

FINAL REMARKS AND CONCLUDING STATEMENTS

Manitoba Environment

In Manitoba Environment's concluding statement it was noted that in almost all cases, the presentations agreed with the proposed MSWQO and called for action by the City of Winnipeg to improve the water quality in the rivers and streams. The importance of the various river uses was underscored during the hearings with the following summary of specific objectives stressed:

- the objective for un-ionized ammonia reflects the best scientific judgement concerning levels that will protect the aquatic community.
- the fecal coliform objective, for primary recreation, and irrigation water which comes in contact with people or is used in public places, provides reasonable protection for users. The primary recreation objective is consistent with neighboring jurisdictions.
- the fecal coliform objective, for secondary recreation, and irrigation of produce is deemed appropriate to provide a reasonable level of protection. It is recognized that there is a large degree of uncertainty with the value.
- The minimum low flow rate for meeting the objectives is *either* the 7-Q¹⁰ or the 4-Q³.

In response to a criticism from the City of Winnipeg that Manitoba Environment's report "A Review of Wastewater Treatment Systems, Processes and Water Quality Management Plans" was inappropriate, it was stated that this report was to be presented at the licensing phase but since the Terms of Reference of the current hearings provided such latitude, a decision was reached to include them in this process.

Attention was drawn to the national and international implications of water quality issues. It was suggested that the City of Winnipeg's current approach to disinfection and CSOs might appear to contradict their positive efforts in the past. The benefits of the multi-stakeholder water quality management process was reiterated. In conclusion, Manitoba Environment stated that the time was right to proceed to the next step in improving the water quality of our rivers and streams.

City of Winnipeg

The City of Winnipeg's representative indicated that the sewer utility has \$104 million of debt which is essentially recent and current capital programs. This debt is expected to increase to \$210 million by 1996, based on continuing commitments to wastewater treatment.

The position of the City of Winnipeg, regarding each water quality objective area, had been noted at appropriate junctures throughout their presentation and are not repeated.

The City's view was that Manitoba Environment used a simplified procedure and did not carry out the necessary studies required to make decisions on site-specific water quality objectives. Manitoba Environment clearly is the Proponent in setting objectives. The City of Winnipeg believes that the setting of numerical objectives hinges, to a large measure, on the costs and benefits involved in obtaining those objectives.

The City demonstrated clearly that the health risk to current users was much less than what Manitoba Environment had suggested. The spending of up to \$700 million to deal with this risk was of doubtful benefit in their opinion.

Evidence of an excellent fishery had been presented to the Commission. The City contended that suggesting aquatic life was unacceptably affected by present un-ionized ammonia conditions was speculation. Further research would satisfy uncertainties regarding the un-ionized ammonia objective and would assist in the development of a site-specific objective with a study to follow examining nitrification options.

The City stated that, in recognition of the need to improve the aesthetic condition of the rivers, a master plan for reducing combined sewer overflows would be developed.

In closing, the Commission was urged to ensure itself that real benefits existed and that adequate information was available prior to committing the City to their estimated expenditure of a billion dollars associated with the water quality objectives proposed by Manitoba Environment.

Town of Selkirk

The Town of Selkirk, stated that it concurred with the overwhelming public opinion that the uses provided for in the classification were both appropriate and necessary to improve water quality. It was noted that the basic underlying science as found in the approach developed by the U.S. EPA had not been challenged at these hearings. While the need for further research has been identified, the interveners with scientific backgrounds advocated, without exception, the adoption of the objectives, followed by further research. Given the potential size of expenditures and the public's expectation of timely change, a planned, prioritized, phased approach would be necessary.

CITIZEN AND GROUP PRESENTATIONS

Ms. Karen Jodoin of the Save Our Seine, Lorette Chapter presented the results of a questionnaire completed during 1991 by 52 respondents. She stated that her group felt that the Seine River should be protected for primary recreation. Poor water quality, agricultural practises, low flow and water levels were cited as the main impediments to present or future use of the river.

