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# **Environmental Impact Statement**

## **Continued Operation and Future Development of the City of Winnipeg Wastewater Collection and Treatment System**

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**February 27, 2003**



## **PREAMBLE**

The Clean Environment Commission (CEC) has requested that the City of Winnipeg prepare an Environmental Impact Statement (EIS) within 30 days, as of January 28, 2003, on the proposed plan for the continued operation and future development of the City of Winnipeg's wastewater collection and treatment system. In the traditional terminology of typical Environmental Impact Statements, "THE DEVELOPMENT" referred to in this document consists of both existing operations and the proposed components to be undertaken in the City's proposed program of enhanced wastewater pollution prevention and control for environmental improvements. This EIS provides an "Effects Assessment" consistent with the elements outlined in the Consultations on Sustainable Development Implementation (COSDI) Report (1999), as requested by the CEC.

The EIS has been prepared by the Water & Waste Department of the City of Winnipeg with assistance from TetrES Consultants Inc.

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  - SUMMARY: Ammonia Reduction in City of Winnipeg Wastewater Effluents
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## 1. BACKGROUND

Prior to the enactment of the current *Environment Act* in 1988, the City of Winnipeg was self-regulating. When the new *Act* came into force, the powers of the City were repealed and the City wastewater treatment facilities required licensing. As an initial step in the licencing process, in 1990, Manitoba Environment (now Manitoba Conservation) proposed a classification system of the Red and Assiniboine Rivers within and downstream of Winnipeg that was intended to protect a variety of beneficial uses of the Rivers. A series of proposed Surface Water Quality Objectives for the protection of these uses, in the form of narrative statements and numerical limits, were proposed by the Province. The proposed classification and numerical limits for the protection of the local reaches of the Red and Assiniboine Rivers prompted a review of the proposed water-quality Objectives, as these could serve as the basis to set limits in licences for the Water Pollution Control Centres (WPCCs) of the treatment plants operated by the City of Winnipeg (City).

### 1.1 CEC HEARINGS 1991/1992

Public hearings were conducted by the Manitoba Clean Environment Commission (CEC) in the fall of 1991 and early winter of 1992. CEC Hearings were held in Winnipeg on November 25, 26, 27, 28, 1992, in Selkirk on December 2, 3, 1991 and again in Winnipeg on January 13, 14, 15, 1992. The CEC provided guidance to the Minister on the proposed classification, water quality objectives, and other matters, in a report dated June 1992. The CEC recommended two major studies be done:

- Recommendation #6: Un-ionized Ammonia Study; and
- Recommendation #7: Fecal Coliform Study;

with CEC hearings to be reconvened after completion of these studies for consideration of their results.

The Minister approved the recommendation in November 19, 1993, and the City subsequently conducted the recommended studies. Manitoba Conservation and the City of Winnipeg have

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considered these recommendations and undertaken a variety of actions in response. The studies were very comprehensive, costly, and required considerable data development. For a variety of reasons, including a serious reallocation of city resources in response to the Red River floods of 1996 and 1997, these took longer than originally estimated. The studies and their full documentation were completed in draft form in 2000. In responding to the recommendations, the City conducted several studies and programs, including:

- undertaking extensive studies of water chemistry, flows, and pollutant mixing downstream of the WPCCs, with a view to developing a thorough understanding of the urban reaches of these rivers in relationship to the treatment plants;
- undertaking a comprehensive engineering evaluation on practicable tertiary wastewater treatment options for effluent ammonia reduction and/or nutrient control, to achieve certain receiving water quality target limits;
- design and execution of a comprehensive toxicology program to establish the sensitivities of local aquatic species to un-ionized ammonia under local receiving water characteristics;
- design and execution of a comprehensive program to establish a management plan for the discharges of combined sewer overflows (CSO) from the City core ; and
- a wide variety of other related matters, including regulatory liaison and public consultation regarding individual studies, public perception of the river system, and other issues relating to City water and waste operations.

The City and Manitoba Conservation met to discuss the results of the studies, including advice from Manitoba Conservation on their priorities of environmental issues. The City had developed an overall plan which they believed would allow for licencing of the three WPCC's to proceed.

## **1.2 2003 CEC HEARINGS**

On September 16, 2002, a malfunction occurred at the North End Water Pollution Control Centre (NEWPCC), resulting in an unplanned shutdown of the NEWPCC and temporary discharge of untreated wastewater into the Red River. This spill was investigated by Manitoba Conservation, Environment Canada and the City of Winnipeg under a separate process. While CEC Hearings were anticipated to occur in the Fall of 2003, the September 16, 2002 incident

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resulted in an accelerated timeframe for commencement of the January 2003 Hearings. As such, the CEC was requested by the Minister of Conservation to convene a public hearing to review and receive public comments on the City of Winnipeg's wastewater collection and treatment systems.

The CEC was instructed to review the current status of the City's wastewater collection and treatment systems and to consider plans proposed by the City for its future upgrading and continued operation according to the following scope:

- The reliability of the City's systems, especially the backup capability of the systems to prevent a discharge of inadequately treated wastewater 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.

At the conclusion of the review, the CEC is to prepare a report with advice and recommendations to the Government of Manitoba on the items noted above.

Hearings were held in Winnipeg on January 20 through 23, 2003, and in Selkirk on January 27 & 28, 2003. On January 28, 2003, the CEC issued instructions requiring the City of Winnipeg to provide an EIS within 30 days respecting the proposed plan for the continued operation and future development of the City of Winnipeg wastewater collection and treatment system. The CEC Chair then adjourned the hearings, with reconvening on or about April 10, 2003.

### **1.3 RESPONSE TO CEC INSTRUCTION OF JANUARY 28, 2003**

The CEC's "Response to Motion" of January 28, 2003, contained the following instruction regarding preparation of an Environmental Impact Statement ("EIS"):

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- “1. *Within a period not exceeding thirty (30) calendar days from the date of this response, the City of Winnipeg shall provide to the Commission and the Regulator an Environmental Impact Statement (EIS) respecting the proposed plan for the continued operation and future development of the City of Winnipeg wastewater collection and treatment system. This EIS shall be prepared and presented in a form consistent with the elements of “Effects Assessment” outlined in the Consultation on Sustainable Development Implementation Report (1999).”*

The City of Winnipeg expressed concern about this direction in terms defined in a letter to the CEC dated February 12, 2003. This letter is provided as Figure 1-1. The City responded directly and immediately to the CEC instruction.

Letter from City of Winnipeg  
To Clean Environment  
Commission  
Figure 1-1



Corporate Services Department • Services généraux

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February 12, 2003

Terry Duguid  
Chairperson  
Clean Environment Commission

The City of Winnipeg has had an opportunity to review and consider the instruction of the Clean Environment Commission (the "CEC") date January 28, 2003 which included the requirement that the City prepare an Environmental Impact Statement (EIS). Though the City is in the process of endeavouring to comply with the instruction, I have been asked to write the CEC and put on record a number of concerns the City has with the CEC's instruction and process.

Throughout this process, the City has made every effort to cooperate with both the CEC and the Province of Manitoba in the undertaking of these hearings and to provide the public with sufficient information so that they could participate in these hearings in a meaningful fashion.

It is of great concern to the City that the manner and tone of the instruction has left the clear suggestion that the City has not provided either Manitoba or the CEC with information which is helpful to the CEC or has made no effort to provide its information in a manner which is clear and understandable to the CEC, other intervenors, and the public. This was not the case.

Though the CEC is of the belief that an EIS is now necessary, the City must go on record stating that the CEC's request of the City has been made in a manner which failed to take into consideration the effect of preparing an EIS will have on the City's resources, other commitments of the City, in particular in the Water and Waste Department. There will be additional cost to the City both in additional consultant costs and the reallocation of the City's resources.

In the City's view, it is unfortunate that the CEC did not take the opportunity of discussing its concerns with the City prior to making its instruction. If the City had been given that opportunity by the CEC, the following information would have been presented:

1. That at no time prior to the hearing being called or on the Minister requesting a hearing by the CEC was the City requested to prepare an EIS. At the hearings, the CEC was aware that the Director of Environmental Approvals had not requested an EIS and had indicated that the studies prepared and information submitted by the City provided the Director with sufficient information to license the City's facilities. It remains the City's view that requiring an EIS at this late date in the process is not consistent with the outcome of the 1991/92 CEC hearings. In fact we were told that an EIS would not be required for this process.
2. In the context of the hearings that took place in the 1990's and the documentation available in that regard, the documentation filed on the registry as a result of the calling of these hearings, the summaries of the City's evidence filed as exhibits and the evidence lead by the City, the CEC has all the necessary information to make its recommendations to the Minister.
3. As the CEC is aware, the province had envisaged hearings to be scheduled later in 2003. However, because of the September incident at the North End Water Pollution Control Centre, the CEC's hearings were accelerated. Upon the announcement by the Minister in October of 2002 that a CEC hearing would be required, the City made its preparations for the hearings a number one priority. This was done with the clear belief that the material prepared and submitted by the City was sufficient for the purpose to enable the hearings to conclude at the end of January. The City complied with the accelerated process and attended the hearings in January. The City held public open houses in both Winnipeg and Selkirk in advance of the CEC hearings. This compliance included the submission of all required documents and preparation and delivery of 7 hours of testimony in the form of presentations. In addition, the City fully answered every question by the Commission and the public.
4. The repackaging of the material into an EIS form consistent with the CEC's instructions will be just that – repackaging. There will be no new information added to the years of research. At no time during the preparation for these hearings was a request or instruction made that an EIS was required.
5. One of the significant purposes for the EIS suggested by the Chairman is to somehow convince Environment Canada to participate and provide an opinion on water quality issues such as nutrients. The opinion of Environment Canada is not a prerequisite to recommendations by the CEC or the Director's licensing of the

City's facilities. There is no evidence that Environment Canada will comment on the EIS once submitted.

6. The CEC should be aware that as a result of its instruction, the City has put major projects on hold which will result in a loss of momentum and additional restart costs. For example, the City is working on a biosolids project and plan for public consultation on those options. This is one example of work that will be delayed for months and perhaps by as much as a year if the public consultation window is missed. This is unacceptable to the City. Other projects affected will be improvements at the North End Water Pollution Centre to address recommendations for improvements, the disinfection project, the ammonia reduction project (centrate treatment), and progress on water treatment where senior staff is required.
  
7. Further, the cost to assign the necessary consulting and staff resources to this work over the next month and to prepare for and attend the resumption of hearings in April and the impact of this unscheduled work on other projects could easily reach \$300,000. This money could and should be utilized for improvements required at the North End Water Pollution Control Centre including the disinfection facility where tangible and real benefits could be realized.

Again, it is unfortunate that the City was not given an opportunity to address the CEC's concerns with regard to both the City's materials and the need for an EIS. Though the manner in which the CEC made its instruction left no room for discussion or request that the CEC reconsider its position, it is certainly hopeful that in the future the City will be permitted input when a decision of the CEC has such significant impact on the City.

Yours truly,

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City Solicitor/Manager of Legal Services  
Per:

**M. S. SAMPHIR**  
Senior Counsel  
MSS:law

copies to: Mr. Steve Ashton, Minister of Transportation  
Mr. Norm Brandson, Deputy Minister of Conservation  
Mr. Serge Scrafield, ADM  
Mr. Larry Strachan, Director of Environmental Approvals  
Mr. John Angus, Chair of Standing Policy Committee on Public Works  
Mr. Jae Eadie, Intergovernmental Affairs  
Ms. Gail Stephens

## 1.4 TIMEFRAME OF EIS

The time available to prepare this EIS was extremely brief in comparison with typical regulatory processes. Due to the brevity of the imposed timeframe, the City of Winnipeg has not conducted any new studies during the preparation of this EIS. This EIS represents the City's best efforts to assemble available existing information into a form consistent with the CEC's request dated January 28, 2003.

## 1.5 EIS OBJECTIVES

This EIS has been prepared to respond to the CEC's request that the Environmental Impact Statement respecting the City of Winnipeg's proposed plan for the continued operation and future development of the wastewater collection and treatment system contain the elements of an "Effects Assessment" outlined in the Consultation on Sustainable Development Implementation Report (COSDI 1999). The following provides the recommendations contained in the COSDI report regarding effects assessment.

### Effects Assessment

*B) Manitoba [should] broaden the concept of assessment from the environmental impact assessment as set out in the Environment Act, to an effects assessment to include the assessment and review of all of the sustainability factors of a development. The effects assessment process would culminate in an approval (through issuance of a license, usually with terms and conditions) or rejection of the proposal. An effects assessment would include the assessment and review of any combination of the following elements:*

- a) purpose of the project;*
  - b) description of the project;*
  - c) assessment methodology and results of public consultation;*
  - d) an analysis of the alternatives to the project and alternative means for the project, in each case including the "do nothing" alternative;*
  - e) need (examined in connection to alternatives);*
  - f) description of the existing development and potential zones of impact;*
-

- g) description of the environmental effects;
- h) description of the social effects, including human health, cultural and heritage values;
- i) description of economic effects;
- j) description of the mitigation measures;
- k) description of cumulative and interdependent effects;
- l) residual effects and their significance;
- m) follow-up plans;
- n) decommissioning; and
- o) project sustainability [note: a) analysis of the balance between the environmental/ecological, social, economic, cultural and human health benefits and impacts of the project, b) the indicators and methodology for performing such analysis will need to be developed over time.].

Accordingly, the primary objective of this EIS is to report on the environmental effects of the development and to respond to each of the elements listed above, “(a) through (o)”, in the “Effects Assessment” as outlined in the cited COSDI document.

Table 1-1 cross-references the COSDI EA elements to specific sections contained in this EIS.

**TABLE 1-1**  
**LOCATION IN EIS OF INFORMATION REQUIRED FOR**  
**COSDI “EFFECTS ASSESSMENT”**

COSDI Element	COSDI Description	Location in this EIS
a	Purpose of project	4.1
b	Description of project	3.1
c	Assessment methods/public consultation	3.2, 7
d	Alternatives (including “Do Nothing”)	4.3, 4.4
e	Need	4.1
f	Existing Development/zones of impact	4.2, 5
g	Environmental effects	5
h	Social effects	5.1
i	Economic Effects	5.1,8
j	Mitigation Measures	5
k	Cumulative effects	5.5
l	Residual effects	5
m	Follow-up plans	6
n	Decommissioning	9
o	Project Sustainability	8

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## 2. REGULATORY FRAMEWORK

A variety of components constitute the regulatory framework within which consideration of the City's wastewater collection and treatment system is considered, and within which appropriate licence limits and conditions can be developed and issued. The framework includes provincial, federal, and municipal components, as discussed in the following sections.

### 2.1 MANITOBA ENVIRONMENT ACT AND REGULATIONS

In 1988, the new *Manitoba Environment Act* became law. Under the *Act*, existing developments with impacts on the environment are subject to licencing. These licencing requirements were applied to the City's treated wastewater discharges into the rivers.

Wastewater treatment plants are defined as Class 2 developments under Manitoba Regulation 164/88 ("Classes of Development Regulation"). As such, they are subject to licencing pursuant to Section 11 of the *Act*. In February 1990, Manitoba Environment received duly completed *Environment Act* Proposal Forms ("EAPFs") for each of the wastewater treatment plants owned and operated by the City of Winnipeg at the time of promulgation of the *Environment Act*. Filing of the EAPFs by the City of Winnipeg formally triggered the *Environment Act* regulatory-review process, which was then intended to result in licences for each of the three facilities. In recognition of the large scale of the City's wastewater collection and treatment systems, the Province determined that licencing requirements would only be finalized following an examination of river uses and broader surface-water quality issues on the portion of the Red River downstream of the southern floodway entrance to Lake Winnipeg and on the portion of the Assiniboine downstream of St. Francis Xavier, west of Winnipeg. Hearings by the Manitoba Clean Environment Commission (CEC) in 1991 and 1992 were expected to provide numerical limits for the protection of beneficial water uses.

The hearings by the CEC in 1991/92 and 2003 are a key component of the licencing process contemplated under *The Environment Act*.

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### 2.1.1 Manitoba Surface Water Guidelines

The Province of Manitoba established Manitoba Surface Water Quality Objectives (MSWQO) which defined the minimum levels of quality necessary to protect specific beneficial uses of surface waters (Williamson, 1998a). Compliance with the objectives is intended to protect aquatic life, designated river uses, and public health, to an adequate degree of safety. Subsequent to the CEC hearings in 1991/92, the CEC recommended, and Manitoba Environment accepted these recommendations, that river uses be protected for the local rivers as shown in Table 2-1 (CEC 1992).

**TABLE 2-1**  
**CEC RECOMMENDATIONS: RIVER USES TO BE PROTECTED**  
**(DRY WEATHER CONDITIONS)**

RIVER USE CLASSIFICATION	RED RIVER	ASSINIBOINE RIVER
Aquatic life and wildlife	✓	✓
Recreation	✓	
a) primary		
b) secondary	✓	✓
Agricultural (Irrigation & livestock watering)	✓	✓
Industrial Consumption	✓	✓

The wastewater collection and treatment systems of the City of Winnipeg operate with the goal of protecting these specified river uses. Details pertaining to how these river uses are protected in current operations and how this protection will be enhanced by proposed upgrades is provided in Sections 4.2 and 4.3.

### 2.1.2 Canada-Manitoba Agreement Cooperative Assessments

Largely because of concerns being expressed by proponents across the country about “duplication of regulatory process”, the federal and provincial governments explored the potential for streamlining and making more congruent their respective regulatory processes in 1996/97. Negotiations among the parties resulted in the Canada-Wide Accord on Environmental Harmonization, signed in January 1998 (CCME 1998). The Canada-Wide Accord was an omnibus agreement under which a series of other arrangements were

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negotiated, including bilateral arrangements between Canada and each of the provinces or territories. On January 30, 1998, the Canada-Manitoba sub-agreement on environmental assessments was concluded. This is a binding sub-agreement under the Accord, and is intended to give effect to the various prescriptions of the Accord.

The federal government has participated in a variety of licencing processes in Manitoba, and is a participant in the current CEC process considering the City's wastewater collection and treatment systems. This EIS will be shared with Environment Canada for its consideration, pursuant to the Canada-Wide Accord on Environmental Harmonization.

## **2.2 CITY OF WINNIPEG SEWER BYLAW**

### Sewer By-law

The *City of Winnipeg Charter Act* allows City Council to adopt bylaws respecting provision of sewer services. Based on a history of prior Sewer Bylaws, the current City of Winnipeg Sewer By-law (No. 7070/97) came into effect in January 1998. Although the Sewer By-law has a variety of sections pertaining to a broad range of issues related to the construction and operation of the City's sewer system, for the purposes of this EIS, the key areas of focus are those dealing with discharges to the sewer system that require control or regulation (see also Section 4.2.4.5).

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### 3. APPROACH TO EIS

#### 3.1 PROJECT DESCRIPTION

The CEC's direction to the City of Winnipeg was to prepare an EIS focussing on the ***continued operation and future development*** of the City of Winnipeg wastewater collection and treatment systems. Consequently, this EIS does not include the historical aspects of this system, some of which have been in place since prior to the establishment of the Greater Winnipeg Sanitary Sewer District in 1935. This Environmental Impact Statement is focussed upon current operations and proposed developments associated with the City's planned pollution-control upgrades. In the traditional terminology of typical Environmental Impact Statements, "THE DEVELOPMENT" as defined in this document consists of both currently supported existing operations and proposed components to be implemented through the City's proposed program of enhanced pollution control. These are described below.

##### 3.1.1 Continued Operations

The City of Winnipeg Water and Waste Department operates extensive collection-system and treatment-system assets. The collection system includes approximately 2200 kilometres of collection sewers, approximately 130 kilometres of interceptor sewers, 71 wastewater lift stations and over 182,000 customer connections within the City of Winnipeg. Existing wastewater-management systems are comprised of several components, including:

- 5 interceptor sewer systems;
- 3 Wastewater Pollution Control Centres ("WPCCs");
- 79 Combined Sewer Overflow ("CSO") locations; and
- 231 land drainage outlets (of which, 101 flow to the Red and Assiniboine Rivers).

The entire system is described in detail in Section 4.2.

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### **3.1.2 Future Development- Proposed Enhanced Pollution Control Components**

The City has conducted major engineering and scientific studies in support of development of a proposed Plan to Improve Wastewater Collection and Treatment. Major elements of this proposed plan are:

- Effluent Disinfection;
- Ammonia Reduction;
- CSO Control;
- Nutrient Management; and
- System Reliability.

These improvements are further discussed in Section 4.3. A comprehensive and detailed listing of these studies is provided in Table 3-1. All documents are available in the Public Registry at <http://www.gov.mb.ca/conservation/envapprovals/reviews/wpgwastewater/index.html>. Appendix A provides the following:

- Council Review & Approval of Report – Standing Policy Committee On Public Works re: Updated Status of Wastewater Related Pollution Prevention Plans in Preparation for Upcoming Clean Environment Commission Hearings File WW-3 (Vol. 12);
  - Executive Summary: Combined Sewer Overflow Management Study; and
  - Summary: Ammonia Reduction in City of Winnipeg Wastewater Effluents.
-

TABLE 3-1

**FUTURE DEVELOPMENT STUDIES**

**City of Winnipeg's Combined Sewer Overflow Management Study**

**Executive Summary**

**Final Report**

- Combined Sewer Overflow Management Study

**Technical Report**

- Appendix # 1 "Illness Risk Report"

**Technical Memoranda:**

**Phase 1**

- # 1 – Problem Definition
- # 1 – Infrastructure
- # 3 – Treatment
- # 4 – Receiving Stream
- # 5 – Control Alternatives
- # 6 – Experience Elsewhere
- # 7 – Technical Framework
- # 8 – Public Presentation
- # 9 – Phase 1 Workshop

**Phase 2**

- # 1 – Problem Definition & Appendices
- # 2 – Infrastructure and Treatment
- # 3 – Control Alternatives and Experience Elsewhere & Appendices
- # 4 – Receiving Stream & Appendices
- # 5 – Public Communication
- # 6 – Potential CSO Management Strategies
- # 7 – Phase 2 Workshop

**Phase 3**

- # 1 – Control Alternatives
- # 2 – Public Communications
- # 3 – Phase 3 Workshop

Appendices:

- Appendix # 1 – Cost Estimates
  - Appendix # 2 – Alternatives, Site Investigation and Evaluation
  - Appendix # 3 – Treatability
  - Appendix # 4 – NEWPCC Impacts
  - Appendix # 5a – Infrastructure Modelling
  - Appendix # 5b – NE/NW Monitoring
  - Appendix # 6 – Floatables
  - Appendix # 7 – Assiniboine river Fecal Coliform Survey
  - Appendix # 8 – Ammonia Impacts
  - Appendix # 9 – Sonar Surveys Health Risk Study
-

**Table 3-1 (cont'd)**

**Public Reports:**

- Phase 1 – Report
- Phase 2 – Report & Study Update
- Phase 3 – Study Update
- Phase 4 – Letter of Endorsement from Advisory Committee

**Ammonia Final Report & TMs**

**Executive Summary:** Ammonia Reduction in City of Winnipeg Wastewater Effluents

**Final Report:** Red and Assiniboine Ammonia Criteria Study - FINAL REPORT

**Toxicity Technical Memorandum:**

- #T1.0 Ammonia Toxicity Testing in 1999 and 2000
- #RC2.0 River Conditions Technical Memorandum

**Fish Habitat Technical Memoranda:**

- #FH 01 Physical data to characterize fish habitat in the Red and Assiniboine Rivers
- #FH 02 Benthic invertebrate and sediment data to characterize fish habitat in the Red and Assiniboine Rivers
- #FH 03 Water chemistry data to characterize fish habitat in the Red and Assiniboine Rivers

**Fish Population Technical Memoranda:**

- #FP 01 The occurrence of external deformities, erosion, lesions, and tumours (DELTS) on fish from the Red and Assiniboine Rivers, 1999
- #FP 02 Species composition, abundance, and distribution of fish in the Red and Assiniboine Rivers within the City of Winnipeg ammonia criteria study area, 1999
- #FP 03 Abundance, composition and distribution of benthic invertebrates in the Red and Assiniboine Rivers within the City of Winnipeg, 1999

**Fish Behaviour Technical Memoranda:**

- #FB 01 Biological and environmental data from experimental gillnetting in the vicinity of the NEWPCC outfall, March 1999
- #FB 02 Biological and environmental data from experimental netting in the vicinity of the NEWPCC outfall, October 1999
- #FB 03 Movements of fish tagged with acoustic transmitters in the vicinity of the City of Winnipeg's water pollution control centers, 1999-2000
- #FB 04 Movements of 10 northern pike tagged with acoustic transmitters in the Red River in the vicinity of the NEWPCC effluent plume, February-March 2000

**Other Stressors: Resource Harvesting Technical Memorandum:**

- #RH2.0 Resource harvesting program report for 1999
- #OSPC 01 Other stressors: Physical Constraints Memorandum

A summary listing is provided in Section 3.2 below.

