Fortin, Environment Canada.
65.	"Environment Canada Proposed Risk Management Strategy Addressing Ammonia, Inorganic Chloramines and Chlorinated Wastewater Effluents Under CEPA 1999: 2nd Table Discussion (Recorder Notes): Feedback on Pollution Prevention Planning Implementation Issues, Winnipeg, MB". Environment Canada. Submitted by Barrie Briscoe and Claude Fortin, Environment Canada.
66.	"Federal Register: Part VII: Environmental Protection Agency: Combined Sewer Overflow (CSO) Control Policy; Notice: Tuesday April 19, 1994." Submitted by the Manitoba Clean Environment Commission.
67.	*Excerpts*: "Combined Sewer Overflows: Guidance For Long-Term Control Plan" United States Environmental Protection Agency. Pages 3-7, 3-8, 3-9, 3-10. Submitted by George Rempel, TetrES Consultants Inc. and Mike Shkolny, City of Winnipeg.
68.	*Excerpts*: "Health Effects Criteria for Fresh Recreational Waters". United States Environmental Protection Agency. August 1984. Page iv. Submitted by the Manitoba Clean Environment Commission.
69.	*Excerpts*: "Ambient Water Quality Criteria for Bacteria – 1986" United States Environmental Protection Agency. January 1986. Page 16 and Table 4. Submitted by the Manitoba Clean Environment Commission.
70.	*Excerpts*: "Guidelines for Water Reuse: Manual". United States Environmental Protection Agency. September 1992. Pages 133 and 134. Submitted by the Manitoba Clean Environment Commission.
71.	*Brief*: "Manitoba Clean Environment Commission - Share Your Views: City of Winnipeg Wastewater Collection and Treatment System". Submitted by Roxanne Anderson.
72.	*Brief*: "Re: Public Hearings scheduled for January 27/28 in Selkirk: Comments and Observations". Submitted by Karl Pohl.
73.	*Brief*. Submitted by John Einarson.
74.	*Brief*. "Presentation to Manitoba Clean Environment on City of Winnipeg Sewage Systems. January 27, 2003". Submitted by Paul Clifton.
75.	*Brief*. "Devil's Creek Watershed Coalition". Submitted by Jane Seniw and Bob Shearer, Devil's Creek Watershed Coalition.
76.	*Brief*. Submitted by Jerry Moskalyk.
77.	*Brief*. Submitted by Laurel Sarginson.
78.	*Visual Projections*: "City's Proposed Ammonia Loadings". Submitted by George Rempel, TetrES Consultants Inc. and Mike Shkolny, City of Winnipeg.
79.	*Visual Projections*: "Manitoba Clean Environment Commission Hearing: City of Winnipeg Wastewater Collection and Treatment Systems". Submitted by Dave Woytowich.
80.	*Brief*. Submitted by Stu McKay, Manitoba Lodge and Outfitters Association.
81.	*Brief*: "Presentation to Manitoba Clean Environment Commission Public Hearing: January 28, 2003, Selkirk, Manitoba". Submitted by Darla Campbell, United Water Canada.
82.	*Response to Motion*. Submitted by Manitoba Clean Environment Commission.
83.	*Letter* dated January 30, 2003 from Terry Duguid, Chairman of the Clean Environment Commission, to the Hon. Steve Ashton, Minster of Conservation.
84.	*Letter* dated January 31, 2003 from Terry Duguid, Chairman of the Clean Environment Commission, to the Hon. David Anderson, Minister of Environment.
85.	*Letter* dated February 12, 2003 from M. S. Samphir, City of Winnipeg, to Terry Duguid, Chairman of the Clean Environment Commission.
86.	*Letter* dated February 19, 2003 from Terry Duguid, Chairman of the Clean Environment Commission, to M. S. Samphir, City of Winnipeg.

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87.	"Clean Environment Commission Public Hearings on the City of Winnipeg Sewage Collection and Treatment Systems, April 14, 2003: Opening Comments by Larry Strachan, Director, Environmental Approvals Branch." Submitted by Larry Strachan, Manitoba Conservation.
88.	"Environmental Impact Statement: Continued Operation and Future Development of the City of Winnipeg Wastewater Collection and Treatment System, February 27, 2003. City of Winnipeg Water and Waste Department. Submitted by Mike Shkolny, City of Winnipeg.
89.	*Visual Projections*: "Winnipeg's Plan to Improve Wastewater Treatment: Clean Environment Commission Hearing, Winnipeg, MB - April 14, 2003: Water and Waste Department, City of Winnipeg". Submitted by Barry MacBride, City of Winnipeg.
90.	*Visual Projections*: "Environmental Impact Statement: City of Winnipeg Wastewater Collection and Treatment System". Submitted by Mike Shkolny, City of Winnipeg.
91.	*Visual Projections*: "Nutrient Management and Lake Winnipeg: Presentation to the CEC. April 14, 2003". Submitted by George Rempel, TetrES Consultants Inc., Mike Shkolny, City of Winnipeg.
92.	"2002 Leachate Hauling Summary" [City of Winnipeg]. Submitted by Mike Shkolny, City of Winnipeg.
93.	"Pumped Leachate Analysis – 2002 Yearly Summary" City of Winnipeg Water and Waste Department Laboratory Services Division-Research Branch. Submitted by Mike Shkolny, City of Winnipeg.
94.	"Presentation by The Organization: More Pigs vs. Saving Lake Winnipeg, April 14, 2003". Submitted by Ron Dalmyn, The Organization.
95.	Opening Statement submitted by Merrell-Ann Phare, Ad Hoc Group.
96.	*Visual Projections*: "Manitoba Clean Environment Commission Public Hearing: City of Winnipeg Wastewater Collection and Treatment System – Winnipeg, Manitoba, 15 April 2003: Presenters: Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe. Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
97.	*Summary Sheets*: "Effects Assessment Components". Submitted by Merrell-Ann Phare, Ad Hoc Group.
98.	*Appendices*: "Manitoba Clean Environment Commission Public Hearing: City of Winnipeg Wastewater Collection and Treatment System – Winnipeg, Manitoba, 15 April 2003: Presenters: Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe". Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
99.	"Exhibit P1: Examples of Toxic Pollutant Testing Requirements" Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
100.	"Exhibit P2: Model Laws, Regulations, and Projects". Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
101.	"Exhibit 2 Part 2: The National Pre-treatment Program". Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
102.	"Exhibit P3: Massachusetts Water Resources Authority Authorization to Discharge under the National Pollutant Discharge Elimination System, Annual Compliance Report, and other Reports". Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
103.	"Exhibit P3, Part 2: [Untitled]". Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.
104.	"Exhibit P4: Information on Mercury and Sludge". Submitted by Merrell-Ann Phare, John Sinclair, Laura Orlando, Rodney C. McDonald, Kenton Lobe, Ad Hoc Group.

