

SECTION 1.0 INTRODUCTION

1.1 NITRIFICATION STUDY BACKGROUND AND OBJECTIVE

1.1.1 Background

When the Manitoba Environment Act was modified in 1988, one of the major concerns that arose was the maintenance of appropriate water quality in the Red and Assiniboine Rivers.

To address these concerns, in 1989 the Minister of Environment requested that the Clean Environment Commission (CEC) convene public hearings and provide recommendations on proposed water quality objectives for the Red and Assiniboine Rivers within and downstream of the City of Winnipeg. Hearings were held in late 1991 and early 1992.

The City of Winnipeg is committed to protecting our rivers as is evident from the magnitude of its past and planned expenditures directly related to this issue. However, the City firmly believes that it has an obligation to its citizens to make informed decisions concerning the level of protection afforded to the rivers and the related expenditures of public funds. To this end, the City of Winnipeg spent considerable effort studying the water quality situation in the Red and Assiniboine Rivers and raised several concerns during the public hearings. The main concerns were related to combined sewer overflows (CSOs), treatment plant effluent disinfection and the impacts of un-ionized ammonia in the river.

With respect to un-ionized ammonia, during the hearings, the City indicated that there were uncertainties with respect to the objectives proposed by Manitoba Environment. Furthermore, the City contended that the U.S. EPA limits were applied inappropriately for Winnipeg, and recommended that site specific guidelines based on site specific testing and conditions be used to set objective levels for un-ionized ammonia. The City also argued that the benefits obtained by improving the treatment efficiencies of its Water Pollution Control Centres (WPCCs) were low and that nitrification at the three WPCCs would be extremely costly.

Following the hearings, in 1992 the CEC made its recommendations and published 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". The CEC made fourteen

recommendations in total. Recommendations 2 and 6 pertained directly to the un-ionized ammonia issue and were as follows:

“Recommendation 2 (Class 2 – Category B – Cool Water Aquatic Life and Wildlife)”

Rivers and streams specified within the classification area should be classified for the protection of cool water aquatic life and wildlife. However, the acceptance of the proposed classification is qualified because there is uncertainty regarding the specific requirements for un-ionized ammonia parameters. The Commission recommends that the site specific requirements for un-ionized ammonia be set at those prescribed by the U.S. EPA by 1997 unless site specific research has determined otherwise. Research requirements have been specified in Recommendation 7.”

“Recommendation 6 (Un-Ionized Ammonia Study)”

Detailed site-specific studies should be undertaken to determine both the acute toxic and chronic effects of un-ionized ammonia from wastewater effluent on the cool water aquatic life of the rivers. Members of the scientific community within Manitoba should be invited to collaborate in the study design. Recommendations should be available before July, 1997 as to the program required to deal with un-ionized ammonia in wastewater at the water pollution control sites along the river system being considered.

The study results will be utilized to establish the un-ionized ammonia objective at a public hearing to be held within six months of the completion of the study.”

1.1.2 Objective

As noted in the foregoing paragraphs, the level of environmental protection to be provided to the Red and Assiniboine Rivers is a major public policy issue. Discharge of un-ionized ammonia from the City’s three Water Pollution Control Centres (WPCCs) is one of several aspects that have to be considered in reviewing the broad water quality issues related to our rivers. There are potentially many approaches available for reducing ammonia discharges from the WPCCs, but provision of any level of ammonia control could be very costly. The City, the Province and the public require comprehensive information to be in a position to make the appropriate policy decisions on this matter.

The purpose of the Nitrification Study is to evaluate the various alternatives for upgrades at the City’s three WPCCs. Together, the Nitrification Study and the Un-ionized Ammonia Study (Ammonia Study) recommended by the CEC (Recommendation 6) provide the City with an information matrix that is sufficient to make appropriate policy decisions related to the planning of future upgrades to its three WPCCs.

For the purposes of developing information to support these policy decisions, the engineering approach to nitrification has been dealt with in broad terms to establish the regulatory requirements through discussion with the province and the public. Further refinements to the engineering can be completed once the regulatory framework has been formulated. The engineering at this stage has only been completed to the conceptual level, which is sufficient to make the appropriate decisions to move the planning process forward. Further refinement of the engineering concepts will be completed once the regulatory requirements are better defined.

Considering all of the foregoing, the objective of the Nitrification Study is to produce conceptual level engineering plans and costs estimates for potential upgrades to the City's three WPCCs at a level of detail that allows the proper planning level decisions to be made by the City. The direction of the Nitrification Study has been adjusted over its course such that it was consistent with the requirements of the Ammonia Study. Thus, the integrated results of the two studies provides the City with the information required to conduct informed discussions with the Province and the public regarding the regulatory requirements for the three WPCCs.