Mr. Robert Hudson of Roseisle, Manitoba, on behalf of concerned citizens in the region of Stephenfield, Manitoba, asked that the CEC set the highest standards feasible for drinking, livestock and irrigation uses, and review the consequences of upstream diversions and reductions in volume.

The presentation of Dr. I. Reid from the Selkirk area included a listing of numerous uses which underscore the importance of the Red River including recreation, commercial use, air bases, security forces, agricultural use, riverbank use and community drinking water. He also noted the problem of pleasure and commercial boats discharging their sewage holding tanks directly into the river. Dr. Reid also spoke of the need to separate the City's combined sewers, Selkirk's fines resulting from not following CEC directives, various options to chlorination, the similarities of the 1991 hearings to those in 1981, and cost/benefit issues. He concluded by stressing that the real problem to address was the cross-connected sewers.

Ms Peg Venables, of the Save Our Seine Residents Committee, presented evidence on behalf of resident in St. Vital and St. Boniface. She spoke of the river's degradation over the past 25 years. Aside from the adoption of the secondary recreation classification for the Seine River, the balance of the recommendations dealt with stream obstructions and flow.

Mr. Edwin Yee, representing the Manitoba Hazardous Waste Management Corporation (MHWMC), discussed the issue of hazardous waste and many of the activities of the MHWMC. Mr. Yee recommended that the City of Winnipeg and Manitoba Environment of Manitoba ensure effective enforcement of their pollution control regulations, specifically with regard to sewerage chemicals. He also recommended that water quality monitoring and objectives include hazardous waste indicators. Mr. Yee indicated that the MHWMC was supportive of the proposed water quality objectives.

Mr. Max Morelli, Canadian Member of the International Joint Commission Red River Pollution Board read the Board's presentation written by Mr. Max Dodson, U.S. Co-Chairman. In 1967, the Board recommended that the governments of Canada and the United States accept the following water quality objectives:

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

In response to questioning, Mr. Morelli noted that the jurisdiction of the IJC is at the boundary. He also noted that North Dakota and Minnesota have adopted the U.S. EPA's un-ionized ammonia criteria.

Mr. Dodson, in his letter, noted that "as more information on indigenous fish migration across the International Boundary becomes available, it is increasingly apparent that downstream releases of contaminants can affect the quality of the fishery in upstream areas". He concluded by supporting the proposed water quality objective and suggested that a whole basin approach to water quality protection be adopted.

Mr. Morelli noted that the Board did not have specific information or data of the migratory species at risk, the extent of the risk, nor the magnitude of any possible effects - the statement made by Mr. Dodson was a hypothesis.

Mr. William Gummer, Chief of the Water Quality Branch, Conservation and Protection, Environment Canada, focused his presentation on the Red and Assiniboine main stem river systems. The brief contained a series of recommendations (a number of which applied directly to this program of applying objectives as follows):

1. that the CCME statement on "Inter-jurisdictional Co-operation on Environmental Matters" be endorsed;
2. true-cost water pricing be used as a means of improving conservation and quality;
3. a basin-wide approach to water quality management be adopted;
4. the proposed water quality uses be adopted;
5. the proposed un-ionized ammonia objective be adopted; and
6. the proposed fecal coliform objectives be adopted.

A number of other recommendations related to the Water Quality Objectives document itself.

In closing, Mr. Gummer noted that we must give nature the benefit of the doubt, and err on the side of protecting the environment. The increasing number and complexity of environmental issues demand that we adopt a more integrated approach.

Mr. Brian Osborne, Canadian Coordinator for the International Coalition for Land and Water Stewardship in the Red River Basin spoke of the need to balance economic realities with environmental necessities and focused on the stewardship of the river. Mr. Osborne referred to the Twin Cities in Minnesota as an example of improved water quality through facility upgrading. The International Coalition offered its experience in non-confrontational consensus building and networking services to Manitoba Environment, the City and others involved in the pursuit of increased water quality.