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### 3.2 ASSESSMENT METHODS

Findings summarized in this EIS are based on extensive engineering and scientific studies conducted on behalf of the City of Winnipeg since the Minister of Environment endorsed the recommendations of the CEC Hearings of 1991/1992. These studies included assessment of historical and collected monitoring data for a wide range of parameters including river water quality and flows, discharges from the city collection and treatment systems, rainfall data, fish habitat studies data, fish toxicity data and others. Manitoba Guidelines for water quality, as well as those from other Canadian and international jurisdictions were gathered and evaluated using scientific methods and extensive peer review. In addition, voluminous data pertaining to existing and proposed infrastructure were assembled and analyzed. Some of these data were used in complex numerical computer simulations to predict impacts on the receiving stream and effectiveness of specific control measures or improvements to the wastewater collection and treatment systems. Modelling efforts included the following areas:

- Land Use/Runoff Response Models
- Control Alternatives Models
- Interceptor and WPCCC Models
- Receiving Stream Models
  - Mixing Zone Model
  - Steady-State Waste Load Allocations Models
  - Dynamic Waste Load Allocation Models
  - Fecal Coliform Decay Models
- Wastewater Treatment Process Models

Due to the complexity of the overall systems and interactions modelled in these assessments, a single computer model of adequate sophistication to achieve the modelling objectives was not found to exist. It was therefore necessary to develop a specialized technical framework which integrated a series of models to simulate the overall system behaviour for current and proposed improvements. A series of linked integrated mathematical computer models was used to simulate system hydrology, pollution loads, conveyance hydraulics, control options, and mixing zone characteristics. The selection of models, approach in integration of models, execution of models, and evaluation of results was reviewed on a multiple and regular basis by local and

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international credible peer review panels comprised of professionals from local, provincial, federal, and American regulatory agencies, as well as appropriate expertise from the consulting industry and academia.

Where adequate site-specific data did not exist to formulate scientific decisions, extensive efforts were made to both monitor and test in order to build credible site-specific data for use in this assessment. Examples of these efforts include aquatic studies focussing on local fish populations, fish habitat, and fish movements, and the establishment of the City of Winnipeg's Ammonia Toxicity Laboratory at the NEWPCC to study the toxicity characteristics of ammonia to local fish species under local receiving stream conditions.

### **3.3 PUBLIC CONSULTATIONS**

Public participation in the elements of the existing and proposed components of the City of Winnipeg Wastewater Collection and Treatment System was considered warranted from the standpoint of City policy as well as through the direction of the Clean Environment Commission in 1991/1992. In addition, the City has established policy guidelines for citizen participation in public works projects. This policy outlines criteria for projects where public participation is warranted. The nature of such projects includes:

- projects having key strategic importance in the City's long-term plans;
- projects that the City seeks public input, awareness, and support for;
- projects that have a history of previous public involvement; and
- projects where a requirement exists for *Environment Act* approvals.

Most aspects of the City of Winnipeg's Wastewater Collection and Treatment System, including the continued operation and proposed improvements included in the City's plan meet these criteria in that the potential costs associated with existing and future operations are large. The magnitude of these costs and their inherent influence on both City budgets and civic policy has lead the City to seek public support and solicit feedback from the public at regular intervals throughout its operations. Ongoing public communication and solicitation of feedback from the public was conducted and is detailed in Section 7.0 of the EIS.

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A comprehensive public consultation process was also planned for initiation and conclusion in 2003 prior to the original date of CEC Hearings set for autumn of 2003. The NEWPCC spill incident in September 2002 resulted in a unilateral decision by the Province of Manitoba to move the CEC Hearings forward to January 2003. The advancement of the CEC Hearings precluded the City from conducting comprehensive public consultation regarding its proposed plan for future pollution control improvements. In response to the calling of the CEC Hearings for commencement in January 2003, the City conducted public open houses in both Winnipeg and Selkirk prior to the commencement of the rescheduled hearings to inform the public on plans to Improve Wastewater Collection and Treatment in Winnipeg.

## **4. THE DEVELOPMENT**

### **4.1 PURPOSE AND NEED FOR THE PROJECT**

The purpose and need for the continued operation and future development in the City of Winnipeg's wastewater collection and treatment system is:

- 1) to provide for the protection of health and property; and
- 2) to protect river water quality.

Winnipeg in the early 1900's was a rapidly growing urban area. For many cities in this era, the rivers presented a convenient means of disposing of wastewater. Pollution control technology was not highly developed at the time in North America, and combined sewers discharging directly to the rivers were used throughout the city. As the community grew, the rivers became severely polluted with domestic and industrial wastewater. The need and rationale for sewage treatment in Winnipeg became explicit, and concern over rising pollution from wastewater in the 1930's led to the establishment of the Greater Winnipeg Sanitary District in 1935. The same year saw construction of a wastewater interception system and primary treatment plant. This primary treatment plant, constructed at the site of what today is known as the North End Water Pollution Control Centre (NEWPCC), was commissioned in 1937. The NEWPCC resulted in an immediate and discernible drop in river pollution. However not all municipalities were connected to the plant. In 1961, when the Metropolitan Corporation of Greater Winnipeg assumed jurisdiction over wastewater collection and disposal in the Metropolitan area, pollution of the rivers had again reached a serious level. One of the more pressing tasks of the Corporation was to provide additional facilities capable of meeting the requirements of a growing urban area.

Since 1977, the City has conducted bi-weekly monitoring of key water quality parameters in the Red and Assiniboine Rivers in order to understand both the performance of its systems and the impacts they may pose to the rivers. This monitoring program is conducted on a year-round basis at 11 locations both inside and outside the City of Winnipeg boundaries. This monitoring provides important information on the health of the local rivers and the response of the rivers to treated effluent discharges.

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## 4.2 EXISTING DEVELOPMENT COMPONENTS

This section will discuss the existing development components associated with Winnipeg's wastewater treatment services and current operations that were put in place to maintain a healthy aquatic environment in the local rivers within and downstream of Winnipeg. The two major components of the development consist of:

- wastewater collection and conveyance; and
- wastewater treatment

A map showing these facilities is provided as Figure 4-1.

### 4.2.1 Collection and Conveyance System

The goal is to provide wastewater collection while preventing basement/surface flooding and minimizing the bypass of wastewater to receiving streams before treatment. A system of sewers, forcemains, and pumping stations, comprise the collection and conveyance system needed to collect the wastewater from the homes and businesses of the City's residents and deliver it to the interceptor sewers, which in turn convey wastewater to the City's three water pollution control centres.

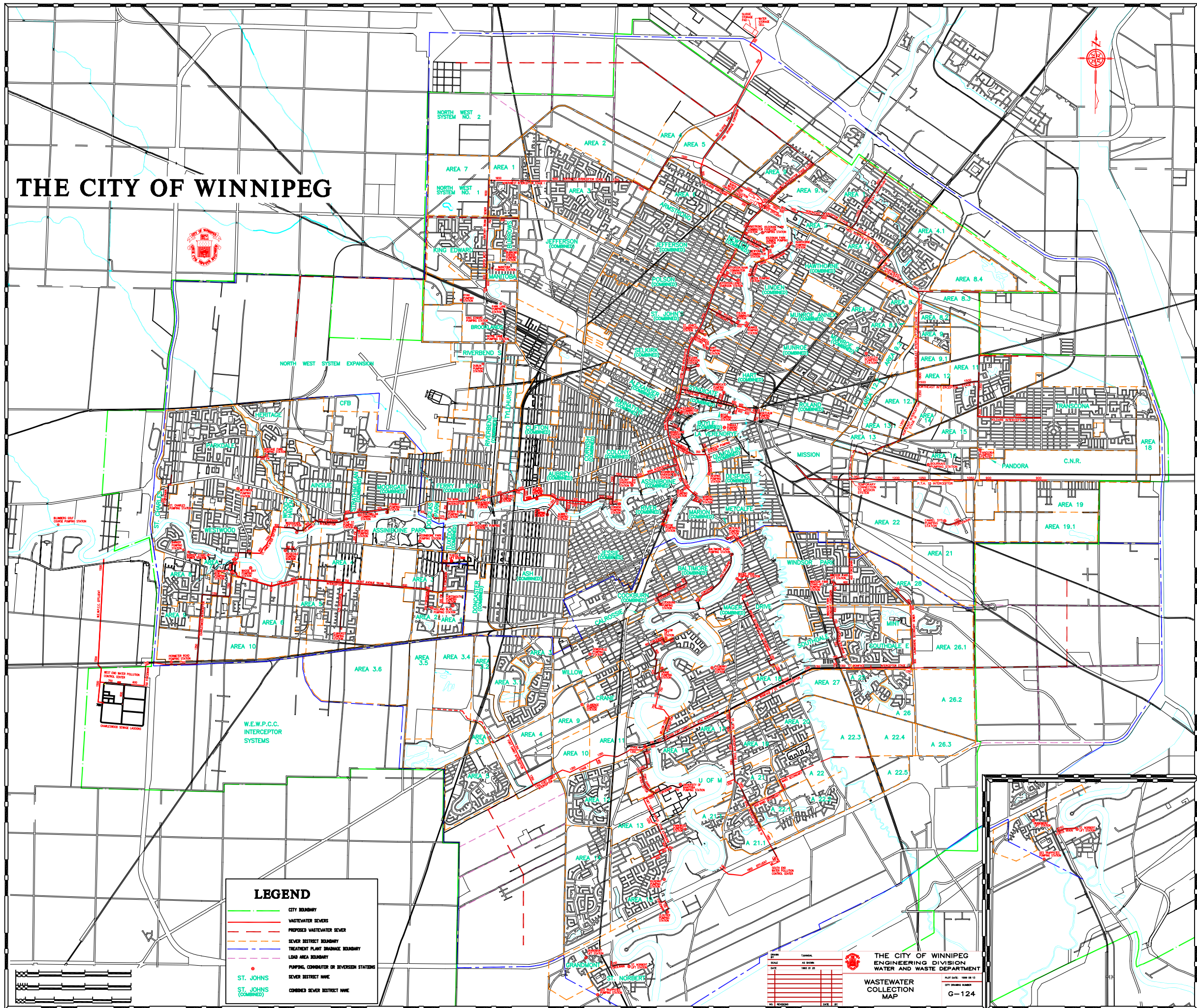
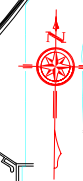
Table 4-1 provides an inventory of the collection and conveyance systems as of December 2002.

**TABLE 4-1  
INVENTORY OF THE COLLECTION AND CONVEYANCE SYSTEMS**

	<b>TOTAL</b>
Customer services connections	<b>183,400</b>
Land Drainage sewers (km)	<b>1372</b>
Stormwater Retention basins	<b>72</b>
Wastewater sewers (km)	<b>1182</b>
Combined sewers (km)	<b>1034</b>
Wastewater lift stations	<b>76</b>
Gravity-based wastewater diversion structures	<b>10</b>
Interceptor sewers (km)	<b>130</b>

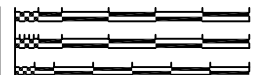
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# THE CITY OF WINNIPEG



**LEGEND**

- CITY BOUNDARY
- WASTEWATER SEWERS
- - - PROPOSED WASTEWATER SEWER
- - - SEWER DISTRICT BOUNDARY
- - - TREATMENT PLANT BOUNDARY
- - - LONG AREA BOUNDARY
- PUMPING, COMBINATOR OR SEVERAGE STATIONS
- ST. JOHNS (COMBINED)
- SEWER DISTRICT NAME
- COMBINED SEWER DISTRICT NAME



THE CITY OF WINNIPEG  
ENGINEERING DIVISION  
WATER AND WASTE DEPARTMENT

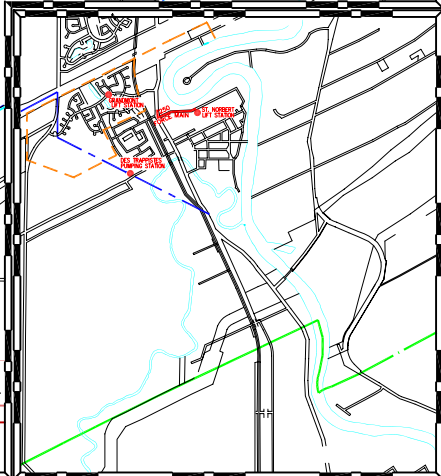
WASTEWATER COLLECTION MAP

DATE: 1982 01 25

SCALE: AS SHOWN

PLAT DATE: 1980 08 13

CITY DRAWING NUMBER: G-124



The following discussion provides a description of each type of sewer system and conveyance mechanism used in Winnipeg.

### Combined Sewers

A combined sewer system is a single pipe conveyance system that collects both wastewater and surface runoff from a defined service area. The older, central region of the City of Winnipeg is served by combined sewer systems. Prior to 1937, the collected wastewater and storm runoff were discharged directly to the local rivers. In 1937 an interceptor system was built to convey the wastewater in the combined sewer systems to the North End Water Pollution Control Centre (NEWPCC) for treatment. Diversion structures, known as interception weirs, were installed in all combined sewers near their outfalls to the river to direct all wastewater flows during dry weather conditions to the interceptor system. The diversion structures were typically sized to divert 2.75 times the normal dry weather flow in the combined sewer systems into the new interceptor system. As such, during dry weather conditions, all wastewater flows generated in the service areas are conveyed to the wastewater treatment plants.

During wet weather conditions, when flows are in excess of the diversion capacity, a dilute mixture of rainwater and wastewater spills to the rivers.

At the end of combined sewer district construction in the 1960's, there were 43 individual combined sewer districts, which originally comprised a total service area of approximately 10,500 hectares. Through selective separation in conjunction with the basement flooding relief program, the combined sewer area has since been reduced to approximately 8700 hectares or about 30% of the developed area of the city. Modifications to the system have resulted in an increase to the interception rate, currently at approximately 4 times the average dry weather flow. Presently, there are 79 combined sewer outfalls to the rivers, including relief pipes that were installed as part of the basement flooding relief program.

Computer modelling of the performance of the combined sewer system over the past 40 years shows that combined overflows occur, on average, about eighteen (18) times in a typical year during the open water recreation season (May 1-September 30, inclusive). The actual number of overflows range from seven (7) to thirty (30) overflows depending on the combined sewer district. For a typical year, about 7.0 million cubic metres of runoff is generated in the combined

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sewer districts. Approximately 32%, or 2.2 million cubic metres, of this volume is captured for treatment in a typical year. The total wastewater portion spilled to the river from combined sewer overflows in a typical year during the recreation season represents about 1.0% of the total annual volume of wastewater generated in Winnipeg.

### Separate Wastewater Sewers

Since 1960, developments in the City of Winnipeg have been serviced by a two-pipe system, one for wastewater and the other for storm water. The wastewater sewer system employs a dedicated piping system, which is completely separated from the land drainage system. This system's role is to collect wastewater and convey its flows to a water pollution control centre (WPCC) for processing before being discharged to local rivers.

The dedicated wastewater sewer system collects wastewaters from domestic, commercial, institutional, and industrial sources. Under normal dry weather conditions, all wastewaters are collected and conveyed to one of the three WPCCs for full secondary treatment.

During and following a rainfall event, extraneous flows result from foundation drainage, ground water infiltration at pipe joints or cracks in the pipe, inflow through openings in manhole lids or joints along the barrel sections. Blockages in the system can restrict or stop flow conveyance in the system and cause water levels to rise and cause the sewers to be surcharged above a safe level. Such conditions can lead to a risk of basement flooding unless the system is relieved. Overflow relief provisions have been incorporated into the sewer system to protect against basements flooding due to high water levels. As such, under extreme wet weather conditions, or as a result of a system malfunction, overflows from the separate wastewater sewer to the local rivers can occur on an emergency basis to protect against wastewater reaching a level that would threaten basement flooding with the resultant property damage and increased health risk to the public.

### Separate Land Drainage Sewers

Separate land drainage sewer (LDS) systems have been used in new developments since the 1960's. The purpose of these systems is to carry only surface runoff from rainfall and snowmelt from urban areas to the local watercourses. The developed area of Winnipeg with separate

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wastewater and land drainage sewers is approximately 22,300 hectares. This future growth is primarily in the south portion of the city and will require expansion of the South and West End Water Pollution Control Centres as development takes place.

In new developments in close proximity to surface watercourses, a pipe-only conveyance system was used and results in direct discharges of land drainage to the local rivers and streams. Due to the increased distance from surface watercourses for subsequent developments, a combination of storm sewer piping and storm retention basins are a more cost-effective means to collect and convey runoff to the rivers. These storm retention basins provide the additional benefit of improving the quality of the collected runoff waters through settling, aeration, nutrient uptake, and die-off of organisms before it is eventually discharged to the local rivers.

#### Wastewater Lift Stations and Diversion Structures

Because of the generally flat terrain of the City of Winnipeg, it is necessary to pump wastewater flows using Lift Stations either to the interceptors, to the WPCCs, or in some cases to trunk sewers. A wastewater lift station is a facility that contains a wet well, dry well, pumps, piping, valves and a variety of appurtenances, and other mechanical and electrical equipment for the pumping of wastewater. The purpose of a lift station is to raise flows to a given elevation so that it can be discharged into a sewer system where it can flow by gravity.

The City operates approximately 76 wastewater-pumping stations and 10 gravity-based diversion facilities distributed throughout the City. All stations report alarm conditions electronically as they occur to the McPhillips Control Centre Operator, who then reports all alarm conditions via radio to Collection System Operators for immediate attention. The McPhillips Control Centre is manned on a 24-hour/7-day basis and an emergency Collection System crew is available on standby during off hours to respond, as well as Electrical/Instrumentation staff should they be needed.

Each of the WPCCs includes a major raw wastewater pumping station. Flows are pumped to sufficient elevation that the wastewater passes through the system and to the river by gravity.

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### Interceptor Sewers

The interceptor sewers convey the wastewater and combined wastewater from the individual sewer districts to the WPCCs. There are five major interceptor sewer systems in the City. The Main, Northeast and Northwest Interceptor systems are tributary to the NEWPCC. The SEWPCC and WEWPCC each have a tributary interceptor system.

#### **4.2.2 Wastewater Treatment**

The City of Winnipeg has three wastewater treatment plants:

- North End Water Pollution Control Centre (NEWPCC);
- South End Water Pollution Control Centre (SEWPCC); and
- West End Water Pollution Control Centre (WEWPCC).

These WPCCs receive wastewater from homes and businesses within Winnipeg through the sewer collection system, and from external sources such as septage and leachate haulers. The wastewaters received at the plants are put through a series of physical and biological treatment processes to meet specific effluent quality targets before it is discharged to the rivers' systems.

The physical and biological process used to treat wastewater is very similar to the natural decomposition that would occur if wastewater was released directly into Winnipeg's rivers. Bacteria feed on the organic materials and break them down and consume available oxygen in the process. As such, the primary goal of the wastewater treatment at Winnipeg's three Water Pollution Control Centres is to protect the aquatic environment of the river system by controlling and accelerating this process so that the final effluent places little demand on the dissolved oxygen resources of the rivers. Without treatment, the organic material in the wastewater would be released to the river, where it would decompose and reduce oxygen levels in the river to a point where they may become inadequate to support aquatic life. The City of Winnipeg has focussed on the provision of best practicable secondary treatment of wastewater for continuous dry weather conditions at all its WPCCs. As such, during normal dry weather conditions all wastewater goes to the WPCCs and receives full secondary treatment before it is discharged to the local rivers. This process produces a final effluent suitable for discharge into the rivers. In

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In addition to providing secondary treatment for all dry weather flows, the treatment plants have capacity to provide primary treatment for wet weather flows conveyed to the plants and secondary treatment for a significant portion of these wet weather flows.

The following provides a brief description of Winnipeg's three WPCCs. The City of Winnipeg has invested more than \$200 Million since 1978 in wastewater treatment, which are modern facilities and almost entirely funded by sewer charges. The following provides a brief history of the growth and expansion of wastewater treatment facilities in Winnipeg.

**North End Water Pollution Control Centre (NEWPCC):**

- 1937: primary treatment
- 1954: major plant expansion
- 1965: secondary treatment
- 1980: primary treatment expansion
- 1984: secondary expansion convert to pure oxygen and computer control system
- 1988: sludge digesters expansion
- 1990: biosolids dewatering building

**South End Water Pollution Control Centre (SEWPCC):**

- 1974: high purity oxygen secondary plant
- 1993: plant expansion
- 1999: UV effluent disinfection

**West End Water Pollution Control Centre (WEWPCC):**

- 1964: lagoons commissioned
- 1976: mechanical plant (aeration)
- 1994: new conventional secondary plant
- 1998: ponds operated for effluent polishing

The processes for each WPCC are listed in Table 4-2.

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**TABLE 4-2**

**WASTEWATER TREATMENT PROCESSES PRESENT AT WINNIPEG'S WPCCS**

<b>TREATMENT PROCESSES</b>	<b>NEWPCC</b>	<b>SEWPCC</b>	<b>WEWPCC</b>
Distributed Control Systems	Yes	Yes	Yes
Main Pumps	Yes	Yes	Yes
Screening	Yes	Yes	Yes
Pre-Aeration	Yes	No	No
Aerated Grit Removal	Yes	Yes	Yes
Primary Clarifiers	Yes	Yes	Yes
Activated Sludge	Yes (Oxygen)	Yes (Oxygen)	Yes (Air)
Secondary Clarifiers	Yes	Yes	Yes
Sludge Storage	Yes	Yes	Yes
Sludge Hauling to NEWPCC	Not applicable	Yes	Yes
Mesophilic Anaerobic Sludge Digestion	Yes	No	No
Sludge Dewatering	Yes	No	No
Odour Control through dilution stacks	Yes	Yes	Yes
Polishing Ponds	No	No	Yes
Effluent Disinfection	No	Yes (UV)	Yes (by Ponds)

Full secondary treatment of wastewater is intended to adequately protect aquatic life and the dissolved oxygen resources of the rivers by reducing the carbonaceous and suspended solids concentrations in the final effluent to levels that are well within the assimilative capacity of the rivers. River water quality modelling was performed to determine the effluent loading the rivers could accept under 7Q10 low flow conditions (average seven day low flow that would have a return frequency of once in ten years) and maintain a dissolved oxygen content of at least 5 mg/L or higher. To achieve this level of performance, it was determined that a secondary effluent quality should not exceed 25 mg/L and 30 mg/L for carbonaceous biochemical oxygen demand and total suspended solids, respectively.

The following table summarizes the process capacities at all three activated sludge secondary wastewater treatment plants in Winnipeg. A description of the City's treatment process is available on-line at <http://members.shaw.ca/gp.lagasse/process.htm>.

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**TABLE 4-3  
 WPCC PROCESS CAPACITIES**

	<b>NEWPCC</b>	<b>SEWPCC</b>	<b>WEWPCC</b>
Current Population Served	374,000	160,000	86,000
Pumping Capacity (ML/d)	Total = 1060 Firm = 860	Total = 360 Firm = 250	Total = 160 Firm = 110
2002 Average Dry Weather Flows (ML/d)	160	50	27
Average Dry Weather Flow Design Capacities (ML/d)	302	59	32
Peak Dry Weather Flow Design Capacities (ML/d) <ul style="list-style-type: none"> <li>▪ Full Secondary Treatment</li> </ul>	600	100	54
Peak Wet Weather Flow Design Capacities (ML/d) <ul style="list-style-type: none"> <li>▪ Full Primary Treatment</li> </ul>	827	176	112

The above table also shows the 2002 flows to the WPCCs. It is evident that there is ample capacity at the NEWPCC whereas the flows at the SEWPCC and WEWPCC are approaching design capacities. Flows to the NEWPCC and WEWPCC are not expected to grow significantly. Flows to the SEWPCC are projected to increase about 30% in the next 40 years.

**4.2.3 Water Conservation Programs**

When the current Water Conservation program began in 1992, the City was expected to run the risk of water shortages by 1997 if supply was not expanded or water demand was not reduced. In the last ten years, water consumption in the City of Winnipeg has reduced dramatically.

Media advertising began late in 1992 and continued in various forms (television, radio, billboards, print media) for several years, both as a stand-alone advertising program and as promotional information for various other Conservation initiatives. The purpose of the programs was two-fold:

- 1) To increase awareness of principles of resource (water) conservation with the public.
-

- 2) To reduce growing demand on water supplies in order to postpone the need for construction/development of additional water sources.

A plumbing retrofit program began in 1993 and it continues to the present. In 1993 a Pilot program was conducted to test various kit distribution methods. In 1994 a full-scale retrofit program was undertaken targeting multi-family residential customers. Concurrently, retrofit kits were made available to single-family residential customers at depots located at City Hall and 1500 Plessis Road (Water & Waste Department). In 1995 the single-family residential mail-out retrofit program began. Kits were distributed to residential customers by mail until 2000. During the duration of these retrofit programs the City has distributed retrofit kits or devices (multi-family owners could purchase specific devices e.g., Showerheads only) sufficient to retrofit approximately 8000 residential homes and greater than 10,000 multi-family residential units.

A Water Conservation Education program aimed at Winnipeg schools was developed in 1994 and 1995 with the assistance of schoolteachers from Winnipeg classrooms. A curriculum supplement was developed aimed at middle years students. In 1995 the program was pilot tested at several schools in Winnipeg. The school program has been delivered by The Fort Whyte Centre, in partnership with Water and Waste Department, since 1997.