1.2 PURPOSE AND OBJECTIVES OF CONCEPTUAL DESIGN PHASE

The Nitrification Study was carried out in two phases – the Preliminary Design and the Conceptual Design. This document summarizes the work completed in the Conceptual Design phase.

The Preliminary Design phase is documented in the report titled “The City of Winnipeg, Nitrification Study, Preliminary Design Report” dated November 2002. The purpose of the Preliminary Design phase was to assemble the information required to facilitate the Conceptual Design of the various alternatives for ammonia control.

The objective of the Conceptual Design phase of the study is to develop conceptual designs and associated cost estimates for a range of ammonia control alternatives available to the City. The information is to be used by the City in the development of policy decisions on ammonia control. Specific activities of the Conceptual Design are summarized as follows:

- The ammonia control alternatives studied for summer conditions range from the application of best practicable technology, to simple modifications of the existing plants to optimize the degree of ammonia removal achieved with minimal expenditure.
- The foregoing alternatives were also evaluated for fall and winter conditions.

- The impact of wet weather flows on the various alternatives was examined and the need to increase the system performance to meet discharge limits were considered.
- Methods to remove nutrients from the effluent were evaluated for each plant.
- For all alternatives, conceptual level cost estimates to represent the total cost of ownership were developed.

1.3 ORGANIZATION OF THIS DOCUMENT

To facilitate an orderly presentation of the large amount of material generated during the Conceptual Design phase, this report is organized in six Parts, with each Part comprised of one or more Sections. The general organization of the report is as follows:

PART I – INTRODUCTION AND PLANNING FRAMEWORK	
Section 1.0 – INTRODUCTION	Outlines the background to the Nitrification Study and the objectives of the Conceptual Design phase.
Section 2.0 – PLANNING APPROACH	Describes the basic design parameters including flows and loads, and the methodology used for the cost estimates.

PART II - FIRST PRIORITY CONTROL ALTERNATIVES	
Section 3.0 – FIRST PRIORITY CONTROL ALTERNATIVES	Provides the rationale for the selection of the first alternatives examined and the effluent targets associated with each.
Section 4.0 – BEST PRACTICABLE REDUCTION	Documents the conceptual design and estimated costs of the best practicable level of control for the three WPCCs.
Section 5.0 – OPTIMIZATION OF EXISTING PLANTS	Describes the approaches available to optimize the ammonia reduction performance of the three existing WPCCs with a minimal expenditure.
Section 6.0 – NEWPCC CENTRATE TREATMENT	Documents the conceptual design of a centrate treatment facility for the NEWPCC.

PART III – SECOND PRIORITY CONTROL ALTERNATIVES	
Section 7.0 – SECOND PRIORITY LEVELS OF CONTROL	Describes the rationale for selecting the effluent limits for the high and modest levels of control.
Section 8.0 – NEWPCC SECOND PRIORITY CONTROL ALTERNATIVES	Documents the conceptual design and cost estimates for the high and modest levels of control for the NEWPCC.
Section 9.0 – SEWPCC SECOND PRIORITY CONTROL ALTERNATIVES	Documents the conceptual design and cost estimates for the high and modest levels of control for the SEWPCC.
Section 10.0 – WEWPCC SECOND PRIORITY CONTROL ALTERNATIVES	Documents the conceptual design and cost estimates for the high and modest levels of control for the WEWPCC.

PART IV – WET WEATHER IMPACTS	
Section 11.0 – WET WEATHER IMPACTS	Describes the analysis of the impact of wet weather flows on the preceding control alternatives.

PART V – NUTRIENT REMOVAL	
Section 12.0 – NUTRIENT REMOVAL ALTERNATIVES	Describes the rationale for considering nutrient removal.
Section 13.0 – CHEMICAL PHOSPHORUS REMOVAL	Describes the conceptual design and cost estimates of a chemical phosphorus removal system for each plant.
Section 14.0 – BIOLOGICAL NUTRIENT REMOVAL	Documents the conceptual design and cost estimates of a biological nutrient removal system for each plant.

PART VI – SUMMARY OF CONCEPTUAL COST ESTIMATES	
Section 15.0 – SUMMARY OF CONCEPTUAL COST ESTIMATES	Summarizes all of the cost estimates prepared in the Conceptual Design Phase in a series of tables and graphs.