Mr. Osborne confirmed that the total estimated cost to date of separating the sewers in the Twin Cities was US \$287 million (since 1984) with the area population close to 2 million. He also confirmed that 2/3s of the original combined drainage area had been separated through ongoing

programs prior to the start of the \$287 million 10 year program. (The City of Winnipeg has approx. 10,000 hectares of combined sewers versus 8,400 hectares in the Twin Cities 10 year program) The previous construction of large trunks may account for the large difference in cost estimates.

Dr. Pete Sarsfield, Director Health Promotion, Protection and Disease Prevention, Manitoba Health, gave a presentation stressing the broad view of ecosystem health and sustainable development. He suggested that without clear water quality objectives, sustainable development was not possible. He presented 5 of the 14 principles for public policy shown in the European Charter on Environment and Health:

- Good health and well being require a clean and harmonious environment;
- The preferred approach would be to promote the principle of "prevention is better than cure";
- Action on problems of the environment should be based on best available scientific information;
- The health of individuals and communities should take clear precedence over considerations of economy and trade.

Dr. Sarsfield suggested that there was not a major difference between primary and secondary recreation in terms of exposure and his contention was that the 200 fecal coliform level should apply to all recreational use.

Mr. Dennis Windsor, presenting on behalf of the Water and Wetlands Research Group of the Canadian Plains Research Center, outlined a number of relevant points made at a recent Symposium of the Plains Aquatic Research Conference. Relative to the current process were statements dealing with a need to apply technology to nutrient removal and a need to consider water basin and regional management perspectives.

Mr. Jerry Moskalyk, operator of a mobile park in the Rural Municipality of St. Andrews, described his lagoon operation.

Ms. Mary Davies, representing the Selkirk and District Chamber of Commerce, expressed her support for the proposed water quality objectives and disagreed with the vision of water quality put forth by the City of Winnipeg. She stated that poor water quality in the Red River was partially

attributed to the loss of a bid for a pharmaceutical company to locate in Selkirk. She emphasized that Winnipeg should not be excluded from the objectives set for the rest of the Province.

Mr. Frank Weins, representing the Selkirk Rotary Club, expressed the organization's support for the establishment of safer water quality standards for the Red River. He stressed that the City of Winnipeg should implement improvements on an incremental basis so it will eventually meet the same water quality objectives as the rest of the Province.

Mr. Alvin Merinuk, Reeve of the Rural Municipality of St. Clements, spoke of the poor river water quality (specifically solid litter) which he has personally experienced, living beside the river. He also read a Council resolution supporting the proposed MSWQO.

Mundeep Kaur, Susan Peters, and Jackie Lussier, students representing Lord Selkirk High School students, made a presentation focusing on the results of a student survey which showed that the majority of respondents felt that improvements should be made to the Red River water quality. Reference was made to similar hearings held in 1981. The hope was expressed that it would not be necessary to repeat the group's points in another 10 years as a result of further inaction.

Mr. Russell Skalesky, representative of the Triple S Community Development Corporation, based in Selkirk, gave a presentation in support of the proposed water quality objectives. He emphasized the Corporation's dismay in learning that the Red River water quality was frequently not suitable for its intended uses. Mr. Skalesky noted the many uses of the Red River and Netley Marsh, and the importance of these waterbodies to tourism, manufacturing, agriculture, recreation and residences in the Triple S area. The significance of consistently enforcing the objectives across all jurisdictions was stressed.

Mr. Joe Smolinski, representing the Selkirk and District Hospital Board, read into the record, a resolution in support of the proposed water quality objectives. The water quality of the Red River was considered to be a very important health issue for people of the area and all Manitobans.

Mr. Harvey Benson, Councillor with the Town of Gimli, was very much concerned with government inaction and approval of projects in isolation. It was recommended that the CEC try to influence the establishment of a long-range plan for water use in Manitoba. Mr. Benson also read a resolution from the Town of Gimli which was supportive of the proposed water quality objectives.