Residential consumption has reduced from 224 litres per capita per day (L/c/d) in 1993 to 207 L/c/d in 2000, a 7% reduction. Other groups have shown even greater reductions. A water demand study done in 1997 (TetrES 1997) showed that non-residential users (industrial, commercial and unaccounted-for-water) had reduced from 246 L/c/d in 1989 to 183 L/c/d in 1996 (a 25.6% reduction).

Water projections done in 1997 indicated that residential water demand should continue to decrease over the next 40 years due to home renovations, which replace older high water-using devices (toilets, showers) with newer low water using devices. This analysis has been considered in the wastewater projections used to plan for future development. Water conservation reduces the per capita demand on water consumption and therefore reduces dry weather wastewater flows received at the WPCC's. This has the positive benefit of delaying future WPCC expansions. Water Conservation programs have no significant effect on CSO

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control programs since the large volumes of combined wastewater are primarily due to runoff and not domestic wastewater.

Enforcement of the subject Sewer Bylaw provisions is undertaken by the Industrial Waste Control Branch (IWCB) of the Water and Waste Department Laboratory Services Division. The enforcement program contains several elements, these being:

- ongoing spot checks of certain industries;
- joint inspections of industries with staff of Manitoba Conservation on a sector by sector basis;
- self-monitoring programs established for certain industries including effluent sampling requirements and data analysis by independent laboratories, and confirmation spot checks by City staff;
- industries are required to provide effluent information pertaining to the concentrations, volumes, of and classification of the effluent with respect to hazardous waste legislation;
- ongoing spot checks of waste hauling vehicles discharging to the City's system;
- automated surveillance of waste vehicle disposal stations at all three wastewater treatment plants that include hydrocarbon sensors, video cameras and a magnetic card entry control systems to identify the time and specific vehicle for each use of the facility; and
- targeted surveys in response to concerns identified either within a specific sewer section or when a parameter of concern is identified in the incoming wastewater at any of the City's three wastewater treatment facilities, or in biosolids being produced at the NEWPCC.

In addition, the IWCB works on an as required basis with industries to identify sources of effluents not in conformity with the Sewer Bylaw and to assist the industry in establishing abatement plans to bring these effluents into compliance. These abatement plans are initiated through a letter from the IWCB clearly identifying the parameters of concern and also requiring that a suitable timetable for completion of the abatement plan be established. The abatement plans are reviewed and if necessary comments are provided by the IWCB. This abatement plan approach has been highly effective in mitigating areas of concern in an effective and timely manner. A key element of this approach is that resources of both the industry in question and the City are focused on quick resolution to the problem rather than on legal proceedings.

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Should the industry not fulfill the requirements of an effective abatement plan in a timely manner, legal action can and has been used to facilitate conformity.

An important role of the IWCB is promotion of compliance with the Sewer Bylaw regulations through responses to information requests from both industries and the public. Industries conform with environmental regulations because of possible legal ramifications and to promote a positive image to the public. Accordingly, industries regularly proactively seek information and advice. The IWCB encourages these requests and is dedicated to providing assistance as this approach promotes proactive and diligent actions by industries to address potential environmental concerns.

#### Abatement Plan for Mercury

Mercury in wastewater and biosolids is a concern in that mercury is a known neurotoxin. The City is actively pursuing the reduction and control of mercury entering the wastewater system.

It has been found by other jurisdictions, notably Toronto, that a significant source of mercury in municipal sewer systems is waste amalgams from dental practices. The City of Winnipeg estimated the amount of mercury that might possibly come from dental practices, and determined that conceivably as much 50 percent of the total mercury entering the wastewater treatment plants could be from this source. This estimate was based on typical amounts of mercury generated in a dental practice in Winnipeg. From discussions with the Manitoba Dental Association (MDA), the licensing body for the practice of dentistry in Manitoba, it was determined that there are approximately 350 dentists in Winnipeg, which have been targeted for source control.

City of Winnipeg staff and Manitoba Conservation staff have met jointly with representatives of the MDA to determine what action is being taken by the MDA with respect to the control of mercury discharges. The MDA has put in place a plan whereby members are required to be in compliance in 2004. The MDA is the only Canadian dental association to take this proactive step. In addition the MDA is requiring its members to submit documentation annually that provides details pertaining to the installation of appropriate filters and the proper disposal of the waste amalgams. This documentation submission is a requirement of registration to practice

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dentistry in Manitoba. Both City and Provincial Staff have acted in advisory capacity to the MDA respecting the options for suitable collection and disposal of the waste amalgams.

The MDA has undertaken to provide the City of Winnipeg with the data collected so that an assessment of the effectiveness of the program can be made. The City also will continue with monitoring of mercury both in wastewater treatment plant influent and in biosolids. An ongoing review of these data will substantiate the effectiveness of the MDA program. Should the MDA program prove not to be effective in reducing mercury as expected, the City of Winnipeg will conduct inspections, then implement bylaw revisions making the installation of amalgam filters mandatory and subject to penalties for lack of compliance. However, it is believed that the approach proposed wherein the MDA collects the data from its members, and the City monitors these data, will be more efficient and effective in addressing the issue of mercury in dental amalgams than an alternate approach. This is in consideration of the fact that there are approximately 350 dentists in Winnipeg that would otherwise need to be individually monitored to ensure compliance.

#### **4.2.4 Environmental Management System**

The Water and Waste Department identified the need to initiate preparation of a formal Environmental Management System (EMS) for its wastewater facilities before the malfunction at the NEWPCC on September 16, 2002. The Department has developed a number of the components and had them in place for some years. Plan Winnipeg 2020 Vision provides general policy direction in this regard in Clause 5A-01 that states in part:

*“The City shall promote environmentally-responsible decision-making within the broad community and within its own operations by:*

- i) *implementing a code of practices to encourage environmentally-responsible methods, applications, and procedures in its operations;.....”*

The Water and Waste Department is committed to preparing an EMS for each of its pollution control centres. The EMS will be a tool for the department to ensure that the environmental implications of its current operations and future modifications in processes or plant expansions

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are assessed for potential environmental impacts including socio-economic effects. The EMS will be prepared in general conformance with ISO 14001. The elements of the EMS will include:

- development of an environmental policy;
- identification of environmental aspects and evaluation of associated environmental impact;
- establishment of relevant legal and regulatory requirements;
- development and maintenance of environmental activities and targets;
- implementation of a documented system, including elements of training, operational controls, standard operating procedures, and emergency response plans;
- implementation of a system to store, update, and enable retrieval of effluent monitoring and other environment-related data;
- monitoring and measurement of operational activities;
- disclosure of relevant information to anyone having interest in the Department's environmental stewardship activities, including insurance providers, federal and provincial regulators, and neighbourhood and community groups;
- environmental internal auditing; and
- management review to ensure continuing effectiveness and suitability.

The Department is currently reviewing the activities and resources necessary to complete the EMS. After this review a schedule will be completed, however it is expected that the EMS (ISO 14001) for all three treatment facilities will be completed within 2 years. The City intends to seek ISO 14001 certification. While there is currently no formal EMS, elements of an EMS are currently in place, as described below.

#### **4.2.4.1 Operating Procedures**

Operating procedures for the wastewater treatment plants are documented in binders that are assembled by area, and are thus called Area Manuals (e.g., Main Building, Aeration & Grit Removal, Digesters, etc.). NEWPCC has 7, SEWPCC has 4, and WWPCC has 1 such manual. The manuals are maintained and kept up to date whenever equipment is added or modified. The manuals contain shop drawings, equipment layout drawings, operation manuals,

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and manufacturers' information for various equipment components. Furthermore, the Manuals form the basis for hands-on Assistant Operator training (discussed in a later section).

Some manuals are in electronic document format and the others are in the process of being converted, in order to simplify maintenance and distribution (e.g., CD-ROM), and to include search capabilities. A more formal document management system is planned for the future.

Associated Engineering, in its independent review of the September 16, 2002 drywell flooding titled: "NEWPCC Review of Failure", January 2003, noted as follows (P.7-1):

*"The operations manual provided for review appeared to be well maintained and up to date. The "Main Building Manual" contains control and operating descriptions, shut down and start up procedures, trouble-shooting guides and routine check lists. The manual also includes control descriptions and process and instrumentation diagrams (P&ID's)."*

This statement applies to all the Area Manuals. Although the Area Manuals provide good operating procedures, the department recognizes the need to further document standard operating and safe work procedures as recommended in the Associated Engineering review, and will be pursuing this in 2003.

#### **4.2.4.2 Maintenance and Training**

##### Technical Currency:

The Water and waste Department is directly involved in several national and international organizations to ensure that it remains current in treatment processes and technology, collection systems, source control, enforcement, operations and maintenance techniques and requirements, surface water quality and ecosystem issues, biosolids treatment and disposal, computer control and instrumentation, laboratory analysis and practices, regulatory trends, and experience elsewhere. This involvement includes corporate and individual membership in organizations, participation in organizations' oversight bodies such as Boards of Directors, attendance at national and international conferences, participation in Internet conferences, and

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subscription to technical journals and magazines. The Department also funds and participates in research studies done by international organizations such as the American Water Works Association and the Water Environment Federation Research Foundations. The City also retains expertise of specialized consultants who offer additional resources in monitoring technical accuracy.

The Department has also initiated and funds cooperative research with the University of Manitoba's Department of Civil Engineering and the University of Manitoba's Department of Soil Science.

The Department maintains a comprehensive specialized technical library maintained by a permanent staff of three library technicians. The library is used by Department staff, and is also available to university students and interest groups on special request.

All the above activities have contributed to the development of state-of-the-art treatment facilities for Winnipeg.

#### Operator Training:

The following is a summary of the training provided to and required of staff employed in operating positions at the Department's Wastewater Treatment Plants.

The position of Assistant Operator is entry-level, with minimum qualifications as described below:

- Grade 12 education.
  - Successful completion of Sacramento State College Field Study training program for operation of Wastewater Treatment Plants (Volumes 1 and 2) within 24 months of the appointment.
  - Must be willing to enroll and successfully complete Manitoba Water and Wastewater Association (MWWA) wastewater treatment 3-week program as provided by Red River Community College.
  - Demonstrated ability to establish and maintain an effective working relationship with others.
  - Demonstrated ability to operate various hand and power tools.
-

- Knowledge of safety regulations, procedures and practices.
- Physically capable of performing the duties of this position.
- Willingness and ability to undertake training related to the duties of this position.
- Must be willing to perform standby duty on weekends and evenings on a rotation basis.

Following employment there is an initial plant orientation, with emphasis on safety procedures. An Assistant Operator is then assigned various tasks of increasing complexity, initially partnering with senior personnel and then at times working alone. Further training is provided in these areas:

- Transportation of Dangerous Goods and Workplace Hazardous Materials Information System (WHMIS).
- Applied knowledge of safety equipment (first aid courses, CPR, etc.).
- Applied knowledge of confined space techniques and procedures.
- Applied knowledge of analytical sample collection and procedures.
- Applied knowledge of the *Workplace Health and Safety Act*.
- Applied knowledge of the Bailey/Net90 Distributed Control System.
- Basic computer skills (MS software, email, spreadsheet, word processing, etc.).
- Computerized Work Management System training (Synergen Series maintenance management).
- Basic knowledge of Self Contained Breathing Apparatus.
- Basic knowledge of security procedures.
- Basic knowledge of storeroom and tool organization.
- Ability to read and interpret basic information from drawings, plans.
- Ability to use housekeeping tools, techniques and procedures.
- Completion of advanced Wastewater Treatment Sacramento State College correspondence course.
- Fifth Class Power Engineering.

As an employee becomes more familiar with the Treatment Plants, further technical training is provided. Through the use of a Training Officer, extensive hands on and classroom training is provided. This includes but is not limited to exhaustive review of operating manuals with supervised practical operating experience, and extensive use of plant blueprints and process

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and instrumentation drawings (P&ID). Trouble shooting techniques are taught and various projects of increasing complexity are completed. In total, this one-on-one training may take six months at consecutive half-days to complete, depending on the aptitudes of the individual.

By providing assistance to Mechanical and Electrical/Instrumentation staff, an assistant operator learns reactive and preventative maintenance. Further extensive practical experience is gained by working with experienced operators similar to an apprenticeship. This may include shift work. Training is also provided as a primer for future Operator Certification through review of Sacramento Courses and ABC sample questions and/or various levels 1 to 4 training as provided by Red Community College.

As an Assistant Operator gains insight through study and experience, he/she will progress to the position of Operator. Here his/her continued familiarity and experience will improve upon the required skills necessary for efficient Plant Operation. Training continues with the addition of any new equipment and any changes to the wastewater treatment process techniques.

Assistant Operators are rotated through the Department's three wastewater treatment plants, so that all will be familiar with all three plants and be effective when working shift or standby.

Generally, assistant operators may be considered for promotion to an operator position after a minimum of four (4) years satisfactory performance as an assistant operator.

The Department has a full time dedicated training position for operations staff for the three treatment plants.

Operator Certification:

Operator certification is not Mandatory in Manitoba. Nevertheless, two treatment plant supervisors are Certified MWWA Class IV on a voluntary basis. Of the 41 operator staff at the City's plants, three operators are MWWA Class III and 24 are Class II on a voluntary basis. A further 6 are Certified Class II and one Class I by written examination (Association of Boards of Certification, ABC). According to Red River Community College course guides, training for ABC certification in Classes III and IV are not available.

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Maintenance:

Industrial Mechanics, Electricians, and Instrumentation Technologists working at the plant are licensed/certified according to the appropriate Manitoba Labour Board designation. The plants utilize a Computerized Work Management System (CWMS) to plan and track maintenance. The new “Synergen” CWMS system is operational at the NEWPCC and will soon be installed at the other 2 plants.

**4.2.4.3 Reliability and Redundancy – Treatment Plants:**

Reliability, redundancy, standardization and flexibility are an integral part of the wastewater treatment plant design process. The Water Environment Federation Manual of Practice No. 8, “Wastewater Treatment Plant Design”, provides design guidelines for reliability considerations, including process, siting (flooding), piping, electrical, instrumentation, control systems, and equipment. Every vital component is designed to enable repair or replacement without violating effluent limitations or causing a controlled diversion. Each unit process is duplicated to permit treatment when one component is out of service. The City of Winnipeg’s Wastewater Treatment Plants meet or exceed all reliability guidelines. The following provides a brief summary indication of reliability inherent in the design of the City’s Pollution Control Centres.

Electrical Reliability:

At NEWPCC, two independent sources of power from two substations are provided. In the event of a power failure or transformer malfunction, the entire plant can be operated from the duplicate source. This practice is also followed at the WEWPC. At the SEWPC, only 1 source of power was available so a stand by generator was provided, which has sufficient capacity to power 3 of the 4 main pumps plus ancillary equipment.

Pumping Reliability:

At NEWPCC, 6 main pumps are provided, while only 2 are required for pumping daily dry weather flow. The wet weather design capacity of the plant can be met with the largest pump out of service. Throughout the plant, there are many smaller pumps that perform important

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functions. Wherever one pump was needed, a duplicate was provided in parallel for reliability. This philosophy was maintained at the other plants.

Process/Equipment Reliability:

Main processes at SE/WEWPCC include preliminary, primary, and secondary wastewater treatment and at NEWPCC only, sludge digestion and dewatering is included. All processes are designed in multiple trains, such that at minimum, any one train can be taken out of service, and the remaining trains can handle flows while meeting treatment quality objectives. This same strategy also applies to all critical plant equipment and tankage. For example, the NEWPCC requires 2 high-speed centrifuges for dewatering biosolids, but 6 were provided, recognizing that these are high energy/maintenance devices. A SEWPCC example is the two oxygen production units - one can provide process oxygen while the other is down, and an oxygen tank is provided for supplemental needs. At WEWPCC for example, 2 large blowers are required to deliver process air to the aeration basins at peak load, but a 3rd, stand-by unit, was provided.

Flexibility and standardization are important criteria of treatment plant design and operation. For example, treatment plants have numerous sludge return pumps (24 at NEWPCC), which include valving and piping such that if any are out of service, valves can be operated to provide service using the working pumps until repairs are completed. Furthermore, all pumps and configuration are identical to provide consistency of operation, maintenance, and parts. To the extent possible, all support equipment, such as the variable frequency drives, are also identical.

Process Control and Instrumentation Reliability:

Operators at the City's plants control/monitor/optimize plant processes through a network of computers located throughout the plant, called a Distributed Control System (DCS). The DCS is the "Nervous System" of the plant, which collects and processes data from various instrumentation such as flow, temperature, levels, pressure, etc. Without the DCS, the plant could not be operated properly at current operating staff levels. As such, it is fully redundant. Two process modules are provided for each function, and if the active one fails, an alarm is issued and control passes automatically to the other module. Two workstations are provided at each control area. Two plant communication loops (network cabling) are provided. An uninterruptible power supply (UPS) is provided at each plant to provide reliability against power

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failure. The DCS provides continuous operational status and stores key operational data for review.

Response to September 16, 2002 Spill from the NEWPCC:

The Water and Waste Department has reviewed the report submitted by Associated Engineering Ltd. and has accepted all recommendations. A summary of Associated Engineering's recommendations and the Department's anticipated response follows:

- #1A – Install Isolating Sluice Gates - The Department has retained consultant services to review the piping arrangement into NEWPCC and to develop alternative gate arrangements and costs.
  - #1B – Pump Well Isolation – Temporary Solution Only – The Department has retained consultant services to design works to isolate the three main building pump wells at the NEWPCC.
  - #1C – Double Block and Bleed – Drain System for suction header – Consultant services have been retained to advise on the installation of this drain system.
  - #1D – Increase Pump Casing Drain Sizes – The Department had identified in its own review of the spill, that a superior method of dewatering the pump system was required. The Department agrees with the recommendation and is proceeding to implement with its own forces.
  - #2A – Conduct Hazard and Risk Assessment - While the City's pollution control centres meet or exceed industry standard reliability guidelines, there may be other risks that were not anticipated or were considered acceptable when they were last upgraded. The Department agrees with the recommendation and will undertake a risk/reliability assessment to identify vulnerabilities, assess degree of risk and consequence of failure, and estimate costs to implement mitigative corrections.
  - #2B – Conduct Job Analysis and Prepare Safe Work Practices – The Department agrees and had identified in its review that written procedures for key activities where safety and plant integrity is at issue are required.
  - #2C - Upgrade Pump Isolation Procedures – The Department will prepare written procedures, alter the main building pumps to facilitate draining, inspection, and determination of valve position.
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- #2D – Upgrade Training Procedures – The Department will be reviewing training procedures and implement “refresher” training.
- #2E – Review Asset Management Strategy and CWMS Strategy – The Department concurs with this recommendation.
- #2F – Draft an Emergency Response Plan – The Department concurs and will proceed as identified in Section 4.2.6.
- #2G – Comply with Recent Workplace Safety and Health Amendments – The Department concurs.
- #2H – Develop Performance Management System - The Department concurs.

#### **4.2.4.4 Emergency Response Planning (ERPs)**

The City of Winnipeg has a comprehensive Emergency Response program, including Procedures, Manuals, and Training. The program is directed by the Emergency Preparedness and Coordination Committee (EPCC), out of the City’s Emergency Operations Centre (EOC), located in the basement of the Council Building, 510 Main St. The Emergency Preparedness Coordinator reports directly to the City’s Chief Financial Officer. On the Committee, the Public Utilities Coordinator is the Manager of the department’s Wastewater Services Division. The procedures provide direction for each City Department in the event of emergencies.

The Department has a history of successfully and efficiently responding to emergencies when they arise, according to the location and nature of the emergency, environmental conditions, and available equipment, staff, contractor, consultant, and other agency resources and expertise available at the time. Recent examples include the North End Plant flooded wetwell incident (September, 2002) and the 1997 Red River flood. A key factor in this success is that many department staff are trained in emergency response and incident commander roles through the Canadian Emergency Preparedness College, coordinated by the EPCC. Training includes basic Manitoba Emergency Management (MEM), Emergency Operations Centre, and Emergency Site Management courses. In the event of an emergency, an emergency steering committee and sub-committees are quickly mobilized in a structured fashion, with the Director or a Manager as chair. A plan is developed early and followed, and decisions are made and resources mobilized on a timely basis. Frequent briefings and feedback sessions are conducted.

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Following the September 16, 2002 spill event from the NEWPCC, the City retained Associated Engineering to undertake an impartial review to identify the root causes of the event and recommend measures to reduce the chances of future events. A recommendation of Associated Engineering was to prepare an Emergency Response Plan for the NEWPCC. The Water and Waste Department is committed to comply with this recommendation. The resulting ERP will also satisfy the prescriptions of the Manitoba Industrial Accidents Council "Industry Emergency Response Planning Guide".

#### **4.2.4.5 Hazardous Waste Abatement Programs**

The current City of Winnipeg Sewer Bylaw 7070/97 (Sewer Bylaw) is focussed on discharges to the sewer system that require control or regulation. Part 5 Section 25 of the Sewer Bylaw specifically addresses restriction of materials from being discharged to the sewer system.

Consistent with provisions for Pollution Prevention under *The Canadian Environmental Protection Act*, the Bylaw encourages responsible corporations to prevent the creation and/or discharge of listed materials that could interfere with the proper operation of the sewer system, or violate Federal and Provincial regulations pertaining to the classification and disposal of hazardous wastes.

Part 7 of the Sewer Bylaw specifically deals with over-strength wastewater, where such flows are not deemed to be "hazardous waste".

#### **4.2.4.6 Monitoring**

The City of Winnipeg routinely monitors the treatment processes at its three Wastewater Pollution Control Centres. Data is collected for regulatory, operational, planning and historical purposes. At present, approximately 30,000 analyses are conducted annually to provide needed information. Table 4-4 provides an outline of the routine monitoring programs now being done. Process control parameters within the WPCCs including effluent quality are monitored daily by means of 24-hour composite samples. The following parameters are routinely monitored to assess treatment performance:

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- pH and temperature;
  - Conductivity;
  - Total Solids (TS);
  - Total Suspended Solids (TSS);
  - Total Volatile Solids (TVS);
  - Volatile Suspended Solids (VSS);
  - Grease;
  - Biochemical Oxygen Demand (Inhibited and uninhibited);
  - Total Biochemical Oxygen Demand (BOD);
  - Carbonaceous Oxygen Demand (CBOD);
  - Total Organic Carbon (TOC);
  - Soluble Organic Carbon (SOC);
  - Digester gases;
  - Oxygen (O<sub>2</sub>);
  - Nitrogen (N<sub>2</sub>);
  - Carbon Dioxide (CO<sub>2</sub>);
  - Methane (CH<sub>4</sub>);
  - Total Kjeldahl Nitrogen (TKN);
  - Volatile Fatty Acids (VFA);
  - Total Alkalinity;
  - Transmissivity;
  - Chlorophyll-a (Algae biomass);
  - Microscopic Examinations;
  - Nitrite - Nitrate Nitrogen (NO<sub>2</sub>/NO<sub>3</sub>-N);
  - Ammonia Nitrogen (NH<sub>3</sub>-N);
  - Total Phosphorous (TP);
  - Cadmium (Cd);
  - Nickel (Ni);
  - Lead (Pb);
  - Chromium (Cr);
  - Copper (Cu);
  - Zinc (Zn); and
  - Iron (Fe).
-

Test Frequency	PARAMETERS																												
	Solids										Biosolids				VFA	Alkalinity Ca+CO3+CH	Gases O2+CO2+CH4	Nutrients						Physical					
	TSS	TSS	VSS	Turbidity	BOD	CBOD	Optical	Bioc/TI	DOC	SOC	TKN	NH3-N	NH3-NCON	TP				Transmissibility (I)	Conductivity	Temp	pH	Chlorophyll-a							
	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
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	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

Notes: (V) = every second day  
 (S) = Sun, Tue, Thu, Sat  
 (M) = Mon, Tue, Wed, Thu, Fri, Sat, Sun  
 (D) = Daily Composite of all Trains 24 times per week  
 (W) = biweekly  
 (SW) = biweekly composite  
 (S) = biweekly composite  
 (F) = Fiscal Calendar  
 (R) = RWMPCC Sampled seven days per week  
 (I) = IWSMPCC & IWSMPCC sampled five days per week, Sunday to Thursday

Table 4-4  
 City of Winnipeg  
 Wastewater Pollution  
 Control Centre Routine  
 Monitoring Programs

#### 4.2.4.7 Emerging Issues

The City has procedures in place to address the significance of emerging issues and to understand their implications for system design, operations and planning of upgrades. These methods include:

- liaison with professional colleagues in other municipal governments;
- membership in AWWA and WEF, the principal technical bodies in the water and wastewater field;
- presentation of papers and attendance at technical conferences focussing on emerging issues;
- monitoring of government and technical literature; and
- membership in the Canadian Water and Wastewater Association which monitors national legislation affecting the water and wastewater sectors.