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105.	"Evidence from Ecosystem Research by Fisheries and Oceans Canada for the Need to Protect Lake Winnipeg from Phosphorus Derived from the Red River Basin". Submitted by Michael Stainton, Alex Salki, Len Hendzel and Hedy Kling, Freshwater Institute, Fisheries and Oceans Canada.
106.	UNASSIGNED - NO EXHIBIT
107.	"Environment Canada Submission to the Clean Environment Commission Hearings on The City of Winnipeg Wastewater Collection and Treatment System. Winnipeg, Manitoba April 15, 2003". Submitted by Barry Briscoe, Environment Canada.
108.	"Agri-Info". March 2003, Volume 1: Agricultural Policy Framework. Agriculture and Agri-Food Canada. Submitted by Barry Briscoe, Environment Canada.
109a	*Visual Projections*: "Submission to Clean Environment Commission on the City of Winnipeg Wastewater Treatment Plants". Barry Briscoe, Environmental Protection, Environment Canada. April 15, 2003. Submitted by Barry Briscoe, Environment Canada.
109b	"The Impacts of Municipal Wastewater Effluents on Canadian Waters: A Review". (Water Quality Research Journal of Canada 1997, Volume 32, no. 4, pg 659-713). P. Chamber, M. Allard, S. L. Walker, et al. Submitted by Barry Briscoe, Environment Canada.
110.	"Presentation to the Manitoba Clean Environment Commission regarding the City of Winnipeg's Wastewater Collection and Treatment Systems". Submitted by Scott Kidd.
111.	*Brief* [Untitled] submitted by Al Mackling, Winnipeg Game and Fish Association.
112.	"Fish Quality and Abundance in the Lake Winnipeg System: Report on a Survey of Recreational and Commercial Fishers and Outfitters, April 2003". Joletta Brown and Eva Pip. Winnipeg Game and Fish Association. Submitted by Joletta Brown, Winnipeg Game and Fish Association.
113.	"Agricultural BMP Examples" 15 April 2003. TetrES Consultants Inc. Submitted by George Rempel, TetrES Consultants and Mike Shkolny, City of Winnipeg.
114.	"City of Winnipeg CSO Plan: Range of Volume and Number of Overflows". Submitted by Mike Shkolny, City of Winnipeg.
115.	*Brief* [Untitled] submitted by Paul Mackenzie.
116.	*Visual Projections*: "Fish Quality and Abundance in the Lake Winnipeg System". Submitted by Submitted by Joletta Brown, Winnipeg Game and Fish Association.
117.	"Presentation to the Clean Environment Commission: April 16, 2003". Submitted by Jack Jonasson, Coalition for Flood Protection North of Winnipeg.
118.	"Propositions and Solutions to Wastewater Collection and Treatment System in Winnipeg: Representation of Jesus Miguel-Garcia to the Manitoba Clean Environment Commission's Public Hearing, April 16, 2003". Submitted by Jesus Miguel-Garcia.
119.	*Visual Projections*: "MB Clean Environment Commission (CEC) April 16, 2003 – Oral Submission Re: City of Winnipeg Waste Water Systems". Submitted by Paul Clifton.
120.	"MB Clean Environment Commission (CEC) April 03, 2003 – Written Submission Re: City of Winnipeg Waste Water Systems". Submitted by Paul Clifton.
121.	"MB Clean Environment Commission (CEC) April 11, 2003 – Supplementary Submission Re: City of Winnipeg Waste Water Systems". Submitted by Paul Clifton.
122.	*Compact Disc*: "Site No. 2 Bartmanovich Road – RL 41, North Side of Roadway, 2003 03 29 (8)". Submitted by Paul Clifton.
123.	"Brief to the Public Hearings of the Manitoba Clean Environment Commission, on the City of Winnipeg Wastewater Collection and Treatment System April 16, 2003". Submitted by R. A. Gallop.
124.	"The Living System Solution". St. Norbert Arts Centre. Submitted by Louise May and Tang Lee, St. Norbert Arts Centre.
125.	*Visual Projections*: "Closing Statements Winnipeg's Plan to Improve Wastewater

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	Treatment: Clean Environment Commission Hearing, Winnipeg, Manitoba April 16, 2003". Submitted by Barry MacBride, City of Winnipeg.
126.	"Closing Comments By Larry Strachan, Director, Environmental Approvals Branch: Clean Environment Commission Public Hearings City of Winnipeg Wastewater Collection and Treatment Systems, Winnipeg, Manitoba – April 16, 2003". Submitted by Larry Strachan, Manitoba Conservation.