Mr. Wayne Faires, Chairman of the Red River Advisory Group and Vice-President of the Lockport Merchants Association, showed a video, taken in August of 1991, of the Red River just north of the St. Andrews lock and dam. The video clearly showed visual debris and litter which floated for miles north of the dam. Mr. Faires asserted that the debris is collected just above the dam, and is cleared away from time-to-time (several times per summer) by passing the material over the dam. He noted logs, planks with nails, plastic bottles, aerosol cans, condoms etc. during the presentation. Following a description of the lower Red River fishery value, Mr. Faires suggested that a solution to the Winnipeg sewage problem must be examined carefully so that the fishery is not jeopardized in any way (e.g., the negative effects from chlorine disinfection). The complex biological diversity must be maintained for the future at all costs.

In response to questioning, Mr. Faires stated that the area south of the dam should be protected as well as taking measures to stop the dumping of collected materials.

Mr. Ron Dalmyn spoke of numerous pollution problem which he has experienced over the years and the problems encountered with government officials and engineers. He stated his support for the proposed water quality objectives and stressed that enforcement of regulations will be required.

Mr. Clyde Rennie, citizen of the Town of Selkirk, suggested that if Selkirk was upstream of Winnipeg, the City of Winnipeg would complain about downstream water quality downstream of Selkirk.

Mr. Jean-Paul Boily and Mr. Robin Wiens of the Saint Boniface Residents Association and the Saint Boniface Riverbank Preservation Committee, spoke of the importance of the Red and Seine Rivers to the community. Mr. Boily suggested that if the proposed objectives were implemented, the river would be better utilized. Implementing the objectives would also remove inconsistencies in public policy encouraging use of the river while permitting the current levels of contamination. Full support was given to the proposed water quality objectives and the mechanism for river management.

Dr. Allan Lansdown, Dr. Diane Malley and Dr. Derek Muir presented on behalf of the Manitoba Environment Council. The main points of the Council's brief are shown below as related to the classification process being undertaken.

1. The present classification of rivers and streams in Winnipeg should not be done in isolation from the classification of the upstream and downstream stretches of the rivers.

2. Water quality objectives are required following classification and they should be updated as relevant new information becomes available.
3. Support is given for the proposed water quality objectives with the exception that all waterways be protected for domestic consumption and primary recreation.
4. The following stretches of river should be protected with a high quality designation: the Assiniboine River west of Headingley, the Red River upstream of Winnipeg, and the Netley-Libau Marsh.
5. The City's cost estimates for sewage treatment options should include the impact of vigorous water conservation programs.
6. The Province and City are urged to be active partners in the proposed Green Plan-funded ecosystem study of the Red - Assiniboine Basin.

A number of other points were raised by the Council delegation in connection with the "Water Quality Objectives Process".

Dr. Malley concluded by stressing the need for environmental monitoring to compare the environments against the objectives and that the objectives should be enforced to ensure that total discharges will maintain the watercourses within those objectives.

In response to questioning, Dr. Malley suggested that if site-specific information was not available, there was a necessity to proceed with the best data on hand, and set water quality objectives. The Council's position was that we should proceed with the proposed objectives.

Dr. Malley agreed that it would not be realistic to have 620,000 people live in one location without any impact whatsoever on the river; rather, she stressed minimization of impact. She also agreed that all current river uses did not deserve equivalent degrees of protection. She stated that an educated guess was sufficient to justify the application of an objective having a price tag of hundreds of millions of dollars, and suggested that there were many examples of this, specifically the pulp and paper industry in relation to organochlorines. Dr. Malley stated that if the 200 coliform level for primary recreation was met, the river would be considered safe, even when considering other natural hazards (turbidity, current, steep banks, boards etc.).

Ms. Deborah Smith on behalf of CHOICES, A Coalition for Social Justice discussed the issues involved with water quality in the context of the Group's principles of fair taxation, spending choices, full employment and social justice. She stressed that the use of waterways as dumps for sewage, chemicals and garbage cannot continue.

She suggested that large expenditures required could be handled by amortizing or spending the money over 25 years.