One of the most significant emerging issues respecting the treatment and disposal of municipal wastewater is concern regarding the widespread use of environmentally persistent chemicals that include those from the pesticide, industrial chemical, and pharmaceutical and personal care product (PPCP) industries. In addition to these, there is particular interest in the biologically active chemicals such as natural/man-made hormones and other which have the ability to exert endocrine effects and potentially affect aquatic life. While the literature will show that these endocrine disrupting compounds (EDC) exist in the environment at very low concentrations (parts per billion or parts per trillion) they still have the potential to disrupt the normal function of endocrine systems which may result in adverse effects on reproduction and the development of aquatic organisms.

Many of the EDC's enter the environment through effluents from municipal wastewater treatment plants. Researchers looking into the presence of EDC's in wastewater have focused primarily on alkylphenols (e.g., nonylphenols, octylphenols), alkylphenol ethoxylate, bisphenol A, natural steroidal estrogens and synthetic estrogens. These chemicals were given the most attention because of their abundance in wastewater, high persistence in the environment and high potency as endocrine disruptors.

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The MWQSOG refer to only one alkylphenolic compound – nonylphenol (NP) found in Canadian effluents at 1-10 µg/L(ppb). A sample analyzed in January of 2003 indicates that the NP level at the City of Winnipeg's North End Water Pollution Control Centre (NEWPCC) is in the range of 3µ/L. The proposed guideline level for NP in streams under MWQSOG is currently set at 1µ/L. That implies that the effluent from the NEWPCC would be in compliance with a dilution ratio of 3:1 in the Red River. This dilution ratio is always exceeded in the Red River, therefore, preliminary observations indicate that NP levels are not a cause for concern at the NEWPCC.

Estradiol (E2) is a natural estrogen excreted by women and men. Synthetic estrogen ethinyl estradiol (EE2) finds its way into wastewater treatment plants from excretion by persons using birth control pills and hormone replacement medications. The City of Winnipeg has tested for these compounds at the NEWPCC and found that the data were confounding in that the measured levels of EE2 increased by 300% through the treatment process. Clearly because no EE2 was added during the treatment process, no conclusions can be drawn other than more work is required to understand the fate and accurate measurement of these compounds during the treatment process.

The USEPA and the EU are still struggling with identifying an analytical in vivo test protocol for determining endocrine disruption – thus the delays in their ability to evaluate chemicals for the EDC potential. The test results that they do have from the vitellogenin (a biomarker) test are very hard to transfer to the real world impact of a positive result. As a result of these uncertainties, there is insufficient information to set risk-based guidelines for water bodies or STP effluents. There is also insufficient knowledge about the removal mechanisms and the capability of conventional wastewater treatment processes to remove EDC's. Regulatory actions are about to take place in Canada that are not based on scientific evidence. These need to be considered as transitional while further scientific information is gathered so that a rational strategy can be implemented that will protect human health and the environment. Some have suggested that the precautionary principle may need to be implemented with respect to EDC's. Given the current state of knowledge respecting EDC's, the most effective implementation of the precautionary principle would be for the Federal Government to regulate on a national level the use of some EDC's, where practical, at source, thereby, reducing their discharge to the environment and minimizing the need for treatment at wastewater treatment plants.

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At present, there is uncertainty as to which chemicals are of concern, and the achievable levels for their removal are uncertain. There are 80 000 chemicals in use, of which just a few are more or less thoroughly tested using the conventional tests, such as LC50, mortality or growth tests. There must be an established “acceptable” level of these compounds in the effluent – since many of them may always be present in the waste stream; and in different forms (soluble, total), how the plant could best be operated to maintain steady removal of these compounds and what the ultimate fate of the compounds is. None of these questions can be answered with certainty. Since many of these compounds are released through normal bodily functions and as necessary pharmaceuticals or personal care products, an immediate and strict regulation would be unreasonable if implemented before we answer these questions and define the best practicable technology and the best available technology for their removal.

Given the foregoing, the City of Winnipeg’s plan is to monitor emerging compounds of concern in order to increase the data base and, thereby, facilitate possible future action when sufficient knowledge has been established regarding appropriate discharge limits and treatment technologies to address this issue.

The City of Winnipeg will continue to follow developments with respect to these emerging issues. Of particular note are ongoing consultations between City of Winnipeg and Dr. Jan Oleszkiewicz; a widely respected researcher and professor at the University of Manitoba, to further understanding on this important matter. Dr. Oleszkiewicz’s work is recognized in North America and also in Europe and as such, he has a global perspective on what the state of knowledge is respecting EDC’s and other compounds of concern. Dr. Oleszkiewicz is currently undertaking studies related to the issue of EDC’s in wastewater systems and the City of Winnipeg will be interact with him on this matter.

### **4.3 PROPOSED DEVELOPMENT COMPONENTS**

This section introduces components currently within the City’s proposed wastewater pollution improvement plan. Table 4-5 provides a listing of the program components, their estimated capital costs, and the proposed timeframes for initiation and completion. This program was approved by City Council on December 11, 2002.

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**TABLE 4-5  
 WINNIPEG'S WASTEWATER POLLUTION PREVENTION PLAN**

<b>Component</b>	<b>Capital \$ (Million)</b>	<b>Year Started</b>	<b>Year Completed</b>
<b>NEWPCC Disinfection</b>	<b>\$ 15</b>	2003	2004
<b>Centrate Ammonia Treatment at</b>	<b>\$ 10</b>	2003	2004
<b>CSO Control Program</b>			
(Stage Ia) - SCADA, Demo, Weirs	\$ 14	2003	2005
(Stage Ib) - Integrate with BFR	\$ 26	2005	2043
(Stage II) - In line storage	\$ 50	2028	2033
(Stage III) - Additional storage	\$ 181	2033	2050
<b>WEWPC Disinfection</b>	<b>\$ 3</b>	2050	2051
<b>Effluent Nutrient Control</b>			
NEWPCC	\$ 127	2019	2022
SEWPC	\$ 47	2022	2025
WEWPC	\$ 7	2025	2026
<b>Sub-Total</b>	<b>\$ 480</b>		
<b>Biosolids Program</b>			
(Stage I) - Pelletization and Storage	\$ 30	2007	2010
(Stage II) - Thermophilic conversion	\$ 20	2012	2014
<b>TOTAL</b>	<b>\$ 530</b>		

#### **4.3.1 Effluent Disinfection**

Ultraviolet (UV) disinfection is proposed for the NEWPCC with commissioning of a disinfection process scheduled for 2005. The use of UV radiation for secondary effluent disinfection has been in place at the SEWPC since 1999. Disinfection is not considered necessary at the WEWPC as the effluent leaving the polishing ponds complies with provincial bacteriological standards. The proposed addition of disinfection at the NEWPCC constitutes a \$15 Million program. UV disinfection has been proven to be effective and offers the additional benefit of avoiding both the handling hazards and dechlorination required to protect aquatic life that is required with disinfection by chlorination. Figure 4-2 illustrates the existing UV system used at the SEWPC.



UV Disinfection Lamp  
Systems at SEWPCC  
Figure 4-2

#### 4.3.2 Ammonia Reduction

The compliance with Provincial regulatory objectives for ammonia in the Red and Assiniboine Rivers was assessed on a site-specific basis under a separate ammonia toxicity study (TetrES and N/S Consultants, 2002). The ammonia concentration to be achieved by tertiary treatment in the final effluent for compliance with regulatory objectives is dependent on river flow and allocation of assimilative capacity. Based on study results, the City believes that the treatment of centrate at the NEWPCC will sufficiently reduce the ammonia concentration below levels that have chronic effects on aquatic life for a given river flow and allocation. The same studies indicate that treatment may be required at the SEWPCC in the future as flows to this plant increase, but no additional treatment is required at the WWPCC. These considerations are currently under consideration by Manitoba Conservation.

A comprehensive engineering study on tertiary wastewater treatment alternatives for effluent ammonia reduction has been completed by Earth Tech (Canada) Inc. to determine practicable

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treatment options for the Winnipeg WPCCs, capital and operations cost estimates, operation and maintenance requirements, and ability to achieve specific end-of-pipe ammonia concentrations to achieve certain receiving water quality limits. The alternative levels of treatment and the associated capital costs are summarized in Table 4-6.

**TABLE 4-6: CAPITAL COST ESTIMATE FOR AMMONIA REDUCTION**

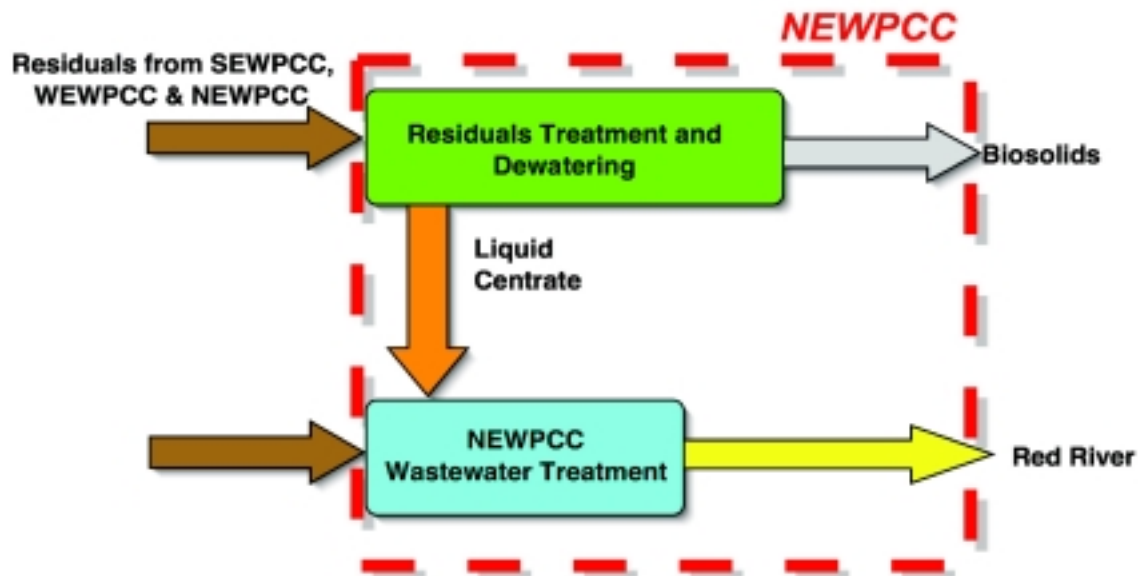
<b>Treatment:</b>	<b>Target Ammonia Concentration in Effluent mg/L</b>	<b>NEWPCC</b>	<b>SEWPCC</b>	<b>WEWPCC</b>	<b>TOTAL</b>
<b>Best Practicable Level of Control</b>	<b>2</b>	<b>\$112</b>	<b>\$33</b>	<b>\$4</b>	<b>\$149</b>
<b>High Level of Control</b>	<b>8</b>	<b>\$93</b>	<b>\$21</b>	<b>--</b>	<b>\$114</b>
<b>Moderate Level of Control</b>	<b>14</b>	<b>\$84</b>	<b>\$14</b>	<b>--</b>	<b>\$98</b>
<b>Centrate Treatment</b>	<b>18</b>	<b>\$10</b>	<b>--</b>	<b>--</b>	<b>\$10</b>

*All costs in millions (year 2000)*

The liquid generated from the dewatering of biosolids at the NEWPCC introduces a significant source of ammonia into the treatment process. This liquid, called centrate, is added to the raw wastewater at the NEWPCC for treatment. While this sidestream is only 1% of the NEWPCC flow, it adds approximately 30% to the raw wastewater ammonia concentration at the NEWPCC.

Figure 4-3 illustrates this process.

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Centrate Treatment at NEWPCC  
Figure 4-3

The City is proposing ammonia reduction at the NEWPCC through nitrification treatment of the centrate sidestream. This treatment option would significantly reduce ammonia concentrations in the NEWPCC effluent. Centrate treatment is estimated to cost approximately \$10 Million. This treatment is expected to result in compliance with proposed site-specific criteria (TetrES/North South 2002). Centrate treatment is common to all the treatment options and would not be a throwaway cost should additional nitrification or nutrient control be required in the future.

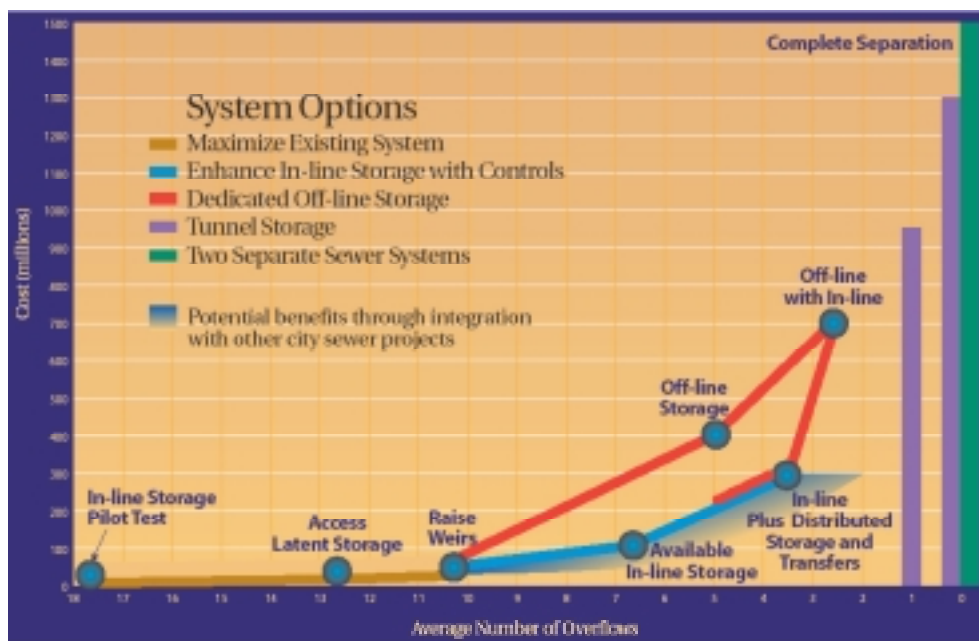
#### **4.3.3 Combined Sewer Overflow Mitigation**

The study of combined sewer overflows in the City of Winnipeg, their impacts and the proposed means and methodology of mitigating these impacts, is discussed in the "Combined Sewer Overflow Management Study Final Report" as produced by Wardrop/TetrES in November 2002. The studies undertaken indicated that CSO events did not contribute to unsatisfactory conditions in the rivers insofar as dissolved oxygen, ammonia, and suspended solids were concerned. The studies concluded that there were two aspects of river water quality which were impacted by CSOs, namely, fecal coliform concentrations (which exceed the 200 fc/100 ml which is the objective in the MSWQO for recreation in the rivers and for irrigation with river

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water) and aesthetics. The control of CSOs is primarily a regulatory and public policy issue. Accordingly, a CSO control plan was developed to reduce the number of CSO events, and their corresponding impacts on the rivers.

A number of methods to control CSOs were considered and evaluated. The measure of performance primarily used to evaluate the benefits of the considered options was the reduced number of overflows during the period May 1 to September 30, and the associated cost. Candidate CSO control plans for the Winnipeg situation were identified for a range of performance measures including U.S. EPA number of overflows, volume capture and compliance with Manitoba Surface Water Quality Objectives. The results of this analysis were used to develop “trade-off” curves, as illustrated in Figure 4-4 to assist in the evaluation of alternative control strategies.



**System Options, Costs, and Overflow Reduction Performance**  
**Figure 4-4**

In reviewing potential CSO control plans, the analysis indicates that the modest identifiable improvements realized from reaching a target range of one to zero overflows do not appear to justify the additional expenditure, i.e., an increment in the range of \$600 to \$1,200 Million, when compared to plans that could control overflows to about 4 per year. Separation of the combined

sewers would be less effective in terms of compliance with Manitoba's objectives for fecal coliform, than a control plan based on 4 overflows per RS.

The key elements of the program are noted below:

- raise weirs;
- dewater latent storage;
- modify interception rates;
- pilot test in-line storage;
- access available in-line storage;
- integrate with other City of Winnipeg sewer related projects; and
- off-line storage.

A tentative schedule and costs for implementing the various elements are shown in the table below.

**TABLE 4-7**  
**CSO CONTROL: PRELIMINARY SCHEDULE & COSTS**

<b>Year</b>	<b>Activity</b>	<b>Cost (Millions)</b>
2002 - 05	Implement a supervisory control and data acquisition system, raise interception weirs, conduct an in-line storage demonstration project and additional engineering studies	\$14
2005 - 43	Integration with basement flooding relief and sewer rehabilitation programs	\$26
2028 - 33	Access existing latent and available in-line storage	\$50
2034 - 50	Develop additional storage to meet long-term CSO control target of 4 CSOs per recreation season	\$180

The details and costs of these options, as well as alternative means of achieving a lower frequency overflow are discussed in the CSO Study Final Report.

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#### 4.3.4 Nutrients

The Province has served notice that it will be developing a nutrient management strategy. It believes it has evidence of a trend for increasing concentrations of nitrogen and phosphorous in the surface waters. It is concerned about the effects of these nutrients on water quality in the Rivers and Lake Winnipeg. Such effects could include excessive algae and aquatic weed growth. Much work is still to be done before the Province will have a strategy and significant public consultation is expected in defining the strategy. As a result, an implementation strategy is still several years away.

Nutrient control at the three WPCCs in Winnipeg could cost about \$180 Million (Earth Tech 2002). If biological nutrient removal (BNR) was implemented for both nitrogen and phosphorus, ammonia reduction would be achieved at the same time. While the City is not proposing a specific development of nutrient control facilities at its WPCC's at this time, the cost and timing for BNR was allowed for in the City's plan to improve wastewater collection and treatment.

The proposed ammonia reduction strategy (see Section 4.3.2 and TetrES/North South 2002) permits adequate time for the Province to complete their study and define a nutrient management strategy before a commitment needs to be made. As such, this would allow both the City and Province to validate the need for nutrient control and would not preclude any potential nutrient control measures required at any of the WPCCs.

#### 4.4 "NO DEVELOPMENT" SCENARIO

The alternative to the development to be licenced is the **absence** of the existing wastewater collection and treatment systems, and the planned upgrades. This alternative would constitute an absence of corporate due diligence by the City in fulfilling its mandates for promoting human health and the integrity of the rivers. The consequences of this scenario, discharge of raw wastewater into the rivers, is both unrealistic and unacceptable to the City. No further attention has been devoted to the "no development" scenario.

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## **5. EFFECTS AND ZONES OF INFLUENCES**

This section will discuss the effects and zones of influence of the existing wastewater collection and treatment system and the proposed specific future elements of the City's future plan. The discussion will focus on the components of the City's current and future operations. Less detail is provided on components already under review by a separate regulatory process, such as the biosolids management program and air quality issues.

The following discussion will describe the effects of the development with respect to the air, soil, and water environments, as well as discussing the cumulative effects and atypical events.

### **5.1 DESCRIPTION OF SOCIO-ECONOMIC EFFECTS**

The entire existing wastewater collection and treatment system is a socially beneficial development. Without it, raw sewage would be disposed of on soil or into watercourses with important public health concerns for the citizens of Winnipeg and downstream communities and river users, severely compromising the ability of the rivers to support aquatic life. As well, the lack of competent collection and treatment would diminish the image of Winnipeg and citizen's pride in their City. The entire wastewater collection and treatment systems could be considered a mitigation measure that has been developed, improved and expanded over a long period of time, until present day, to meet the growing needs of the City as population increased, and businesses and commerce grew. Without competent wastewater treatment, businesses and industrial development would be curtailed with a corresponding reduction in job and associated service sector opportunities.

The design and construction of treatment works valued at over \$200 Million over the past 25 years has generated significant economic opportunity and employment for consulting engineers, contractors, manufacturers and suppliers. The operation continues to provide these opportunities. The proposed works included in the \$530 Million environmental improvement plan will generate additional economic benefits and opportunities over the life of the plan.

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The existing system and the works contained in the improvement plan will also benefit the river environment and the associated public that use the river for recreation, enjoyment, and employment. The Red River, and to a lesser degree the Assiniboine River, support heavy recreational use within both the urban and rural environments. Developments such as The Forks and the river walk attract citizens and tourists to the rivers. The rivers are also used for boating activities such as powerboats, canoes, kayaks, personal watercraft, water taxis, and tour boats. In addition water sports such as rowing, paddling, and water skiing occur on the rivers. Improved access to the rivers through park and walkway access has raised the prominence of the rivers as a community amenity.

The rivers are not used extensively for swimming as the rivers' natural turbidity and colour contribute to poor visibility. Strong currents, and steep, muddy banks also pose safety hazards to swimmers.

Fishing on the rivers is extremely popular. The Urban Fishing initiative, a partnership between the Province, the City, The Mid-Canada Marine Dealers Association, the Manitoba Wildlife Federation, Fish Futures and many private tackle outfitters, has promoted fishing within urban reaches. Fishing clinics for young children are advertised in the City's Leisure Guide, and opportunities to under-privileged children, as well as celebrity fishing derbies, have increased the popularity of the fishing activity.

Downstream at Lockport is a world-renowned fishery, particularly for channel catfish and walleye. The Province has reported that for the year 2000, the total angler days in the Red River drainage area was estimated to be about 430,000. The corresponding direct angler expenditures for 2000 were about \$15,000,000 (\$2002). Therefore the continued operation and improvement of the wastewater facilities to sustain this activity is important.

The socio-economic effects of the Development are positive and the zone of influence is extensive, going well beyond the City urban area. The continued operation of the City's wastewater treatment facilities also benefits and positively affects the environmental sustainability of wastewater treatment services within adjoining municipalities in the Capital Region. The City's WPCCs accept septage that is hauled by truck from the rural municipalities where centralized treatment and disposal are not available, or where centralized facilities have not been sized to accommodate this higher strength waste. In addition, the City receives the

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residual treatment plant sludges from some facilities in the capital region for centralized processing and conversion to biosolids at the NEWPCC. This cooperative arrangement has avoided the duplication of facilities, and provides efficiency through centralized disposal, providing an overall socio-economic benefit and contributing to the stewardship of the regional environment.

The residual effects of the Development are positive and continuing.

## **5.2 AIR**

### **5.2.1 WPCC Emissions**

The operation of wastewater treatment plants inevitably involves some odours. The facilities at the WPCCs are almost all covered and odours are mostly captured in the ventilation air, which is dispersed into the air through dispersion stacks. Some nuisance odours remain as discussed below. These effects are considered temporary and localized.

#### NEWPCC and SEWPCC

On March 30, 1988 the Clean Environment Commission issued Order #1188 and #1190 to the City of Winnipeg to set limits, terms and conditions for the emission of noise, odour and particulates to the atmosphere from the NEWPCC and SEWPCC respectively.

The City of Winnipeg developed a long-term strategy for controlling odour emissions from the NEWPCC and SEWPCC. This strategy has three phases:

- 1) odour audit,
- 2) pilot odour control technology evaluation, and
- 3) odour control technology design and implementation.

Phases 1 & 2 have been completed.

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The Phase 1 Odour Audit was completed in July 1994. Phase 2 Pilot Testing and Evaluation was completed in July 1998, and included a review of several odour control alternatives for each odour source with recommendations and preliminary cost estimates.

The City's consultants, Arthur D. Little Inc., recommended three odour mitigation processes which will reduce the identified odour emissions and bring these plants into compliance with a proposed nuisance-based odour licence. In priority order, these processes are:

- South End (sludge storage): thermal oxidation with carbon adsorption as back-up;
- North End (sludge dewatering building): recuperative thermal oxidation with carbon adsorption as back-up; and
- North End (grit building): oxidation by chlorination and venting to main stack.

The Water and Waste Department has held discussions with Manitoba Conservation to review the proposed odour mitigation works, the required odour emission licence alterations and a schedule to implement the proposed odour mitigation processes. In December 2002 a natural gas-fired microturbine generator was installed at the SEWPCC which will thermally oxidize odours from the sludge storage tanks. In the fall of 2002, Earth Tech Canada Inc. began a study to pilot test a biogas-fired microturbine to mitigate odours from the dewatering building at the NEWPCC. After an appropriate testing period, the same odour mitigation process will be applied to the grit building such that the use of chlorine at the NEWPCC site is avoided.

### WEWPCC

In April 1990, as part of the upgrades to the WPCCs, expected odour emissions and recommended odour mitigation requirements were reviewed. These recommendations included a 20-meter high odour dispersion stack and scrubbing of the emissions from the sludge storage tanks and the sludge truck bay. These odour mitigation works were installed during the construction of the new WEWPCC.

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### **5.2.2 Greenhouse Gas Emissions**

During the sludge digestion process at the NEWPCC, some of the matter is converted to methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>), which are considered to be greenhouse gases (GHGs). The methane is captured and stored in a gas storage sphere located at the NEWPCC. This fuel is used year round to heat the sludge in the digesters and is used to heat the plants during winter months. On very cold winter days, when there is not enough methane produced to heat the plant, heating requirements are supplemented by natural gas. Excess methane in the summer months is converted to less damaging CO<sub>2</sub> through the use of waste gas burners. In this manner, all methane produced is captured and converted to carbon dioxide and water vapour in a controlled environment.

### **5.2.3 Biosolids Application**

The application of biosolids to land involves localized odour nuisance, especially when the biosolids cannot be incorporated into the soil quickly, as in winter, for example. The biosolids application program is being reviewed by Manitoba Conservation in a separate process.