Mr. William Kocay and Mr. Doug Symington, representing the Manitoba Recreational Canoeing Association, spoke of the recreational uses of Winnipeg's rivers. Health concerns result in the rivers being under-used. Mr. Symington also noted many impacts on other users resulting from poor water quality. He recommended that the rivers of Winnipeg should be clean enough to allow body contact, and anticipated accidental ingestion of water. He also recommended that a 5 or 10 year plan be developed to clean up the rivers. In the absence of a clean up or until a clean up occurred clearly visible signs should be posted, indicating the dangers of contact with the water.

Dr. Alan Ronald, a medical practitioner of Winnipeg, had practiced in the field of infectious diseases in Winnipeg since 1968 having seen approximately 10,500 Manitobans with infections during that time. During the past 10 years, he had not recalled treating one person infected from Winnipeg's rivers. He stated that there was no evidence to suggest the rivers were causing disease. He expressed his concern about the setting of artificial standards which were not scientifically set and that as much science as possible should be considered in making critical decisions.

Mr. Dennis Breed of Winnipeg expressed his concern for the welfare of the rivers in the classification area. He spoke of the need to consider wildlife and fish as well as humans and the need to address the biological aspects of the whole ecosystem. He focused on the need to control pesticides.

Mr. Gerard Lecuyer of the Enviraction Group based in St. Boniface spoke of the need to improve the quality of our rivers and river banks. He suggested that a detailed plan be developed for the next 25 years dealing with sewer separation and a longer term plan to cover the following 50 or 100 years. He expressed his qualified support for the proposed water quality objectives and recommended increased consultation with the citizens of Winnipeg.

Mr. Lyle Ross of the National Farmer's Union, spoke of the farm community's need to be assured of water supply and quality.

Dr. Gerry McKenny representing Manitobans against the Assiniboine Diversion, spoke of the need for water resources planning and management to consider both the quantity and quality of the resource. He noted that future withdrawals and damming will have negative impacts on downstream users.

Mr. Michael Tokarz, a citizen of Winnipeg, presented information on water conservation, combined sewers, recreation, irrigation as well as dissolved oxygen, and un-ionized ammonia. He suggested that when sewage from combined sewers is discharged into the river, the public should be informed by radio broadcast. He also suggested that north of Winnipeg should be proposed as unacceptable for swimming and water-skiing at present with a view towards making the quality suitable for primary recreation.

Mr. Ronald Basarab of the Winnipeg Rowing Club and the Manitoba Rowing Association suggested that re-development of Winnipeg's waterways could not stop at the water's edge and that the quality of the water must not be allowed to deteriorate any further. He also discussed the need for public announcements of water quality.

Mr. David Blicq of Winnipeg a member of the Save Our Seine River Committee and a concerned city resident noted that it is imperative that the Seine River be included in any planning for a "Rivers Initiative". He discussed the grassroots-level cleanup, the extent of the problem including large-scale obstructions, access to the river and compliance with water quality objectives.

Dr. Jim Ross, President of the Manitoba Medical Association, asked that surface water quality objectives be respected throughout the Province and that environmental impact assessments be done prior to implementation of any remedial measures. The Association acknowledged the health risk from pollutants but noted that illnesses do not occur with any frequency and with much severity.

Mr. Jim Duncan of Winnipeg sent a letter to the Commission indicating that current and potential uses of the waterways should be safeguarded and improved. He suggested an economically feasible time frame for improvements.

Mr. Arthur Turner of Headingley sent a letter, of qualified support for the proposed water quality objectives, to the Commission.

Mr. Ron Ellis of the Manitoba Paddling Association Inc. sent a letter supporting the primary recreation designation for the Red River and suggested the same classification be given to the tributaries to maintain the water quality level in the Red River.

Ms. Kathy Palsson of Hnaua, Manitoba sent a letter to the Commission which expressed her concern regarding the accelerated deterioration of Lake Winnipeg's water quality during recent years. She suggested that the City of Winnipeg's disregard of the water quality guidelines would have severe consequences for the future of our Province.