The effects of the Development on air quality are temporary and involve nuisance odour. The zone of influence of the Development is local to the WPCC's and the biosolids application site. The City is proceeding, under a separate process, to address nuisance odours.

## **5.3 SOIL**

The Province of Manitoba regulates the disposal and use of biosolids under the *Manitoba Environment Act*. The City's Environment License No. 1089 E RR sets terms and conditions for the application of biosolids to farmland including requirements for rigorous monitoring and research programs. These terms and conditions are followed, with detailed reporting of the "WinGRO" program provided to Manitoba Conservation through an annual compliance report. The City of Winnipeg has successfully operated a land application program called "WinGRO" since 1990, where dewatered biosolids are recycled on to agricultural land on a year-round basis.

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A condition of the existing license, issued in June 2000, is the requirement to conduct a licence review to determine if new evidence warrants a change in the specifications, limits, terms or conditions contained within the current licence. Correspondingly, the City initiated a comprehensive study to determine if changes to the WinGRO are required based on current information and emerging trends. It is expected that the technical/scientific aspects of the study will be completed by mid-September 2003.

Once the study has been completed along with public consultations, a submission will be filed with Manitoba Conservation shortly after it has gone through the City's administrative process.

The effects of the Development on soil related to the application of biosolids to land are localized and are beneficial. The biosolids act as a soil conditioner and a fertilizer (thereby displacing the need for the addition of chemical fertilizers). The land application program is under review under a separate process. The City's improvement plan allocated \$50 Million for improvements in the biosolids management program.

## **5.4 WATER**

There are three main components of the Winnipeg collection and treatment system which discharge into the Red and Assiniboine Rivers. The components and the nature of their discharges are as follows:

- three WPCCs with treated effluent discharge;
- combined sewer systems convey all the wastewater to the WPCCs during dry weather flows, but spill an untreated dilute mixture of wastewater and run-off in excess of the capacity of the diversions structures during wet conditions directly into the rivers; and
- land drainage sewers which discharge runoff either directly to the rivers or their tributaries, or indirect discharge through stormwater retention ponds.

These sources, and the characteristics of their associated discharges, may affect river uses such as:

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- aquatic life;
- recreation; and
- agricultural irrigation.

Winnipeg's three WPCCs provide best practicable secondary treatment before the treated wastewater is discharged to the rivers. Combined sewer overflows currently discharge a dilute mixture of untreated wastewater and rainwater into the rivers. Land drainage may discharge directly to the river or in some areas may discharge through stormwater retention basins. The basins serve to both reduce peak runoff flow to the rivers and improve the quality of the storm water before discharges to the rivers.

Discharges associated with City of Winnipeg the entire wastewater collection and treatment systems have been studied and monitored extensively to assess the effects of these discharges on aquatic life, key water quality parameters, and river uses such as recreation. The City has proposed a long-term program that includes several components that are treatment improvements and mitigation measures constituting improvements in quality of discharges. The potential effects associated with both existing and proposed aspects of the City's collection and treatment system are described in the following sections.

#### **5.4.1 Effects on Aquatic Life**

The Red and Assiniboine Rivers support a rich and diverse assemblage of aquatic species. About 35 fish species were captured from the Rivers in fish habitat field studies associated with the recent studies of ammonia levels in the Red and Assiniboine rivers. These studies found that fish travelled significant distances throughout the study area. Full details on the existing aquatic life including discussion on habitat, population distribution and invertebrate are available in the Ammonia Technical Memorandum (TMs) – Fish Habitat TMs – FH01, FH02 and FH03 as well as Fish Populations TMs FP01, FP02 and FP03. Due to the fact that aquatic life has different responses to different quality parameters in the receiving streams, effects on aquatic life associated with discharges are discussed in terms of dissolved oxygen, suspended solids, and ammonia, in the following sections.

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#### **5.4.1.1 Dissolved Oxygen (DO)**

##### Effects of Existing Continued Operation

Dissolved oxygen (DO) is a very important parameter in the protection of aquatic life. DO levels in the rivers within and downstream of the City of Winnipeg, have been shown to be well above the minimum concentrations in the Manitoba Surface Water Quality Objectives (MSWQO) virtually all the time. Figure 5-1 shows monitored DO levels in the Red River at the Floodway Control Structure (1977 to 2002), the Redwood Bridge (in the centre of the City), and the Red River at Lockport. The plots demonstrate that DO levels from upstream of Winnipeg through to Lockport are typically well above the minimum concentrations set by Manitoba Conservation. It is important to note that, in 1993 (after three back-to-back rainfall events estimated to have return frequencies of 1-in-100 and 1-in-50 years), a depressed DO content was observed and travelled through the City. These extreme events resulted in the only observed concentrations below MSWQO. The Assiniboine River has shown no DO concentration below MSWQO criteria.

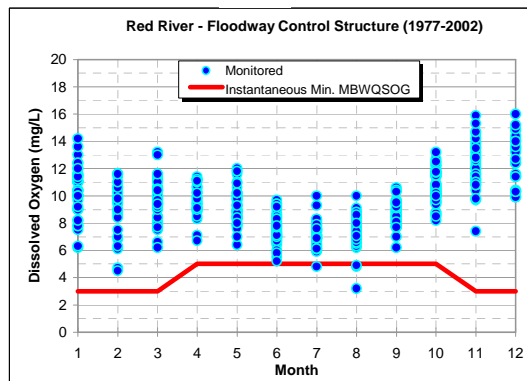
Approximately 90 to 95 percent of the CBOD is removed at each of the three WPCCs. WPCCs produce a secondary effluent with less than 25 mg/L CBOD and 30 mg/L TSS concentrations. Monitoring of effluent quality indicates that the effluent CBOD is well below the desired 25mg/L compliance limit.

Combined sewer overflows from wet weather conditions result in discharges containing diluted raw sewage. Real-time monitoring of DO levels occurring both during and after a CSO event has indicated that no significant change in DO occurs after CSO events (ref. CSO Management Study Final Report, Section 4.2.1).

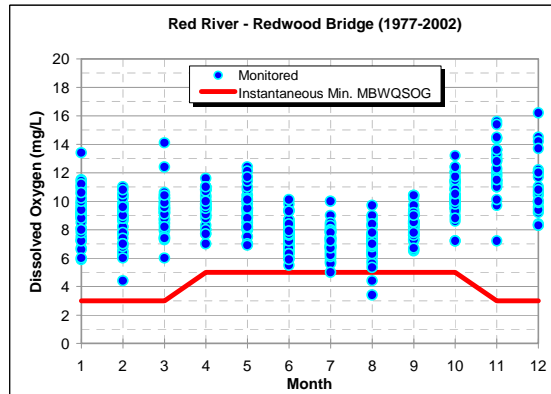
The zone of influence of all of the WPCCs, LDSs and CSOs on River DO levels for the Assiniboine River, extends from the WEWPCC outfall on the Assiniboine River to the confluence with the Red River, and for the Red River, from the SEWPCC outfall to between the North Perimeter Bridge and Lockport.

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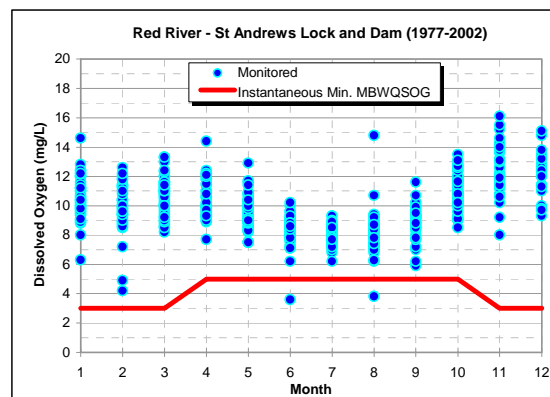
(a)



(b)



(c)



Monitored DO Levels  
Red River  
Figure 5-1

Routine biweekly river water quality sampling since 1977 on the Red and Assiniboine rivers demonstrates that the City of Winnipeg negligibly impacts DO levels in the river, and that DO levels are well above the minimum concentrations established for protection of aquatic life. In addition, supporting information from fish habitat studies confirm the presence of an abundant and diverse assemblage of fish species, which indicates existing collection and wastewater treatment operations adequately provide for the protection of aquatic life in the rivers.

#### Effects of Future Development

Proposed developments in the City's long-term plan will result in the reduction of CSOs from 18 to 4, and an increased capture of combined wastewater which will be brought to the plant for full secondary treatment. The increased capture of CSOs, disinfection at the NEWPCC, and centrate treatment at the NEWPCC will not change the dissolved oxygen concentrations in the rivers. The City will continue to upgrade its secondary treatment facilities to protect the DO concentrations in the rivers from treated effluent discharges from the WPCCs as development occurs. The City believes no further actions are required to improve oxygen levels.

#### Residual Effects:

There will be a continued protection of ample oxygen resources in the rivers for protection of aquatic life. There will be no significant ecological effects.

### **5.4.1.2 Suspended Solids**

#### Effects of Continued Operations

High levels of suspended solids, relative to background concentrations, can impact on the health and survival of aquatic life. Both the Red and Assiniboine Rivers carry a naturally high concentration of suspended solids in their flows as they are received into and through Winnipeg. This is typical of Prairie Rivers that flow through the fertile soils and clays in southern Manitoba. The name "Winnipeg" originates from the Cree language, and is translated to mean, "muddy waters". The Red river gets its name from the colour of the clays it flows through and carries as it flows to Lake Winnipeg. Aquatic life in the Red and Assiniboine rivers have adapted and

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thrived in the highly turbidity conditions of the local rivers that are natural in response to the suspended solids they normally carry.

During snowmelt and rainfall conditions, the suspended solids increase dramatically upstream of the city due to runoff from the rural agricultural lands that have been highly channelized to improve drainage characteristics for farm practices, crop production and harvesting. As such, the river waters entering the city during wet weather conditions are high in suspended solids. Suspended solids are also contributed by dry and wet weather discharges from the WPCCs, and from wet weather discharges from the land drainage and combined sewer systems, however urban drainage, including CSOs, do not significantly increase or alter the suspended solids load of the river under these conditions.

During dry weather conditions, the typical suspended solids load in the local Rivers range in concentrations from 85 to over 200 mg/L during open water as they entering Winnipeg. The treatment processes at WPCCs have been designed to reduce the total suspended solids (TSS) to a maximum concentration of 30 mg/L in the secondary effluent. The raw influent to the plants under dry weather conditions are typically in the order 300mg/L. As such, the WPCCs remove over 90% of the suspended solids received in the raw wastewater.

The WPCCs produce high quality secondary effluents that meet the treatment goal of 30 mg/L for TSS.

The CSOs and land drainage also discharge TSS to the rivers. Although TSS concentrations from these discharges are higher than from the WPCCs, these discharges do not significantly affect TSS concentrations in the rivers.

The zone of influence of the City operations on TSS in the river is localized, approximately within the urban limits, and is not significant.

#### Effects of Future Development

Increased capture of CSO's, disinfection at the NEWPCC and centrate treatment at the NEWPCC, will not materially change the TSS levels in the rivers.

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### Residual Effects

The residual effects on TSS are not significant and will have no significant effect on aquatic life in the river.

#### **5.4.1.3 Ammonia**

##### Effects of Continued Operations

Human and animal waste contains organic nitrogen and urea which breaks down through natural processes. Ammonia is a natural component of this ecological cycle. When present in high concentrations in effluent discharges, ammonia can stress aquatic life in the Rivers. If ammonia is present in very high concentrations, acute effects, such as fish kills, can result. For the Red and Assiniboine Rivers, the concern with respect to ammonia relates mainly to potential chronic effects, which mainly consist of reduction in growth rate of fish and tissue damage, not fish kills. Ammonia does not accumulate in the food chain and has no effect on the safety of eating fish.

In conventional secondary treatment such as is used in the three Winnipeg WPCCs, limited removal of ammonia takes place. Accordingly, the effluents discharged to the Rivers contain levels of ammonia. The toxicity of aqueous ammonia solutions to aquatic life, such as fish, is mainly attributed to the un-ionized form of ammonia. The concentration of un-ionized ammonia varies with river temperature and pH. Summaries of key water quality parameters such as pH, NH<sub>3</sub> and temperature are shown in Section 3 of the Phase 2 River Conditions TM. Historical data indicates that concentrations of ammonia in the urban reaches of the Rivers downstream of the WPCC's occasionally exceed the Manitoba Conservation objectives due to WPCC effluent discharges. Historical ammonia data and its use in calibrating a water quality model are discussed in the Phase 2 River Conditions TM Section 8. As the river flows downstream, the ammonia concentrations reduce due to natural conversion of ammonia to nitrates and more significantly the uptake of ammonia by algae. The zone of influence of the discharge from WPCCs during low flow conditions extends as far as Selkirk, however, the concentration of ammonia will be below a chronic concentration which will affect aquatic life for most of the zone of influence.

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To determine the potential effects of ammonia discharged from the WPCCs in the river, the City conducted a comprehensive Ammonia Criteria Study for the Red and Assiniboine Rivers. The study involved an extensive review of the protocols used in the development of protective ammonia criteria (see Ammonia Criteria Study Technical Report Section 3). As criteria from other regulatory jurisdictions was based on datasets that were not associated with local stream characteristics or fish species, the goal of the ammonia study was to develop site-specific protective criteria suitable for protection of aquatic life in the Red and Assiniboine Rivers. The procedures for the development of site-specific criteria were researched and are discussed in Section 5 of the Ammonia Criteria Final Technical Report. An extensive testing program of local indigenous species was conducted and is discussed in detail in Technical Memorandum #T1.0 Phase 2 Toxicity Workstream: Ammonia Toxicity Testing Program in 1999 and 2000. The data collected in these toxicity tests were combined with public domain data to develop site-specific criteria for the Red and Assiniboine Rivers as discussed in Section 6 of the Ammonia Criteria Study Final Technical Report.

To determine whether the site-specific criteria will be met while considering both **cumulative effects** and low flow conditions, a science-based and site-specific application procedure was developed. The four key aspects of the application included:

- The concept of using local site-specific conditions (local fish species and their toxicity, local pH, temperature) for definition of allowable ammonia concentrations;
  - determination of the allowable in-stream chronic concentration (chronic concentration is defined to be over an averaging period of at least 30 days) and is discussed in detail in Section 6.7 of the Ammonia Criteria Final Technical Report;
  - design flows:
    - the selection of design flows should be based on representative statistics which review the period of record that best reflects the most likely occurrence of low flows for the next 10 years;
    - using the flows from 1962 to the present flow will best represent the likely flows for the future and will be consistent with practices applied locally for several historical data parameters and elsewhere for flow data;
    - periodic review of the flow record should be conducted to reflect changing climatic conditions. It is recommended that reassessment should occur within 10 years (see
-

follow up studies – Section 6). There is further discussion of design flows in the Ammonia Criteria Study Final Technical Report Section 7.1.1.

- waste load allocation – the City proposal takes into account sustainability and **cumulative effects** by allowing for significant development upstream and downstream of the City of Winnipeg. By proposing that the City to utilize only 90% of the allowable ammonia concentration in the Red River, both upstream and downstream of the City (at the City boundary), provision is made for significant development outside the City. The City proposal also allows for only 75% of the allowable ammonia concentration in the Assiniboine River to be utilized by the City at the City's upstream boundary on the Assiniboine River. This proposal takes into account sustainability and **cumulative effects** by allowing for up to 300,000 additional people immediately outside of the City of Winnipeg limits in the Capital Region without exceeding the allowable criteria in the Red and Assiniboine Rivers.

The effect of the discharges of the treatment plants at low river flows was assessed using water quality modelling (computer models were used as discussed in Phase 2 River Conditions TM). This was done to determine whether the existing criterion met the protective criteria in the river while accounting for potential **cumulative effects** associated with loadings from additional development upstream and downstream. The findings of the assessments concluded the following:

- **WEWPCC** - an assessment of the discharges from the WEWPCC indicated that discharging the effluent through the polishing ponds reduces ammonia enough to meet the existing criteria at the low design flow conditions;
- **SEWPCC** - current discharges from the SEWPCC into the Red River comply with the proposed criteria. Future growth of the SEWPCC service area may result in increased ammonia loads and should be monitored to determine if further reductions of ammonia are required; and
- **NEWPCC** - the existing discharges from the NEWPCC would not meet the proposed criteria in the river during low flow conditions.

The plumes from the WPCCs were not observed to impede fish movements. However, some fish displayed an attraction to the areas influenced by the plume.

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The effluent mixes rapidly downstream of the outfall such that ammonia concentrations are below those acutely toxic to fish.

A number of fish were monitored using acoustic tags, and it was found that the fish were able to pass through the NEWPCC area suggesting that plumes are not barriers to their movement. Tagged fish in general were found to be highly mobile. Tracking data suggested that fish may migrate into and out of the study area on a seasonal basis. This suggests that exposure of fish to municipal wastewater effluents is generally intermittent, and varies with the season.

The WPCC discharges influence the ammonia concentrations in the Red and Assiniboine Rivers but not to the extent that they represent a toxicity concern to aquatic life, with the exception of the NEWPCC effluent under low flow conditions.

#### Effects of the Future Development

The City's proposed long-term plan specifies a course of action for each of the three WPCCs. For each of the three plants, the proposed development components are:

- **WEWPCC** - for the WEWPCC , the City will maintain the use of the polishing ponds to meet the proposed site-specific protective ammonia criteria in the future, therefore there will be no significant change in the effects on the Assiniboine River downstream of the WEWPCC.
  - **SEWPCC** - for the SEWPCC the current discharges from the plant should allow the City to meet the site-specific protective criteria for low-flow conditions. Future development growth in the service area of the SEWPCC may increase the ammonia load to the river thus triggering the City to further reduce ammonia from this WPCC as it becomes necessary to maintain compliance. The City has proposed to monitor ammonia loads from the SEWPCC in order to determine when further ammonia reduction is required.
  - **NEWPCC** - for the NEWPCC the proposed treatment of liquid centrate (see Section 4.3.2) will reduce ammonia concentrations in the river to be in compliance with the protective site-specific protective criteria for ammonia. With implementation of centrate treatment and the associated removal of its ammonia loading, a significant reduction of risk to aquatic life from ammonia is expected should low flow conditions occur in the future.
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The above actions will reduce the zone of influence of the NEWPCC effluent on ammonia concentrations in the river and is expected to result in compliance with the ammonia protective criteria.

### Residual Effects

While current and proposed operations will continue to result in ammonia discharges from the three WPCCs, these discharges (after centrate treatment at NEWPCC) will not cause exceedance of the protective criteria at or above the low design flow conditions. Therefore the discharge of ammonia will cause a significant ecological impact on aquatic life in the Red River.

## **5.4.2 Nutrients**

### Effects of Continued Operations

Nutrients such as nitrogen and phosphorous have the potential to increase algal growth in rivers and lakes. The Province of Manitoba has initiated a Nutrient Management Strategy to understand the effects of nutrients on water quality in the rivers and Lake Winnipeg and determine if nutrient control is required. Much work is still to be done before the Province will have a strategy and significant public consultation is expected in defining this strategy. As a result, an implementation strategy is at least several years away.

The phosphorous concentrations in the raw wastewater to the WPCCs range from about 6mg/L. Although not specifically designed for nutrient control the WPCCs reduce phosphorous concentrations in the treated effluent to about 3 to 4 mg/L. Similarly, nitrogen concentrations from the WPCCs are reduced from a range of about 34 to 43 mg/L to a range of about 20 to 32 mg/L on average.

Nutrients in discharges from the WPCCs can effect algal growth in the rivers. This impact of excessive algal growth is only apparent during low flow conditions. The effect of nutrient discharges from the WPCCs on algal growth during low flow conditions were studied in the Ammonia Criteria Study and are discussed in Technical Memorandum #RC2.0 River Conditions – Section 10.

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The zone of influence of nutrients discharged from the treatment plants extends to Lake Winnipeg. Currently, according to the provincial study the discharges from the City to Lake Winnipeg represent about 6.3% of the total loadings of phosphorous and 5.2% of the nitrogen. To properly understand impacts of nutrients to the Lake, cumulative effects from all discharges needs to be assessed. It is part of the provincial nutrient management strategy to understand these cumulative effects and the City of Winnipeg supports this analysis.

#### Effects of Future Development

The effects of nutrient controls at the WPCC's were studied by critical-period river modelling in the Ammonia Criteria Study (TM #RC2.0 River Conditions – Section 10). Nutrient reduction from the WEWPCC and SEWPCC will have little impact on the reaches immediately downstream of these plants since the nutrient load is dominated by upstream sources. Nutrient control could reduce algal growth downstream of the NEWPCC at Lockport during low flow conditions. During high flow conditions, the nutrient removed would not be significant when compared to large loads carried by the Red River from upstream sources.

Nutrient control would reduce the phosphorous and nitrogen loads contributed by the City of Winnipeg to Lake Winnipeg from 6.3% to 2.5% for phosphorous, and from 5.2% to 2.1% for nitrogen at a cost of \$181 Million. The City does not plan to implement nutrient control at this time but its plan makes provision for such potential implementation. The effect of basin wide nutrient loading and corresponding water quality response in the Lake is not well understood yet and is the subject of the on-going Provincial study on Lake Winnipeg.

#### Residual Effects

Even with full biological nutrient control at all three WPCC's, the concentration of nitrogen and phosphorous emanating from plants would be 10 mg/L and 1 mg/L respectively. Land drainage discharges would still continue.

The ecological effects of nutrient reduction in the rivers and Lake Winnipeg are not known at this time. The cumulative effects of all nutrient discharges must be included in the provincial nutrient management strategy. The City believes that the proposed Provincial Nutrient Management Strategy will have significant implications for all Manitobans, including the City of

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Winnipeg and the program should be the subject of an Environmental Impact Assessment of its positive and adverse effects.

### **5.4.3 Effects on Recreation**

Manitoba Conservation had previously classified recreation into primary and secondary categories. Primary recreation included activities involving complete immersion in the receiving stream such as swimming and waterskiing. Secondary recreation included activities that do not involve intentional immersion, such as boating. The CEC recommended and Manitoba Conservation accepted a prescribed set of recreational river uses to be protected under dry weather flow conditions. These uses are primary and secondary recreation for the Red River only, and secondary recreation for both the Red and Assiniboine Rivers. Important factors in the desirability of a waterbody's suitability for recreational use are safety, aesthetics and health risk. The risk to health is usually characterized by the microbiological content of the water, while the aesthetic quality of a waterbody can be characterized by presence of solids, odour, floating and other debris in the water course. The Rivers are not used extensively for primary recreation because of the naturally turbid water, steep banks, muddy bottoms, and strong currents.

#### **Effects of Continued Operation**

The bacteriological quality of the rivers is affected by Winnipeg discharges to the rivers and can affect recreation and public perception. The concentration of fecal coliform organisms in the water is used by Manitoba Conservation, and other regulatory agencies, as an indicator of risk to human health. The provincial numerical objectives on fecal coliform requires concentrations to be less than 200 fecal coliform per 100 ml (fc per 100 ml) for primary recreation. Present concentrations frequently exceed the Manitoba objectives for fecal coliform. This issue is relevant to both dry and wet weather flow management.

Section 7.6 of the CSO Management Study Report discusses the fecal coliform concentrations in the river under representative conditions (prior to existing disinfection of SEWPCC effluent). Compliance has been assessed during the recreation season from May 1 to September 30. In assessing the compliance with the primary recreation objective of 200 fc/100 mL, monitored results ranged from compliance as low as 0% of the time (for a location just downstream of the

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NEWPCC) to an average of about 55% for all locations on the urban river system. Compliance was determined based on the geometric mean of the predicted hourly concentrations of fecal coliform in the rivers.

The existing zone of influence on the river extends downstream to Lockport and Selkirk.

### Effects of Future Development

- WPCCC Effluent Disinfection

Compliance with fecal coliform objectives, prior to SEWPCC disinfection was often not achieved due to the dry weather impacts of the undisinfected effluents from the three WPCCs, particularly the NEWPCC. Disinfection of the SEWPCC effluent went on-stream in July 1999. The City has made budget provisions for disinfecting the NEWPCC (2005 target in-service date). Treated effluent from the WEWPCC is discharged to the Assiniboine River via the existing polishing ponds. The retention time in these ponds is sufficient to reduce fecal coliform concentrations in the effluent to MSWQO limits (200 fc/100 mL).

Figure 5-2 shows that disinfection of all WPCCC effluents will result in compliance with the primary objective (200 fc/100mL) about 75% of the time at the worst case location.

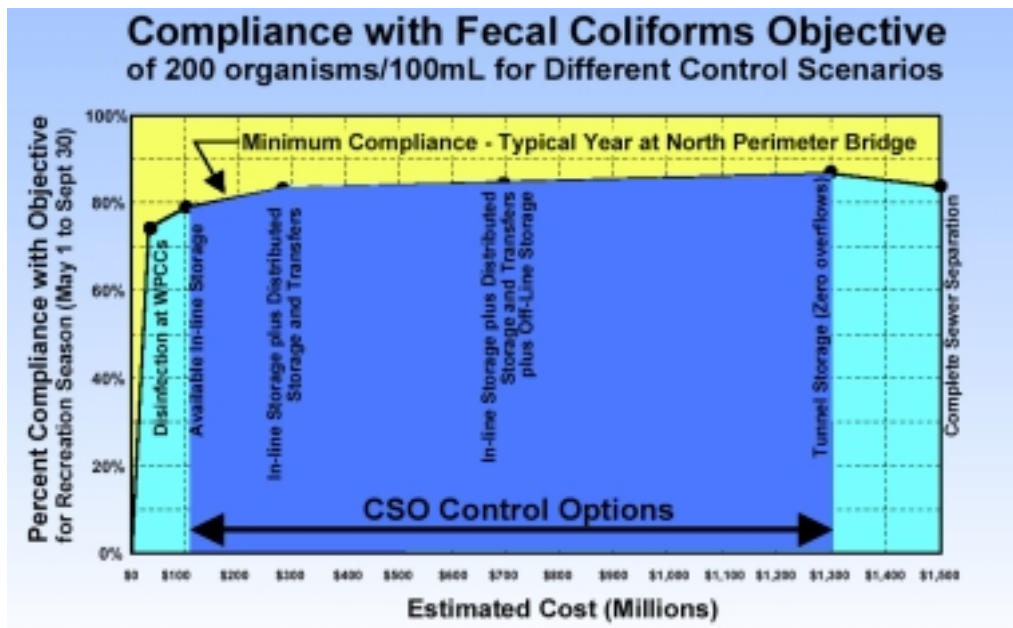


Figure 5-2



Disinfection of WPCC effluents will significantly improve compliance with the MSWQO for fecal coliforms under dry weather conditions. Disinfection will not appreciably improve compliance under wet weather conditions due to CSO and land drainage contributions. Figure 5-3 illustrates the effects of wet weather discharges, mainly CSOs, on fecal coliform concentrations in the rivers. The zone of influence from dry weather discharges will be greatly reduced by disinfection at the NEWPCC. No exceedance downstream will occur due to dry weather flow discharge.

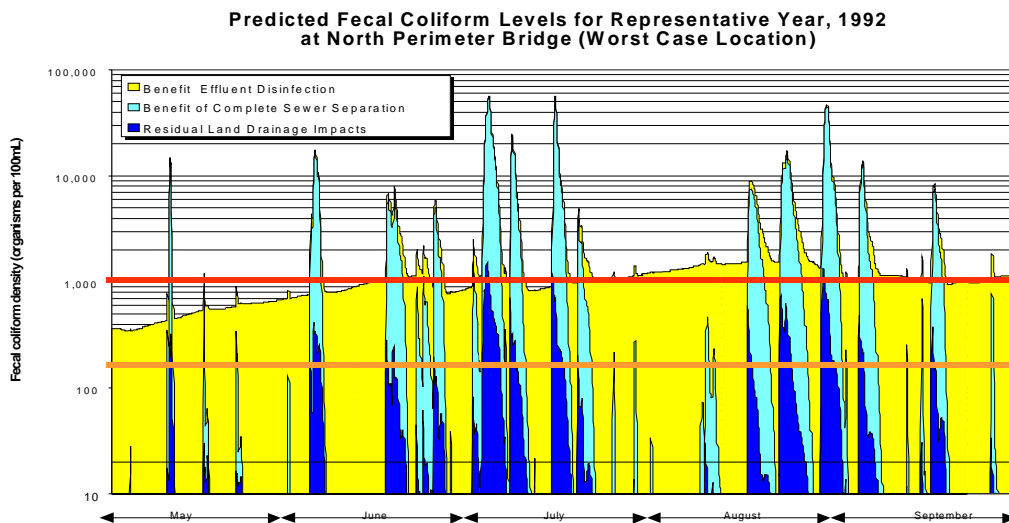


Figure 5-3

- CSO Controls

Several CSO control options were reviewed and assessed as part of the CSO Management Study. These options were modelled using an integrated model approach.

Figure 5-2 illustrates the compliance with the 200 fc/100ml objective for specific control alternatives. Relative to dry weather disinfection at all plants, the increase in compliance with any wet weather control option is relatively modest in terms of improving compliance with MSWQO.

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Modelled CSO control options and their predicted effects included the following scenarios:

- The in-line storage option, which includes disinfection of the dry weather flows at the treatment plants, showed compliance, with the primary recreation objective, of about 80% at the worst location.
  - The in-line storage option in itself results in only a slight increment in improved compliance (3-5%) compared to the planned implementing of disinfection of the WPCCs and correcting dry weather overflows. This is because non-compliances resulting from CSOs are of relatively short duration.
  - Non-compliance would occur during those WWF events when CSOs occur. With in-line storage fully implemented, CSO events would occur about 5 to 8 times during the recreation season on an overall system basis. Some districts could overflow more frequently and would need other control measures to conform to the average system performance.
- As can be seen from Figure 5-2, other more costly control options do not improve the average compliance by more than an additional 2 or 3% over disinfection and in-line storage alternative.
- Separation of the combined sewers would not result in an improved benefit in terms of average compliance. Separated districts discharge significant quantities of land drainage, which would cause exceedances of the fecal coliform objectives.

The frequency of exceedances of surface water recreation objectives downstream of the City of Winnipeg will be reduced by CSO control. The largest 4 CSO events will not be stored, therefore, the zone of effects from CSOs will not be reduced, however the duration of the effect over the recreational season will be reduced.

#### Residual Effects

Wet weather events will cause non-compliance with MSWQO fecal coliform objectives under many wet weather events due to land drainage and those 4 CSOs per year not captured under CSO control program (see Figure 5-3).

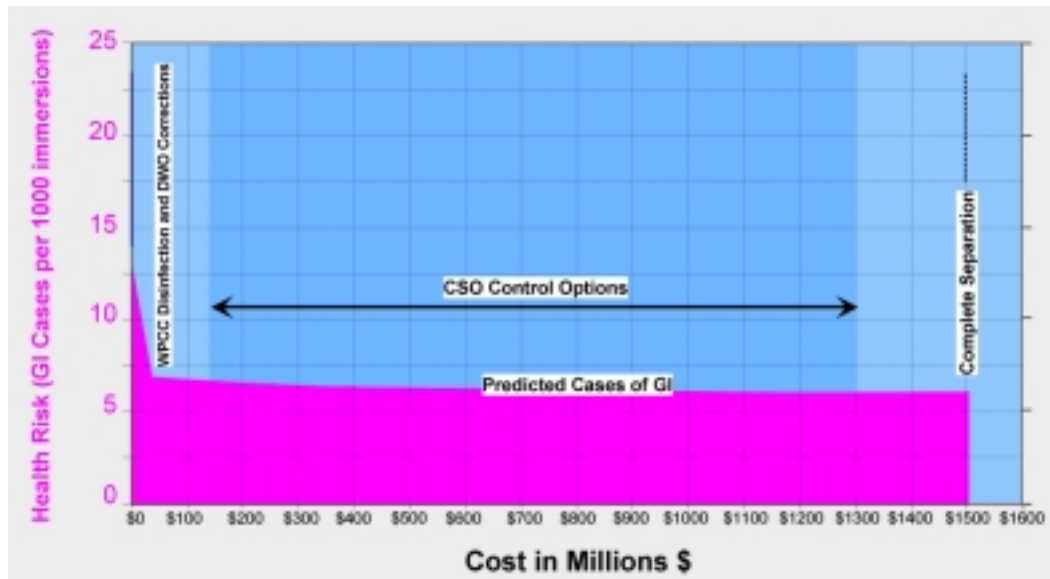
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Even with disinfection there will still be a discharge of 200 fc/100 mL from each WPCC during the recreation season. Although 200 fc/100 mL would meet the primary recreation objective, this still represents some risk of illness (10 cases of Gastrointestinal Illness per 1,000 Immersions; see Illness Risk Assessment, Appendix 1 of CSO Management Study). This level of risk is considered acceptable by Manitoba Conservation, as implied by their Surface Water Quality Objectives.

Most regulatory agencies, including Manitoba, do not give direction on the percent of time that compliance is required to meet their water quality objectives. Alberta Environmental Protection, however, requires that the geometric mean for primary recreation and secondary recreation be below the objective 80% and 90% of the time, respectively. Most locations on the Winnipeg rivers would meet (or be very close to meeting) such criteria after the WPCC effluents are disinfected. Some locations on the river would not comply but selective implementation of CSO control plans would meet these criterion. There would still be exceedances of objectives during and after wet weather events.

The rationale behind the MSWQO for fecal coliforms is protection of public health (Manitoba Conservation 1988). Figure 5-4 shows the predicted illness risk in terms of GI cases/1,000 immersions for the various control scenarios. This shows that there is virtually no change in risk associated with wet weather controls, i.e., once WPCC effluent disinfection is in place. There are many other “community health” factors that could be considered with respect to CSO control, however, in terms of estimated differences in disease associated with water-based recreation, the CSO control scenarios are not significantly different.

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Predicted Illness Risk  
Figure 5-4

As stated in the Illness Risk Report, Appendix 1 of the CSO Management Study Final Report, “CSOs are wet weather events and intermittently contribute pathogens to the river, many of which are fairly ubiquitous in the surface water, including the Red and Assiniboine Rivers. CSO control would reduce the concentrations of some pathogens in the rivers, during and shortly after rainstorms..... From a public disease standpoint, the available epidemiological analyses and evidence indicates that the public health benefits of CSO control, in terms of avoided disease caseload, will not be measurable....”

#### 5.4.4 Aesthetics

##### Effects of Continued Operations

The Red and Assiniboine Rivers are typical prairie rivers and carry a high sediment load which gives them their “muddy” appearance. Although there is algae in these rivers it is difficult to see due to the high load of suspended solids carried by the rivers. The treated wastewater effluent from the three WPCCs has very little effect on aesthetics on the Red and Assiniboine rivers. The treated effluents are screened and all floatable materials are removed. CSOs do have aesthetic effects in terms of floating debris which include litter and sanitary waste. Land drainage sewers also have aesthetic impacts on the rivers due to street litter and debris being

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carried into the rivers. The zone of effect is the urban area downstream to approximately Lockport.

#### Effects of the Future Development

Disinfection of the effluent, ammonia reduction and nutrient control have no significant effects on the current aesthetic condition of the rivers, as such improvements are not visible from an aesthetical standpoint. CSO controls will reduce the number of overflows from 18 a year to approximately 4 a year, thereby reducing the aesthetic impacts of CSOs.

#### Residuals

Residual effects from the four CSOs per year, as well as street litter emanating from the land drainage sewers will continue.

#### **5.4.5 Other Constituents**

The City of Winnipeg has undertaken three priority pollutant surveys, two in 1991 and one in January 2003. The surveys included analyses for metals, volatile organics including such compounds as benzene, base neutral extractables including such known carcinogens as Benzo (a) pyrene, and organochloride pesticides. In addition to these tests, the testing in January 2003 also included analyses for total PCB, nonylphenols and nonylphenol ethoxylates, and dioxins and furans. The 1991 surveys included sampling locations at the Red River at the South Floodway, the Red River at the North Perimeter, and the Assiniboine River at Headingly. Also included in the surveys were samples of the effluents from all three of Winnipeg's water pollution control centres. The 2003 survey consisted of samples obtained from the NEWPCC raw wastewater influent and also the effluent from the NEWPCC.

In the 1991 surveys, 143 compounds were analyzed in the treatment plant effluents. Of those 143 parameters, 121 or 85 percent were found to be below detection. In the 2003 survey the number of analyses of the NEWPCC influent was 159, and of those 120 or 75 percent were found to be below detection. The effluent data consisted of 159 parameters in total, and of those 127 or 80 percent were found to be below detection. Of the river samples taken, where

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parameters were found to be above detection, the levels found were determined to be below surface water quality guidelines both for drinking water and for aquatic organisms.

It is worth noting that in the 2003 survey, total PCB was found to be below detection. There were 27 species of dioxins and furans tested. Of those 6 were shown to be above detection with the remaining 21 species being below detection. The concentrations that were found were at very low levels, in that the detection limits for dioxins and furans are in the range of 1.0 to 2.6 picograms per litre (parts per trillion).

Nonylphenols were determined to be at a concentration of 3.1 µg/L (parts per billion) in the NEWPCC effluent. The nonylphenol guideline for surface waters to protect aquatic life has been set at 1.0 µg/L. As the dilution of the NEWPCC effluent always exceeds 3 times by a significant margin, it can be assumed that the level of nonylphenols found in the NEWPCC effluent will not be cause for concern with respect to aquatic organisms.

Clearly, the existing database for priority pollutants in the effluents of Winnipeg's water pollution control centres is limited and, therefore conclusions should be drawn with caution in recognition of this limited database. Accordingly, the City of Winnipeg may increase the number of priority pollutant surveys in order to increase the database respecting these compounds of concern.

## 5.5 CUMULATIVE EFFECTS

Planning of future system upgrades now underway (cf. Section 4.3) ensures that the ongoing collection and treatment system will continue to improve, continuing to reduce the significance of the City's incremental burden upon the downstream aquatic watershed.

The methods used by the City in determining effects of WPCCs, CSO and LDS discharges on the rivers explicitly considered the cumulative effects from upstream and downstream sources. The use of cumulative effects is described in Section 5.5, and is highlighted by bolding the term "**cumulative effects**" when it is referred to. Some examples of the City's determination of cumulative effects can be summarized as follows:

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- in modelling dissolved oxygen, the upstream boundary conditions which are influenced by upstream loads was used in predicting downstream dissolved oxygen conditions arising from the City's incremental loading;
- upstream fecal coliform concentrations were utilized in determining the bacteriological concentrations in the river. Fecal coliform loading from the City's WPCCs were added to these upstream concentrations to identify their significance;
- in modelling of ammonia and in the development of proposed upgrades, the City again explicitly considered cumulative effects. The influence of upstream ammonia concentrations was considered to evaluate the City's incremental loads. The future potential upstream/downstream loads of ammonia were also considered, as the City proposal allows for significant development outside of Winnipeg within the Capital Region of Winnipeg to occur while still providing for the proposed ammonia criteria to be met under low river-flow conditions;
- in determining the effects of nutrient discharges from the City of Winnipeg on the river system, the upstream loads were considered and the City loads were added to these.

It is understood that cumulative effects of **all** loads, from point and non-point sources, as well as natural loads will be considered by Manitoba Conservation in the development of any Lake Winnipeg nutrient-management strategy.

## **5.6 ATYPICAL OPERATIONS OR CONTINGENCY EVENTS**

### **5.6.1 Identifying and Assessing Risks from Key Events**

A key component of a competent Environmental Impact Assessment, and therefore of any Summary EIS, is a description and evaluation of the classes of contingency events that can arise from the proposed development. In the case of the City's sewage collection and treatment system, clearly a major contingency event is a large spill of untreated sewage to the rivers. Such an event occurred on September 16, 2002.

A thorough listing of the most likely and/or most potentially significant contingency events from this complex collection, conveyance, and treatment system has not yet been completed by the

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Department of Water and Waste. Their 2003 capital budget includes \$750,000 to complete a risk and criticality assessment for the three wastewater plants.

In respect of the criticality assessments, the Department anticipates that this process will identify, and prioritize the causes of contingency events most appropriate of further detailed study. The criticality assessment is expected to be completed in 2004. Upon receipt of this report, the Department will respond to all recommended courses of action where risks are identified and risk evaluations are considered appropriate. The City will:

- consider and respond to recommended priorities of attention for these classes of events;
- design appropriate risk-assessment processes for all of these selected events;
- complete risk assessments, using competent expertise, to identify the most appropriate risk-management measures for each of these events;
- summarize these studies for purposes of public and regulatory review;
- provide documentation of these studies to Manitoba Conservation; and
- develop impact-management plans, programs, or processes as elaborated in the abovementioned studies, and implement these programs on a prioritized basis, consistent with other City programming.

### **5.6.2 September 2002 Sewage Spill**

While staff at the NEWPCC were attempting to undertake routine maintenance of one of the influent raw sewage pumps, an accident occurred resulting in the flooding of the entire influent pumping system. This failure resulted in the NEWPCC being out of operation for 2 days and 9 hours. Overflows of raw sewage to the Red River occurred over this period.

Immediately after the plant shutdown, the Water & Waste Department and Manitoba Conservation initiated a comprehensive Red River monitoring program to assess the effects of the raw sewage spill. Results indicated that while dissolved oxygen concentrations were depressed, the levels were maintained above those required to sustain aquatic life. Overall, the effects of the spill on the river were temporary and not significant, largely due to the above normal flows in the river. A copy of the Manitoba Conservation report on the river water quality monitoring is available in the Public Registry.

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Through exemplary efforts of plant staff, the operation of the treatment plant was restored within 2 days and 9 hours. During this period, 427,000 m<sup>3</sup> of raw sewage were spilled to the Red River.

This accident is viewed by the Department as serious and considered preventable. While the failure did not result through negligence of staff, the absence of formal procedures and documentation for operation and maintenance contributed to the occurrence.

The Water & Waste Department undertook an investigation of the spill event. In addition, the City retained a consultant, Associated Engineering Ltd., to do an independent assessment of the failure. Both of these reports are available in the public registries. A review by Manitoba Conservation was also concluded, and a review by Environment Canada is in progress.

### **5.6.3 Preventing Contingency Events**

The City is engaged in the comprehensive process of enhancing its emergency preparedness, including the development of site-specific emergency response plans (cf. Section 4.2.4.4). The results of these studies will then influence the scope, number and complexity of the ERPs and other risk-management measures now in preparation.

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## 6. FOLLOW UP

### CSO Monitoring and Reporting

The City intends to undertake a monitoring/reporting program throughout the duration of the implementation of the CSO control program. The aim would be three fold:

- to determine changes in the magnitude, frequency and duration of CSOs during implementation of the program;
- to determine the quality of wastewater stored in-line and off-line and the overall success of capturing CS for temporary storage during wet weather; and
- the improvements in water quality in the rivers.

This monitoring program should include provision for a Supervisory Control and Data Acquisition (SCADA) system.

Periodic reporting (every 5 to 10 years) on the overall CSO control program, costs, improvements in CSO control, and compliance with objectives is proposed to be done by the City, for review by Manitoba Conservation and the public to assess the direction and scope of ongoing control programs.

### Ammonia Criteria Monitoring and Confirmation Studies

Acquisition of additional information through monitoring programs and additional toxicity testing is planned. These actions are required to confirm the ammonia control strategy and compliance with the criteria. These include the following:

- conduct additional toxicity testing to improve the confidence in the local aquatic species test data,
  - develop and conduct a focused monitoring program to create a baseline of fish species potentially affected and determine the presence of the early life stages (a period of highest sensitivity to ammonia) of key fish species in the critical fall months;
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- develop and conduct a water quality monitoring program during times of summer/fall low flowsto assist in understanding the distribution of ammonia concentrations during such critical conditions; and
- continue to assess design river flows and allocation of the river's assimilative capacity.

#### Other City of Winnipeg Proposed Monitoring Programs

The addition of Centrate Treatment and Disinfection at the NEWPCC will result in an expansion of existing monitoring programs to provide needed information for these new unit processes. Effluent streams from the pollution control centres will have pH and temperature added to the present monitoring programs.

In 2002, the City initiated a program to monitor mercury in the influent, effluent and biosolids streams. It is anticipated that this program will continue. Senior Governments are in the process of investigating Endocrine Disrupting Compounds (EDCs) in various wastewater streams. The City has done some preliminary EDC monitoring and expects to participate in future monitoring in this area once it becomes clear which compounds are of greatest concern to the environment.

#### Periodic Review

Historically the City of Winnipeg has undertaken periodic reviews of their wastewater collection and treatment systems every 5 to 10 years. During these reviews the City considers new technology, emerging regulatory issues and changes in the projections for City populations and wastewater flow rates to plan upgrades to the system. In addition to these periodic reviews the City is continually keeping up to date on emerging issues in surface water protection and wastewater treatment technology. The City adds to and modifies their monitoring programs to take account of these changing conditions and will continue to do so in the future. As scientific-based studies clarify emerging surface water issues, the City will continue to invest in cost effective technology which provides a benefit to the aquatic environment and human health.

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Notices of Alteration

Assuming the existing WPCC operations are licensed under the Manitoba *Environment Act*, future alterations/upgrades will be submitted to Manitoba Conservation for review and approval. It is expected that Notices of Alteration will be sought for each of the proposed upgrades such as NEWPCC disinfection and centrate treatment in accordance with the *Environment Act*.

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## 7. PUBLIC CONSULTATION

The City of Winnipeg Water and Waste Department has historically engaged in public consultation and public information initiatives regarding issues associated the Department's operations and surrounding environment. Much of the information was provided in the form of brochures to the public. These information packages have covered topics and issues including:

- Water Conservation Initiatives;
- Reduction of Floatable Debris in Winnipeg Rivers;
- Preserving Our Historic Rivers;
- Stormwater Retention Lakes; and
- Water Quality and Uses for Winnipeg's Rivers.

In some instances, the City has been very proactive in its provision of information to the public, for example, in 1995, the City of Winnipeg launched Canada's first municipal water conservation web resource. Since then, the Department has added other information to the City of Winnipeg's website focussing on issues such as Combined Sewer Overflow and Basement Flooding.

The City has followed its established policy guidelines for citizen participation in public works projects, including projects which have strategic importance in the City's long-term plans, projects where the City is seeking public input, awareness and support for a project, a history of public involvement in the project, and projects where a requirement exists for *Environment Act* approvals.

Public Consultation programs focussing on the "Development" as defined in Section 3.1 began in 1990. At this time, the City commissioned a survey conducted by specialist consultants to assess public attitudes towards river water quality. The survey questioned 815 randomly selected Winnipeg residents above the age of 18 for the purpose of obtaining feedback on issues pertaining to river use, perceived barriers to use and desire for increased recreation, knowledge of pollution control, and willingness to pay for increased pollution control. Since the onset of the Combined Sewer Overflow Study, initiated after the 1991/92 CEC Hearings, a framework for ongoing public consultation was integrated into the study of pollution control

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options and future improvements to the wastewater collection and treatment system. In the case of the CSO Study, Public Consultation was integrated into each of the 4 Phases of this multi-year study. This public consultation also responded to direction from the CEC 91/92 Hearings calling for participation of members of the local scientific community.

In 1994, the City began a series of Open Houses, Information Displays in larger Winnipeg shopping malls, and numerous appearances at other public events. In the fall of 1994, the CSO Study Team developed a poster contest focussing on raising awareness in schoolchildren of reducing floatable debris in Winnipeg's rivers. The objective of this contest was to raise public awareness of CSO issues and their relation to river water quality. Posters from 17 Winnipeg elementary schools were entered in the contest, with entries displayed at the Forks during an Open House weekend conducted in October 1994. An Open House was held over a 2-day period in October 1994 at The Forks Pavilion. The Open House focussed on both river quality issues and the CSO Management Study. Consulting Team staff were on hand at all times during the events to answer questions. The Open House was prominently advertised in local major print media, and with posters displayed on the grounds of the Forks site. Attendance at the Open House was modest, with a total of 100 people attending and reading the Open House displays. Of these, 24 people completed a questionnaire requesting opinions regarding their evaluation of the information presented at the Open House, public opinion regarding river water quality issues, and comments on any aspect of the CSO Management Study. While the Open House was considered to be a useful activity, the lack of attendance demonstrated the difficulty of drawing attention to planning studies.

A series of Mall and Event appearances were conducted from 1994 to the present. These appearances consisted of storyboard information, information handouts and brief questionnaires that included forms for the public to request additional information. Additional brochures developed for basement flooding, floating debris in the rivers, and safe fish cooking procedures were also distributed at these events.

The Department also developed a working physical scale model of the relationship between rainfall, residential sewer connections, basement flooding, land drainage, combined sewer overflows and Winnipeg's rivers. This hydraulically-correct model displayed how collection systems respond to rainfall events and also demonstrated the need to balance protection of property from threats such as basement flooding. This model generated substantial interest

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from the public at every public appearance due to its effectiveness in illustrating the relationships between various components of the City's wastewater collection system that are underground and unseen by the general public.

Reaction to the Mall displays was seen as favourable and an effective way to get information to the public. The Department expanded upon these efforts by scheduling multi-day information displays staffed by City personnel and their consultants at the following events:

- Family Fish Festival (1995 and 1996);
- Rivers & Creeks Workshop (1995);
- Mid-Canada Boat Shows ( 1996 and 1997);
- Home Expressions Shows (1996, 1997, 1998, 1999, 2000);
- Trade Show (1997);
- Western Canada Water and Waste Association Conference (1997); and
- Public Works Day (1999 and 2000).

These events constituted approximately 40 days total of direct public consultation. Each event enjoyed strong attendance, resulting in good turnout at the City's information displays.

In response to enquiries from advisory committee members, scientific community members, interested residents and special interest group requests, a database was developed for the purpose of recording and scheduling communications to the Department. This database grew to about 1,800 contacts, including 1,500 residential contacts that responded to various City questionnaires.

In addition to an information outreach program to the general public, efforts were made to engage the views and regularly inform a number of Special Interest Groups with known interest in both the City's infrastructure and river water quality issues. These groups included:

- Urban Planning Committee;
  - Rotary Club;
  - River Users Group;
  - The International Coalition;
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- The Red River Basin Commission;
- The Urban Fishing Committee;
- Royal Winnipeg Yacht Club;
- Redboine Yacht Club;
- Winnipeg Canoe Club;
- Winnipeg Power and Sail Squadron Rowing Club;
- Jet Sport Association Manitoba;
- Water-ski Manitoba;
- Harbour Patrol;
- Winnipeg Police Divers Unit;
- Fire Department Water Rescue Unit;
- Friends of the La Salle;
- North Tache River Group;
- Coalition for a Canoeable Seine;
- Omands Creek Wolsely Residents Association;
- Save Our Seine;
- North St. Boniface Residents Association; and
- St. Boniface Riverbank Preservation Committee.

In addition to public information events and meetings, the City developed a number of brochures/handouts, Study Phase Reports, and Newspaper/Newsletter articles.

Publications included:

**Brochures/Handouts:**

- “You Can Help Keep Floating Debris Out of Our Rivers”
  - “Combined Sewers and River Quality”
  - “Fish Handling and Food Safety”
  - “Keeping Your Basement Dry”
  - “Water Quality and Uses for Winnipeg Rivers, Oct., 1991”
  - “River Quality and Combined Sewer Overflows”
    - Update, January 1996
-



- Update, January 1997
- Update, January 1998

### **Phase Reports**

Upon completion of each phase of the CSO Management Study, a compendium of the phase studies and results was compiled in to a reader-friendly public report and distributed to members of the public who expressed interest in additional information. In Phase 2, a total of 992 reports were distributed to various stakeholders via mail in 1996 alone.

### **Newspaper/Newsletter Articles**

Study Team members completed several articles fro community newsletters and other publications. These articles targeting CSO issues and river water quality appeared in publications including:

- Fisherman's Gazette;
- Winnipeg Real Estate News;
- Civic Pulse Newsletter;
- International Coalition Newsletter; and
- Western Canada Water and Wastewater Association Bulletin.

### **Ongoing Future Proposed Public Consultation and Provision of Information**

The City intends to continue its efforts of providing the public with timely information regarding its operations and proposed programs. The City has resolved to respond to future direction from Manitoba Conservation in this area, however the City will move forward with new information initiatives including the following:

- Effluent Quality Monitoring Results for Winnipeg's Water Pollution Control Centres (including results from regular and special testing) will be provided to the public via the City of Winnipeg's website;
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- City River Quality Monitoring results will be provided to the public via the City of Winnipeg's website;
- in the event of any future events, Major Incident Reports will be provided to the public via the City of Winnipeg's website; and
- Annual Performance Reports will be provided on the City of Winnipeg's website.

Supplementing the provision of data and performance reports, the City will continue its practice of releasing study reports and findings on a timely basis to the general public, through mechanisms such as its own website or regulatory public registries, as appropriate.

## 8. SYSTEM SUSTAINABILITY

The City of Winnipeg has advanced a near-term and long-term pollution prevention and environmental improvement implementation plan to improve protection of public health and property, and to enhance and benefit the aquatic environment of the Red and Assiniboine Rivers. The City believes that this approach is consistent with the principles and guidelines of sustainable development as outlined in the Province's *Sustainable Development Act*. The plan (as shown in Table 8-1) addresses the major environmental and health issues confronting the City of Winnipeg. The plan has been developed based on the results of 8 years of study and research by the City into the combined sewer overflow and ammonia issues as described in Section 4.3. The plan received the approval of the Council of the City of Winnipeg on December 11, 2002. The plan represents the City's continued commitment to stewardship of the water quality of the Red and Assiniboine Rivers that has seen the City expend over \$200 Million in environmental related upgrades over the past 25 years.

The pollution prevention plan to improve wastewater collection and treatment responds to environmental/health priorities of Manitoba Conservation, as the City currently understands them. Manitoba Conservation, during their presentations to the Clean Environment Commission on January 20, 2003, identified priorities for City of Winnipeg actions, based on an environmental and health protection basis, as follows:

- 1) Potable Water Treatment Plant.
  - 2) Wastewater Plant Effluent Disinfection.
  - 3) Ammonia Reduction.
  - 4) Biosolids Management.
  - 5) Nutrient Management.
  - 6) Combined Sewer Overflows.
  - 7) Land Drainage.
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**TABLE 8-1  
 WINNIPEG'S WASTEWATER POLLUTION PREVENTION PLAN**

<b>Component</b>	<b>Capital \$ (Million)</b>	<b>Year Started</b>	<b>Year Completed</b>
<b>NEWPCC Disinfection</b>	<b>\$ 15</b>	2003	2004
<b>Centrate Ammonia Treatment at CSO Control Program</b>	<b>\$ 10</b>	2003	2004
(Stage Ia) - SCADA, Demo, Weirs	\$ 14	2003	2005
(Stage Ib) - Integrate with BFR	\$ 26	2005	2043
(Stage II) - In line storage	\$ 50	2028	2033
(Stage III) - Additional storage	\$ 181	2033	2050
<b>WEWPC Disinfection</b>	<b>\$ 3</b>	2050	2051
<b>Effluent Nutrient Control</b>			
NEWPCC	\$ 127	2019	2022
SEWPC	\$ 47	2022	2025
WEWPC	\$ 7	2025	2026
<b>Sub-Total</b>	<b>\$ 480</b>		
<b>Biosolids Program</b>			
(Stage I) - Pelletization and Storage	\$ 30	2007	2010
(Stage II) - Thermophilic conversion	\$ 20	2012	2014
<b>TOTAL</b>	<b>\$ 530</b>		

The potable water treatment plant, although noted as the first priority, is not specifically part of the plan below, but represents a \$214 Million financial requirement for the City's water and sewer utility customers. The water treatment plant is scheduled for completion of construction in 2007. Approximately 50% of the required funding is currently being secured through the water utility rates and placed in a water treatment reserve fund. The remaining 50% will be debt financed and paid through future water rates. This project is the top priority for the City and the Province and scheduling of the wastewater improvement initiatives has taken the planned implementation timeframe for the water treatment plant, and both of their corresponding impacts on the water and sewer utility rates charged to Winnipeg's customers, into consideration. The sequencing and timing of wastewater pollution prevention initiatives within the next 10 years makes specific provision not to jeopardize plans and financing of the potable water treatment plant for Winnipeg.

The environmental improvements included in the plan have long-term financial implications to the Sewer Utility, which will potentially involve rate increases. Capital improvements are supported 100% by funds generated through the sewer rates charged to utility customers.

The plan outlined in Table 8-1 totals \$530 Million, which is a significant financial commitment for any municipality, or municipal utility. Spending for the improvements identified in Table 8-1 has been prioritized and allocated to activities where the most benefits are realized taking human health, environment and affordability into account.

The plan provides for immediate action on wastewater plant effluent disinfection and ammonia reduction, which are high priority issues. The plan has an allowance for modification to the City's current biosolids disposal program, although this matter is currently under study and is expected to be the subject of a separate regulatory process. Results of the Biosolids Management Study will be available in late in 2003.

The plan also includes an allowance of \$181 Million for the provision of nutrient control (nitrogen and phosphorous removal) facilities at the City's three Pollution Control Centres. The expenditure for nutrient control is uncertain at this time as the Province completes their provincial nutrient management strategy. It is expected that the NMS will examine alternative ways to reduce nutrient loadings. Nutrient management at the City facilities is one of many alternatives to reduce nutrient loadings to Lake Winnipeg. It is accepted that the Province will integrate environmental and economic considerations in developing their strategy.

The City considered the inclusion of the nutrient control and biosolids disposal items in the plan to be environmentally and fiscally prudent, in the context of Manitoba priorities, and in accordance with the principle of sustainable development to integrate environmental and economic decisions.

The plan has proposed the mitigation of the adverse effects of combined sewer overflows (CSO) over an approximate 50-year period. The staging of CSO mitigation reflects its relative priority in the array of issues and also the influence of the allocations for a modified biosolids disposal program and for nutrient control. Combined sewers were constructed in Winnipeg over an 80-year period and have existed, with their inherent adverse effects, for in excess of 120 years. The mitigation of CSO's over a longer time period provides inter-generational equity

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through the sharing of the large cost to address this long-standing issue, and does not penalize current generations for the actions of earlier generations.

Addressing the lowest priority issue, land drainage, has not been included in the plan described by Table 8-1 as Manitoba Conservation has indicated that this item will be deferred indefinitely.

The proposed improvement program will be financed by the Environmental Projects Reserve (EPR), which is funded by the sewer rate. In December 1993, Council established a River Quality Environmental Studies Reserve Fund to finance projects to improve river quality. The Reserve was renamed in January 1996 to the Environmental Projects Reserve (EPR) to better reflect the projects this Reserve was to support. The EPR is financed through transfers from the Sewage Disposal System Fund which is supported by sewer rates paid by customers of the Sewer Utility. At present the contribution to the EPR is approximately \$7 Million per year, which represents about 10% of the annual Sewer Utility budget.

The existing financial plan includes \$7 Million per year for environmental program needs and can finance the proposed improvement plan for the next ten years. Capital requirements would be met from the EPR Fund preserving the “pay-as-you-go” philosophy to the extent practicable within the next 10 years. Additional requirements or accelerated implementation timeframes will impact near and far-term funding requirements. A separate increase to the sewer rate and modification to the ten-year financial plan would be required.

After ten years, an increase to the Environmental Projects Reserve will be necessary. Current projections will require that the EPR funding be increased to about \$14 Million after ten years, and increased again after twenty years to approximately \$21 Million and be held relatively constant for the subsequent twenty years before sewer rates could be reduced. As well, some debt financing will be required to pay for nutrient control if required in future. Table 8-2 presents the projected increase to the EPR. Depending on actual project costs experienced, the amount of the annual EPR may require adjustment to meet the timeframes in preceding Table 8-1.

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**TABLE 8-2**

**PROJECTED INCREASES IN EPR**

Annual EPR (Millions)	Timeframe (Years)
\$ 7.0	2003 to 2012
\$ 14.0	2013 to 2022
\$ 21.0	2023 to 2032

The plan does not include capital funding requirements for other system or treatment plant upgrades or rehabilitation that might be needed during the same timeframe that would not be supported by the Environmental Projects Reserve (EPR) Fund. Typically, other wastewater treatment plant initiatives for capacity upgrades or rehabilitation of aged components amount to another \$10-15 Million annually. In addition the City has existing programs to rehabilitate underground sewers at \$11.5 Million annually and the basement flood relief program, which is aimed at reducing the frequency of flooding basements, at \$7.5 Million annually. These expenditures for maintaining the continued operation of the system are necessary to sustain its ongoing effectiveness.

The proposed plan is considered financially sustainable and contributes to the overall quality of the environment within and downstream of Winnipeg.

The improvement plan is flexible, in that there are significant uncertainties, which are expected to be resolved within the next 10 years. Additional research, environmental and engineering studies, monitoring, ongoing dialogue with the Provincial regulator, and public consultation will be conducted over the next 10 years to better assess the needs, timing, and costs of future pollution prevention plan actions. There will be sufficient opportunity and time to anticipate, prevent and mitigate adverse effects not currently contemplated.

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## 9. DECOMMISSIONING

The City of Winnipeg's Wastewater Collection and Treatment System provides an essential service requiring continued maintenance and periodic upgrades in response to:

- projected significant changes in the city's population;
- changes in technology; and
- evolving regulatory considerations.

The likelihood of decommissioning the wastewater collection and treatment capability is considered low, as its need will exist throughout the life of the City of Winnipeg itself. Under the City's Proposed Plan, there are no plans for decommissioning facilities or subsystems within the 50-year planning horizon. However, while the system is considered to remain a permanent and integral part of the City of Winnipeg itself, decommissioning of individual components may occur in the future in situations where existing facilities reach the end of their useful life.

In recent years, two components of the system have been decommissioned. The Sludge Drying Beds located in the RM of West St. Paul were decommissioned in 1994 after decades of service since their commissioning in 1965. Decommissioning occurred in response to CEC Order No. 1089, because practical new mechanical technology allowed the Province and the City to respond to consistent public complaints about seasonal odour nuisance and replace the Beds with a mechanical dewatering process. The Charleswood Sewage Lagoons were retained but reconfigured in their operation as "polishing ponds" for tertiary treatment of effluent from a new secondary treatment facility in 1998. In both cases, the Department demonstrated good faith and good planning in its liaison with Manitoba Conservation (then Manitoba Environment) as its decommissioning plans were developed, reviewed and implemented (ref. Wardrop-McLaren 1988, 1989).

In the event of closure of plants or facilities at some distant time, the City would prepare a comprehensive decommissioning plan for the reclamation of the plant/facility site and adjacent property. The plan would include an end-use plan, and a budget and schedule for site restoration, and would be submitted to Manitoba Conservation for approval one year prior to the intended date of closure.

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## 10. CONCLUSIONS

The existing secondary wastewater treatment plants are well operated and performing as designed with respect to achieving a secondary treatment effluent quality of 25 mg/L CBOD and 30 mg/L TSS. Ongoing river sampling programs and laboratory, in addition to sophisticated numerical modelling of the rivers DO levels, has confirmed that the existing plants perform adequately to protect the health of the rivers within and downstream of Winnipeg. As such, the City believes that the plants should be licensed based on their existing performance.

The proposed plan by the City of Winnipeg to improve wastewater collection and treatment will initiate several major capital programs that will provide a higher degree of public health and environmental protection than currently afforded by the existing systems. It is recognized the public consultation is an integral part of these plans and will be incorporated into the programs as they are initiated and implemented. The proposed plan will:

- Implement the recommendations of the Associated Engineering Ltd. report on the September 16 malfunction to improve reliability of the wastewater treatment facility.
  - Initiate a criticality and risk analysis study on the reliability of Winnipeg's three WPCCs and consider recommendations from the reviews of the September 16, 2002 spill. The study will be finalized by December 31, 2004.
  - Initiate the installation of effluent disinfection at NEWPCC, which is planned to be in operation for the 2005 recreation season. The estimated cost to construct this facility is approximately \$15 Million. This undertaking, when complete, will result in compliance with Provincial objectives for microbiological quality at the point of discharge.
  - Initiate the installation of centrate treatment at NEWPCC, which is planned to be in operation by 2005. The estimated cost to construct this facility is approximately \$10 Million. This undertaking, when complete, is expected to result in compliance with site-specific Provincial objectives for ammonia quality in the Red River.
  - Conduct additional ammonia toxicity and monitoring studies in 2003/4 to improve the support for site-specific ammonia criteria in the local rivers.
  - Begin the process of CSO mitigation by installation of an in-line storage pilot test and monitoring its performance, raising weirs to capture and treat more wet weather flows, and beginning the implementation of a Supervisory Control and Data Acquisition system (2003-
-

05). Opportunities will be investigated with current and planned basement flooding relief projects, concurrent sewer rehabilitation construction projects, as well as to cost-effectively integrate CSO control options or provisions.

- Allow for improvements to biosolids program. The estimated cost for a major alteration to the program is approximately \$50 Million. A comprehensive study is being conducted on this matter and will likely be the subject of a subsequent regulatory review process.
- Allow for potential nutrient control at the WPCCs. This permits sufficient time for the Province to complete their Nutrient Management Study before the City committing to nutrient control at the WPCCs, which can cost up to \$181 Million to construct.
- Allow for a long-term program to reduce CSOs from an average of 18 events to 4 events per recreation season. The estimated cost to achieve this level of performance is estimated at \$270 Million and will take about 50 years to realize.

The City supports the need for adequate environmental controls to protect public health, property and the environment. The City will respond to the direction received on these plan components and other elements of the Plan from Manitoba Conservation after the CEC review.

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## **APPENDIX A**

**Council Review & Approval of  
Report – Standing Policy Committee  
On Public Works re: Updated Status of Wastewater  
Related Pollution Prevention Plans in Preparation for  
Upcoming Clean Environment Commission Hearings  
File WW-3 (Vol. 12)**

**EXECUTIVE SUMMARY:  
Combined Sewer Overflow  
Management Study**

**SUMMARY:  
Ammonia Reduction in City of Winnipeg  
Wastewater Effluents**

**Council Review & Approval of  
Report – Standing Policy Committee  
On Public Works re: Updated Status of Wastewater  
Related Pollution Prevention Plans in Preparation for  
Upcoming Clean Environment Commission Hearings  
File WW-3 (Vol. 12)**

**Minute No. 66****Report - Standing Policy Committee on Public Works - November 19, 2002****Item No. 2 Updated Status of Wastewater Related Pollution Prevention Plans in Preparation for Upcoming Clean Environment Commission Hearings File WW-3 (Vol. 12)****COUNCIL DECISION:**

Council concurred in and adopted the recommendation of the Standing Policy Committee on Public Works that the Administration be authorized to submit the following positions and information on the City's pollution control programs and systems at the Clean Environment Commission hearings in January of 2003:

1. Effluent Ammonia (NH<sub>3</sub>) Reduction:
  - a) That the discharges from the City's wastewater treatment plants be regulated on a site-specific basis consistent with the findings and recommendations of the City's study entitled "Red and Assiniboine Rivers Ammonia - Criteria Study, Final Technical Report, November 2002" prepared by TetrES Consulting Inc., in association with North/South Consultants Inc., and external advisors.
  - b) That the program related to control of ammonia to protect the aquatic environment in the Red and Assiniboine Rivers include:
    - i. Treatment of centrate at the North End Water Pollution Control Centre (NEWPCC),
    - ii. Continued use of the polishing ponds at the West End Water Pollution Control Centre (WEWPCC),
    - iii. No additional treatment works at the South End Water Pollution Control Centre (SEWPCC) for ammonia reduction with a review of the site-specific requirement for ammonia treatment at the SEWPCC in 10 years.
  - c) That additional studies, monitoring programs and testing of ammonia toxicity to expand the site-specific knowledge on the effects of ammonia on local species be undertaken in cooperation with Manitoba Conservation.
2. Combined Sewer Overflow (CSO) Control:
  - a) That a long-term CSO control program be adopted in principle as described in the City's study entitled "Combined Sewer Overflow Management Study, Final Report, November 2002" prepared by Wardrop Engineering Inc., in association with TetrES Consultants, CH2M Gore & Storrie, EMA Services, and external advisors. The report provides a long-term alternative that would reduce overflow events on a citywide basis to an average of 4 events per summer recreation season (May 15 to Sept 30, inclusive) within about a 50-year timeframe.

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**Report - Standing Policy Committee on Public Works - November 19, 2002**

3. Effluent Limits for the Water Pollution Control Centres (WPCCs)
  - a) That effluent discharge limits for the Water Pollution Control Centres be recommended to the Clean Environment Commission based on the existing secondary treatment performance.
  - b) That effluent discharge limits for fecal coliform be established to protect the Red and Assiniboine Rivers for recreational use during the summer recreation season.
  
4. Reduction of Nutrients in Effluent Discharges
  - a) That it be recommended to the Clean Environment Commission that limits, which would entail tertiary treatment for nutrient reduction, not be established until the Province has completed their basin-wide Nutrient Management Study, and conducted stakeholder and public consultations.
  
5. Wastewater System Reliability
  - a) That the Clean Environment Commission be advised that the City will undertake Risk/Criticality Assessments at the three WPCCs in 2003 subject to Council approval of capital funding therefore to assess the reliability and backup capability of treatment systems to prevent the discharge of untreated sewage.
  
6. That the Proper Officers of the City be authorized to do all things necessary to implement the intent of the foregoing, including the execution of any documents related thereto.

**Report - Standing Policy Committee on Public Works - November 19, 2002**

DECISION MAKING HISTORY:

Moved by Councilor Angus,

That the Standing Policy Committee on Public Works recommendation be adopted by consent.

Carried

EXECUTIVE POLICY COMMITTEE RECOMMENDATION:

On December 4, 2002, the Executive Policy Committee concurred in the recommendation of the Standing Policy Committee on Public Works.

STANDING COMMITTEE RECOMMENDATION:

On November 19, 2002, the Standing Policy Committee on Public Works concurred in the administrative recommendation.

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**RE: UPDATED STATUS OF WASTEWATER RELATED POLLUTION  
PREVENTION PLANS IN PREPARATION FOR UPCOMING CLEAN  
ENVIRONMENT COMMISSION HEARINGS**

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**For submission to:** Standing Policy Committee on Public Works

**Original report signed by:** Barry D. MacBride, P.Eng.  
Director  
Water and Waste Department (WWD)

**Report date:** November 8, 2002

**In camera item:** No

**Recommendation(s):**

It is recommended that the Administration be authorized to submit the following positions and information on the City's pollution control programs and systems at the Clean Environment Commission hearings in January of 2003.

**1. Effluent Ammonia (NH<sub>3</sub>) Reduction:**

- a) That the discharges from the City's wastewater treatment plants be regulated on a site-specific basis consistent with the findings and recommendations of the City's study entitled "*Red and Assiniboine Rivers Ammonia - Criteria Study, Final Technical Report, November 2002*" prepared by TetrES Consulting Inc., in association with North/South Consultants Inc., and external advisors.
- b) That the program related to control of ammonia to protect the aquatic environment in the Red and Assiniboine Rivers include:
  - i. Treatment of centrate at the North End Water Pollution Control Centre (NEWPCC),
  - ii. Continued use of the polishing ponds at the West End Water Pollution Control Centre (WEWPCC),
  - iii. No additional treatment works at the South End Water Pollution Control Centre (SEWPCC) for ammonia reduction with a review of the site-specific requirement for ammonia treatment at the SEWPCC in 10 years.
- c) That additional studies, monitoring programs and testing of ammonia toxicity to expand the site-specific knowledge on the effects of ammonia on local species be undertaken in cooperation with Manitoba Conservation.

**2. Combined Sewer Overflow (CSO) Control:**

- a) That a long-term CSO control program be adopted in principle as described in the City's study entitled "*Combined Sewer Overflow Management Study, Final Report, November 2002*" prepared by Wardrop Engineering Inc., in association with TetrES Consultants, CH2M Gore & Storrie, EMA Services, and external advisors. The report provides a long-term alternative that would reduce overflow events on a citywide basis to an average of 4 events per summer recreation season (May 15 to Sept 30, inclusive) within about a 50-year timeframe.

**3. Effluent Limits for the Water Pollution Control Centres (WPCCs)**

- a) That effluent discharge limits for the Water Pollution Control Centres be recommended to the Clean Environment Commission based on the existing secondary treatment performance.
- b) That effluent discharge limits for fecal coliform be established to protect the Red and Assiniboine Rivers for recreational use during the summer recreation season.

**4. Reduction of Nutrients in Effluent Discharges**

- a) That it be recommended to the Clean Environment Commission that limits, which would entail tertiary treatment for nutrient reduction, not be established until the Province has completed their basin-wide Nutrient Management Study, and conducted stakeholder and public consultations.

**5. Wastewater System Reliability**

- a) That the Clean Environment Commission be advised that the City will undertake Risk/Criticality Assessments at the three WPCCs in 2003 subject to Council approval of capital funding therefore to assess the reliability and backup capability of treatment systems to prevent the discharge of untreated sewage.

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**REPORT SUMMARY**

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**Key Issues:**

The Manitoba Clean Environment Commission (CEC) has been requested by the Minister of Conservation to convene a public hearing to review and receive public comments respecting the City of Winnipeg's wastewater collection and treatment systems. Originally, the Hearings were envisioned to be held in late-2003, however, after the malfunction at the NEWPCC, the Province has decided to accelerate the hearing process.

This report provides an overview of specific environmental and health risk issues related to wastewater collection and treatment that will be dealt with at the Hearings, and the recommended framework for implementation of programs to address these issues. The total cost for these programs is estimated to be \$530 million.

**Implications of the Recommendation(s):**

General Implications

- None
- For the organization overall and/or for other departments
- For the community and/or organizations external to the City of Winnipeg
- Involves a multi-year contract

Comment:

- Public communication/consultation activities had been planned by the Department on the pollution control initiatives in accordance with Council's policy on consultation for major works. However, timing of the CEC Hearings tentatively scheduled for January 2003 will not permit adequate time for a comprehensive public consultation program.

Policy implications

- No
- Yes

Comment:

- Recommendations of this report will establish a policy for a long-term program for dealing with CSO and ammonia control, which will be presented at Clean Environment Commission hearings in 2003.
- The Manitoba government will set pollution control requirements for the City of Winnipeg after these hearings through conditions in an Environmental Licence to be issued.

**Financial Implications**

- Within approved current and/or capital budget
- Current and/or capital budget adjustment required

Comment:

- Programs being recommended by this report have long-term financial implications to the Sewer Utility, which will potentially involve rate increases.
- The proposed capital program will be financed by the Environmental Projects Reserve (EPR), which is funded by the sewer rate. The existing financial plan includes \$7 million per year for environmental program and can finance the proposed capital program for the next ten years. After ten years, an increase to the Environmental Projects Reserve will be necessary.
- Additional requirements or accelerated implementation timeframes recommended by the CEC and/or imposed by Manitoba Conservation following the hearing process will impact near and far-term funding requirements would require a separate increase to the sewer rate and modification to the ten year financial plan.



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**REPORT**

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**RECOMMENDATION(S):**

It is recommended that the Administration be authorized to submit the following positions and information on the City's pollution control programs and systems at the Clean Environment Commission hearings in January of 2003.

**1. Effluent Ammonia (NH<sub>3</sub>) Reduction:**

- a) That the discharges from the City's wastewater treatment plants be regulated on a site-specific basis consistent with the findings and recommendations of the City's study entitled "Red and Assiniboine Rivers Ammonia - Criteria Study, Final Technical Report, November 2002" prepared by TetrES Consulting Inc., in association with North/South Consultants Inc., and external advisors.
- b) That the program related to control of ammonia to protect the aquatic environment in the Red and Assiniboine Rivers include:
  - i. Treatment of centrate at the North End Water Pollution Control Centre (NEWPCC),
  - ii. Continued use of the polishing ponds at the West End Water Pollution Control Centre (WEWPCC),
  - iii. No additional treatment works at the South End Water Pollution Control Centre (SEWPCC) for ammonia reduction with a review of the site-specific requirement for ammonia treatment at the SEWPCC in 10 years.
- c) That additional studies, monitoring programs and testing of ammonia toxicity to expand the site-specific knowledge on the effects of ammonia on local species be undertaken in cooperation with Manitoba Conservation.

**2. Combined Sewer Overflow (CSO) Control:**

- a) That a long-term CSO control program be adopted in principle as described in the City's study entitled "Combined Sewer Overflow Management Study, Final Report, November 2002" prepared by Wardrop Engineering Inc., in association with TetrES Consultants, CH2M Gore & Storrie, EMA Services, and external advisors. The report provides a long-term alternative that would reduce overflow events on a citywide basis to an average of 4 events per summer recreation season (May 15 to Sept 30, inclusive) within about a 50-year timeframe.

**3. Effluent Limits for the Water Pollution Control Centres (WPCCs)**

- a) That effluent discharge limits for the Water Pollution Control Centres be recommended to the Clean Environment Commission based on the existing secondary treatment performance.
- b) That effluent discharge limits for fecal coliform be established to protect the Red and Assiniboine Rivers for recreational use during the summer recreation season.

**4. Reduction of Nutrients in Effluent Discharges**

- a) That it be recommended to the Clean Environment Commission that limits, which would entail tertiary treatment for nutrient reduction, not be established until the Province has completed their basin-wide Nutrient Management Study, and conducted stakeholder and public consultations.

**5. Wastewater System Reliability**

- a) That the Clean Environment Commission be advised that the City will undertake Risk/Criticality Assessments at the three WPCCs in 2003 subject to Council approval of capital funding therefore to assess the reliability and backup capability of treatment systems to prevent the discharge of untreated sewage.

**REASON FOR THE REPORT:**

To authorize the position of the City to be advanced before the Clean Environment Commission Hearings on Pollution Prevention Plans and wastewater treatment plant licensing issues as prescribed by the terms of reference in the letter of instruction issued by the Minister of Conservation on October 3, 2002 to the chairman of the Clean Environment Commission.

**HISTORY:**

- 1991 to 2002 Over this period, Council approved funds in the Capital budget totalling \$9,120,000 for Combined Sewer Overflow (CSO) Management.
- 1992 to 99 Over this period, Council approved funds in the Capital budget totalling \$3,031,000 for Ammonia (NH<sub>3</sub>)/Nitrification Studies.
- 1993 11 The Minister of Environment accepted the Clean Environment Commission's recommendations evolving from the former 1991/92 hearing process, which required the City to undertake detailed studies of its combined sewer overflows and site-specific effluent ammonia toxicity impacts.
- 1994 02 Engineering Services were assigned to Wardrop Engineering Inc., in association with TetrES Consultants, CH2M Gore & Storrie, EMA Services, and external advisors to undertake the CSO Management Study.
- 1998 11 Engineering Services were assigned to TetrES Consultants Inc., in association with North/South Consultants Inc., and external advisors to undertake the Ammonia (NH<sub>3</sub>) Study.
- 1999 07 Disinfection of effluent from the South End Water Pollution Control Centre (SEWPCC) was initiated at a capital cost of approximately \$4.5 million.

- 2001 02 27 Capital funding in the amount of \$6.48 million was approved by Council for disinfection of effluent from the North End Water Pollution Control Centre (NEWPCC).
- 2002 02 11 Capital funding in the amount of \$8.52 million was approved by Council for disinfection of effluent from the NEWPCC.
- 2002 09 10 The Standing Policy Committee on Public Works received as information the Water and Waste Department report entitled "STATUS OF WASTEWATER RELATED POLLUTION PREVENTION PLANS"
- 2002 09 16 Pumping of raw wastewater at the NEWPCC was interrupted due to a major malfunction, which consequently resulted in the spilling of raw wastewater to the Red River from about 5:00 p.m. on September 16, 2002 to approximately 2:00 a.m. on September 19, 2002.
- 2002 10 03 The Minister of Conservation issued instructions to the Clean Environment Commission pursuant to clause 6(5)(b) of The Environment Act to convene public hearings on the City of Winnipeg's wastewater collection and treatment systems.

## **DISCUSSION:**

### **1) Introduction**

Clean Environment Commission (CEC) Hearings have been called and have been advertised. As such, the City of Winnipeg Water and Waste Department (WWD) is compelled to provide positions on the recommended actions and discharge limits for the resolution of specific environmental or health issues associated with Winnipeg's wastewater collection and treatment systems. This report will specify positions recommended and implementation plans for:

- Effluent Ammonia Reduction;
- Combined Sewer Overflow (CSO) Control;
- Effluent Limits for the Water Pollution Control Centres (WPCCs);
- Reduction of Nutrients in Effluent Discharges; and
- Wastewater System Reliability Issues.

The recommended positions will be advanced through the hearing process, subject to Council authorization.

The original schedule submitted as part of the WWD's report considered by the Standing Policy Committee on Public Works on September 10, 2002, contemplated that the hearings would not be held until autumn of 2003, and would have afforded ample opportunity for the City to undertake public communication and consultation activities on the pollution prevention initiatives under consideration. Due to the accelerated timeframe imposed by the Province, sufficient time does not exist for the City to undertake a public consultation program given that the Hearings will begin January 20, 2003.

## **2) Upcoming CEC Hearing Process**

At the request of the Minister of Environment, the Clean Environment Commission (CEC) held public hearings in 1991/92 on the classification of the Red and Assiniboine Rivers in the Winnipeg area. These hearings were intended to define appropriate beneficial uses of the Rivers and associated water quality objectives, which would ultimately lead to the licensing of Winnipeg's Water Pollution Control Centres (WPCCs) under The Manitoba *Environment Act*. Procedurally it was always envisioned that a second stage of CEC hearings would be convened to consider the results of the foregoing studies and other environmental/health issues affecting the licensing of the City's wastewater operations.

After the 1991/92 hearings, the CEC submitted its report that identified several recommendations that related to the City of Winnipeg's wastewater collection and treatment systems to address specific environmental and health issues. To fulfill requirements of the CEC's recommendations, which were adopted by the then Minister of Environment, the WWD carried out multi-year comprehensive studies on the ammonia (NH<sub>3</sub>) and CSO issues. In addition, the City has committed to implement wastewater disinfection of its effluents to comply with the designation of the Rivers for recreation use.

The Minister of Conservation has now requested that the CEC 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. The Terms of Reference for the CEC hearings as provided by the Minister of Conservation are included as Appendix A.

This report along with other supporting technical material and reports will be placed in the Public Registry by Manitoba Conservation and will be available for review by the general public on November 20, 2002. The material will also form the basis for the deliberations by the CEC. The reports to be submitted by the City for the Public Registry will include:

- The Red and Assiniboine Rivers Ammonia - Criteria Study, Final Technical Report, supporting appendices, and technical memorandums prepared by TetrES Consulting Inc., in association with North/South Consultants Inc., and external advisors, November 2002.

- The Combined Sewer Overflow Management Study, Final Report, Executive Summary, Technical Report, supporting appendices, and technical memorandums” prepared by Wardrop Engineering Inc., in association with TetrES Consultants, CH2M Gore & Storrie, EMA Services, and external advisors, November 2002.
- The Nitrification Technical Study, supporting appendices, and technical memorandums prepared by EARTH TEC (CANADA) INC., November 2002.
- Executive Summary: Ammonia Reduction in City of Winnipeg Wastewater Effluent, prepared by TetrES Consulting Inc., November 2002.
- Nutrient Characterization of Discharges from Winnipeg, by the Water and Waste Department (currently in preparation).
- Effluent Discharges Limits for Winnipeg’s Water Pollution Control Centres, by the Water and Waste Department (currently in preparation).

The CEC will provide advice and recommendations to the Minister of Conservation by April 3, 2003 following the hearings. Manitoba Conservation will consider the CEC input for the licensing of certain City of Winnipeg wastewater operations under *The Environment Act*.

### 3) **Pollution Prevention Plan**

#### **a) Overview of Plan**

A near-term and long-term implementation plan has been developed to address the major environmental and health issues confronting the wastewater utility as shown in Table 1. The pollution prevention plan responds to environmental/health priorities, as we currently understand them. The plan does not include capital funding requirements for other system or treatment plant upgrades or rehabilitation that might be needed during the same timeframe that would not be supported by the Environmental Projects Reserve (EPR) Fund. In December 1993, Council established a River Quality Environmental Studies Reserve Fund to finance projects to improve river quality. The Reserve was renamed in January 1996 to the Environmental Projects Reserve (EPR) to better reflect the projects this Reserve was to support. The EPR is financed through transfers from the Sewage Disposal System Fund.

Table 1

<b>Component</b>	<b>Capital \$ (Million)</b>	<b>Year Started</b>	<b>Year Completed</b>
<b>NEWPCC Disinfection</b>	\$ 15	2002	2004
<b>CSO Control Program</b>			
(Stage Ia)	\$ 14	2002	2005
(Stage Ib)	\$ 26	2005	2043
(Stage II)	\$ 50	2028	2033
(Stage III)	\$ 181	2033	2050
<b>Centrate Ammonia Treatment at NEWPCC</b>	\$ 10	2002	2004
<b>WEWPCC Disinfection</b>	\$ 3	2050	2051
<b>Biosolids Program</b>			
(Stage I)	\$ 30	2007	2010
(Stage II)	\$ 20	2012	2014
<b>Effluent Nutrient Control</b>			
NEWPCC	\$ 127	2019	2022
SEWPCC	\$ 47	2022	2025
WEWPCC	\$ 7	2025	2026
<b>Totals</b>	<b>\$ 530</b>		

**NOTE:** Costs shown are in 2002 dollars and no inflation allowance has been included to year of construction.

Derivation of the plan is based on the following assumptions:

- Disinfection of effluent and ammonia centrate reduction at the NEWPCC is a priority and acceptable to the Province regulator;
- Disinfection at the WEWPCC can be deferred indefinitely due to the satisfactory performance of the existing polishing lagoons;
- A long-term CSO control strategy to achieve a target of 4 overflows per summer recreation season will be supported by Provincial regulator;
- Allows for a new biosolids management system in case the current operation needs to be modified for technical, operating or regulatory reasons;
- The ultimate program, to be undertaken within about a 40 to 45 year period, must be flexible, in that there are significant uncertainties, which are expected to be resolved within the next 10 years.
- Additional research, environmental and engineering studies, monitoring, ongoing dialogue with the Provincial regulator, and public consultation will be need to be conducted over the next 10 years to better assess the needs, timing, and costs of future pollution prevention plan actions.

**b) Financial Considerations**

The following highlights the financial implications of expenditures listed in Table 1.

1. Capital requirements would be met from the EPR Fund preserving the “pay-as-you-go” philosophy to the extent practicable.
2. Sequencing and timing of wastewater pollution prevention initiatives within the next 10 years makes specific provision not to jeopardize plans and financing of the potable water treatment plant.
3. The current funding from the Sewer Rate to the EPR of \$7 million per year will be maintained for the next 10 years. Current projections will require the EPR funding to increase to about \$14 million after ten years, and increase again after twenty years to approximately \$21 Million and be held relatively constant for the subsequent twenty years before sewer rates could be reduced. Table 2 presents the projected increase to the EPR. Depending on actual project costs experienced, amount of the annual EPR may require adjustment to meet the timeframes in preceding Table 1.

Table 2

Annual EPR (Millions)	Timeframe (Years)
\$ 7.0	2003 to 2012
\$ 14.0	2013 to 2022
\$ 21.0	2023 to 2032

Additional details on specific elements of the programs are discussed in the following sections.

**4) Effluent Ammonia (NH<sub>3</sub>) Reduction**

The concern with NH<sub>3</sub> relates to whether the concentrations in the river approach levels that could cause chronic toxicity effects on aquatic life (e.g., fish tissue damage, reduced reproductivity of fish, not fish kills). Conventional secondary treatment at the NEWPCC and SEWPCC do not reduce NH<sub>3</sub> significantly and would require tertiary treatment to accomplish NH<sub>3</sub> reduction on a year-round basis. The existing polishing lagoons at the WEWPCCC significantly remove NH<sub>3</sub> during the summer months.

Toxicity of NH<sub>3</sub> is very complex and requires site-specific information for appropriate protection of aquatic life in the local rivers. Based on the results of extensive City studies, WWD recommends that site-specific regulation of NH<sub>3</sub> in the urban reaches of the Red and Assiniboine rivers is an appropriate position to be taken at the CEC hearings. A 10-year program has been developed that reduces ammonia in final effluent discharges and resolves key areas of uncertainty.

The first stage of ammonia reduction will involve centrate control at the NEWPCC at an estimated capital cost of \$10 Million. This will reduce ammonia discharge by about 30 percent. If Manitoba Conservation agrees to the proposed site-specific approach, NH<sub>3</sub> control will not be required at the SEWPCC until 2020. It is unlikely that NH<sub>3</sub> control will ever be required at the WEWPCC because the existing polishing ponds effectively reduce NH<sub>3</sub> concentrations.

### **5) Combined Sewer Overflow (CSO) Control**

Combined sewers were built in Winnipeg between 1880 and 1960. They serve an area of approximately 8,700 hectares or about 30% of the currently developed area. These sewers carry wastewater only, during dry weather, and stormwater plus wastewater during rainstorms. Over the long term, CSOs occur on average of about 18 times per year during the summer recreation season (May 15 to September 30). The key findings of the CSO study include the following:

- During and following a rainfall event, CSOs cause a significant short-term increase in fecal coliform concentrations. These elevated concentrations typically “die-off” in three to four days at which time the concentrations return to levels observed during normal dry weather conditions.
- Disinfection of the effluent from the NEWPCC will have the most significant benefit in terms of reducing fecal coliform concentrations in the river, in that these discharges are continuous during dry and wet weather conditions. Beyond disinfection of the WPCC effluent, additional CSO control provides minor incremental benefit with respect to improved compliance with microbiological limits.
- CSO control should not be considered a significant public health issue in the conventional context of avoiding disease. The extent of CSO control that is appropriate and acceptable to the community is fundamentally a public policy and a regulatory compliance issue.
- CSO control is very costly and benefits difficult to measure
- Alternatives for CSO control include complete separation of all combined sewers at a cost of approximately \$1.5 Billion, or reduction of CSOs to an average of about 4 events per recreation season at a cost of about \$270 Million.
- For Winnipeg, the most cost-effective means to gain greater CSO control is to maximize the use of available sewer system storage supplemented as required by future underground storage to achieve an average of about 4 overflow events per recreation season at an estimated cost of approximately \$270 Million.



As such, the following CSO control plan is recommended for presentation to the CEC. The plan is staged long-term, a 40 to 45 year undertaking, which enables steady progress on CSO mitigation while preserving funds for other evolving priorities.

Year	Activity	cost (Millions)
002 - 05	Implement a supervisory control and data acquisition system, raise interception weirs, conduct an in-line storage demonstration project and additional engineering studies	14
005 - 43	Integration with basement flooding relief and sewer rehabilitation programs	26
028 - 33	Access existing latent and available in-line storage	50
34 - 50	Develop additional storage to meet long-term CSO control target of 4 CSOs per recreation season	180

The above program is conceptual even within the first 10 years. It is anticipated that it would be subject to ongoing review and adaptation depending on the evolution of other environmental issues.

**6) Effluent Limits Discharge for Water Pollution Control Centres (WPCCs)**

The City’s three WPCCs have not been licensed in their entirety under *The Environment Act*. Part of the CEC hearing process to be convened will be to establish appropriate discharge limits for licensing purposes. The effluent constituents of concern were identified as:

- 5-day Carbonaceous Biochemical Oxygen Demand (CBOD<sub>5</sub>) associated with the carbonaceous component of wastewater. Biodegradation of carbonaceous matter remaining in final effluent discharges can negatively impact the dissolved oxygen (DO) levels in the receiving stream.
- Total suspended solids (TSS). Concentrations above a certain concentration can impair the ability of fish and other organisms to respire sufficient levels of oxygen from the water column to sustain life.
- Bacterial contamination, as measured by the fecal coliform indicator organism, to protect the recreational use of the Rivers.

The City’s WPCCs provide the best practicable secondary treatment to adequately protect the river environment. Disinfection is essentially complete at the SEWPCC and WEWPCC, and the NEWPCC will be completed in 2004, which will satisfy compliance with microbiological objectives.

### **7) Reduction of Nutrients in Effluent Discharges**

The Province believes it has evidence of increasing concentrations of nutrients, that is nitrogen (N) and phosphorous (P), in the surface waters of southern Manitoba. The enrichment of surface waters by these nutrients can adversely affect water quality and lead to such problems as excessive algal and aquatic weed growth. Manitoba Conservation has embarked on a Provincial Nutrient Management Study to examine these effects and develop an implementation strategy to minimize nutrient loading from both point and non-point sources. Much technical work is still to be done and significant public consultation by the Province is expected. As a result, an implementation strategy is 2 to 3 years away.

The concern expressed by Manitoba Conservation is founded on the possible trend towards the eutrophication of Lake Winnipeg, and the overloading of the Red and Assiniboine Rivers by nutrients (N and P) from point and non-point sources and need to limit and/or reduce the loading from these sources. There are major uncertainties associated with the need for nutrient control by the City.

The nutrient discharges from Winnipeg are a small proportion of the nutrient load to Lake Winnipeg. All dry and wet weather discharges from Winnipeg represents about 10.5 percent of the total annual phosphorus load and 7.9 percent of the total annual nitrogen load to the south basin of Lake Winnipeg. Wet weather nutrient loading alone from CSOs and land drainage represent about 1.0 percent of the total annual nitrogen and phosphorus load to Lake Winnipeg. Nutrient control of N and P at the three WPCCs, considered as point discharge sources, is estimated to cost \$181 Million. Since nutrient control is a basin-wide issue, the requirement for Winnipeg to implement nutrient reduction at the WPCCs cannot be determined until Manitoba Conservation has completed their Nutrient Management study and public consultation program. Further, if it is decided that nutrient control of Winnipeg plants is cost effective, the cost should be borne by all lands contributing nutrients on a proportional basis.

### **8) Wastewater System Reliability**

Part of the CEC deliberations will be to consider the reliability and backup capacity of the City's collection and treatment systems.

Under normal circumstances, all wastewater flows generated during dry weather conditions in the sewer districts tributary to the North End Water Pollution Control Centre (NEWPCC) receive fully secondary treatment before being discharged to the Red River.

At approximately 1:15 p.m. on September 16, 2002, pumping of all raw sewage at the North End Water Pollution Control Centre (NEWPCC) was interrupted. Analysis of the NEWPCC surge well records and corresponding river levels found that overflow to the Red River started at about 5:00 p.m. on September 16, 2002 and ceased at approximately 2:00 a.m. on September 19, 2002. Based on a review of system records and conditions, the full duration of the overflow event was estimated at about 57 hours and resulted in approximately 427 ML (427,000 m<sup>3</sup>) of untreated wastewater to be spilled to the Red River. The nature of such an event is that any impact would be small and short lived.

Design of permanent works to isolate all three pump wells is currently underway. Concurrently, a second program was initiated to allow the safe extraction of the defective valve. The extraction is extremely difficult and requires careful planning and execution under a controlled situation. It is anticipated that the valve extraction and examination of the valve failure mechanism will be completed by early-December 2002.

The WWD has an ongoing capital improvement and asset management process to identify works required to maintain the wastewater collection and treatment system operating safely, reliably and cost effectively. The actions to be undertaken subject to Council approval of funding include:

- Risk and Criticality Assessment of WPCCs, starting in 2003
- NEWPCC Surgewell-Main Pump Condition Assessment and Upgrading starting in 2003
- Condition Assessment of River Crossings, Forcemains and Pumping Stations, starting in 2003
- Reliability Upgrades at the WPCCs, starting in 2003
- Various Interceptor Condition Assessment and Sewer Rehabilitation Works, starting 2004.

#### **9) Other Relevant Environmental Issue - Biosolids Management**

The solids residual from wastewater treatment after digestion and dewatering is referred to as to biosolids. While not included in the Terms of Reference for the CEC at the planned hearings, future regulatory review processes will engage a review of the City's biosolids land application program. A major study is currently underway reviewing the City's biosolids land application practices including review of metals loading on soils, nutrient application rates, and winter spreading operations. The study is also investigating and other management options and costs.

Evolving regulations and practices elsewhere suggest that modifications to the current practice may be required to produce a product that has alternative end uses other than land application. Early indications are that modifications could involve capital expenditures of up to \$50 Million. The potential for the need to expend \$50 million has been included in the Pollution Prevention Plan. Results of the Biosolids Management Study will be reported to Council in 2003.

**FINANCIAL IMPACT:**

The following financial impact statement for this project has been prepared in accordance with the recommendation adopted by Council on December 13, 2000.

**Financial Impact Statement**

**Date:** November 1, 2002

**Project Name:**

**First Year of Program 2003**

Updated Status of Wastewater Related Pollution Prevention plans in Preparation for Upcoming Clean Environment Commission Hearings

	2003	2004	2005	2006	2007
<b>Capital</b>					
Capital Expenditures Required	\$ 10,820,000	\$ 19,250,000	\$ 15,400,000	\$ 1,500,000	\$ 1,500,000
Less: Existing Budgeted Costs	<u>10,820,000</u>	<u>19,250,000</u>	<u>15,400,000</u>	<u>1,500,000</u>	<u>1,500,000</u>
Additional Capital Budget Required	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>
<b>Funding Sources:</b>					
Debt - Internal	\$ -	\$ -	\$ -	\$ -	\$ -
Debt - External	-	-	-	-	-
Grants (Enter Description Here)	-	-	-	-	-
Reserves, Equity, Surplus	10,820,000	19,250,000	15,400,000	1,500,000	1,500,000
Other - Enter Description Here	-	-	-	-	-
Total Funding	<u>\$ 10,820,000</u>	<u>\$ 19,250,000</u>	<u>\$ 15,400,000</u>	<u>\$ 1,500,000</u>	<u>\$ 1,500,000</u>
Total Additional Capital Budget Required	<u>\$ -</u>				
Total Additional Debt Required	<u>\$ -</u>				
<b>Current Expenditures/Revenues</b>					
Direct Costs	\$ -	\$ -	\$ -	\$ -	\$ -
Less: Incremental Revenue/Recovery	-	-	-	-	-
Net Cost/(Benefit)	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>
Less: Existing Budget Amounts	-	-	-	-	-
Net Budget Adjustment Required	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>	<u>\$ -</u>
<b>Additional Comments:</b> Financial Impact based on cash flow projections. Funding provided from The Environmental Projects Reserve (EPR). This is the first five years of a 50 year plan as described in this report. Expenditures in 2006 and 2007 have been reduced to allow contributions to the EPR to accumulate which will be utilized to fund biosolids disposal program improvements projected to be required in 2007 to 2010.					

Moira L. Geer C.A.

In preparing the report, there was consultation with and concurrence by:

- Not applicable

This Report Submitted By:

Department: Water and Waste

Division: Engineering

Prepared by: M. A. Shkolny, P. Eng. and N. T. Szoke, P. Eng.

File No. 020-17-01-01-00 and 020-17-08-01-00

## **Appendix A – Terms of Reference for CEC Hearings**

### **Public Hearings - City of Winnipeg Wastewater Collection and Treatment Systems**

On October 3, 2002 the Minister of Conservation, the Honourable Steve Ashton, requested that the Commission convene public hearings to review and provide advice and recommendations respecting the City of Winnipeg's wastewater collection and treatment systems.

The Commission has responded by scheduling the hearing as follows:

Winnipeg - Winnipeg Convention Centre, 375 York Avenue, Winnipeg

- January 20, 21 and, if necessary, 22, 2003
- 13:00 - 17:00 and 19:00 - 22:00 (January 20 and 21)
- 09:00 (January 22)

Selkirk - Selkirk Banquet and Conference Centre, 168 Main Street, Selkirk

- January 27 and, if necessary, 28, 2003
- 13:00 - 17:00 and 19:00 - 22:00 (January 27)
- 09:00 (January 28)

### **Public Hearing Notice**

#### **Background**

In June of 1992, the Clean Environment Commission issued a report entitled, "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." 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 Sept. 16, 2002 resulting in the discharge of untreated wastewater into the Red River raising concerns with respect to the backup 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 backup 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.