Resolutions in support of the proposed water quality objectives were received from Selkirk and District Planning Area Board, the Village of Dunnottar, the Rural Municipality of Victoria Beach, the Rural Municipality of St. Andrews, the Selkirk Army, Navy & Air Force Veterans in Canada, the Selkirk Kinsmen and Kinette Clubs, and the Maritime Museum of Manitoba.

Dr. William Paton, Associate Professor, Department of Botany/Biology, Brandon University, in a written submission drew attention to water quality problems in a southern Manitoba watershed and the applicability of certain water quality parameters and indicators.

Dr. Gordon Goldsborough of Brandon University, forwarded a presentation reviewing the document "Water Quality Monitoring and Modelling of the Red and Assiniboine Rivers". The review document had been prepared and presented by the City's consultant as evidence to the hearing.

A letter concerning the water quality objectives from Mr. Rick Hnatiuk of the Selkirk and Area Weed Control District stated that the District supported the proposed water quality objectives.

Miss Jessica Schafer representing Ms Marianne Cerilli presented a group of slides from a canoe trip on the Assiniboine River in the summer of 1991. Attention was drawn to litter and debris in and beside the river, private developments, wastewater and disposal treatment and domestic consumption.

Paula Harding, Regional Manager, Federal Facilities Accommodation, Public Works Canada, responded in writing to Manitoba Environment, regarding the dumping of debris over the St. Andrews Lock and Dam. She stated that operating staff will manually remove debris which has been collected at the dam, if it can be safely handled. Remaining debris is cleared by manipulating the dam's curtains and frames in order to prevent damage to the facility. Plans have been made to review the present system of handling debris.

DISCUSSION

Terms of Reference and Geographic Area of Consideration

The Clean Environment Commission has been asked to recommend water quality objectives for the protection of beneficial uses for rivers and tributaries within and downstream of the City of Winnipeg. Prior to and during the hearings, there was some ambiguity resulting from the terms of reference which were to guide the hearing process and the geographic boundaries for the classification area.

The original terms of reference for the Clean Environment Commission Hearings, announced in November 1989, required a detailed review of water quality issues including projected treatment costs and anticipated benefits for the Red and Assiniboine Rivers. In July 1991, the Minister of Environment revised the terms of reference, stressing the current and future uses of the rivers without mention of the costs and benefits associated with the adoption of water quality objectives. In November 1991, the Minister of Environment provided further clarification in a letter to the City of Winnipeg. At that time, the Minister acknowledged the appropriateness of the Commission considering a wide range of factors, including costs and benefits, in reaching their conclusions. The City of Winnipeg indicated their frustration with the changing terms of reference. The City's preparation for the hearings had been primarily based upon the original terms of reference. The consideration of costs and benefits was seen to be crucial when establishing water quality objectives. The City also expressed the view that Manitoba Environment was responsible for presenting cost/benefit information as the hearing's proponent. However, during the hearing process, Manitoba Environment did not deal with the costs and benefits of implementing the objectives. The Town of Selkirk's representative noted the difficulties associated with having various parties discussing water quality objectives based on differing terms of reference and the interpretation of letters.

The most recent terms of reference also enlarged the geographic area to include eight tributaries of the Red and Assiniboine Rivers within and downstream of the City of Winnipeg. The Commission has assumed that the classification for the La Salle and Seine Rivers above the Winnipeg boundary will remain as established in the 1981 Clean Environment Commission classification process. This would also apply to Devil's, Netley and Cook's Creek. The significant portion of both Omand's and Bunn Creek are within the Winnipeg Area and will be classified in this process. The reach of Sturgeon Creek within Winnipeg will be classified as part of this process. The upper reach of Sturgeon Creek can be classified when the balance of the Assiniboine River is classified (i.e. above the Trans Canada Highway at St. Francois Xavier). The earlier classification will have to be modified to fit the 1988 Water Quality Objectives Document.

The City of Winnipeg stressed the costs and benefits of protecting various water uses and questioned the parameters of the MSWQO specific requirements, particularly the objectives for un-ionized ammonia and fecal coliform. Manitoba Environment, The Town of Selkirk, and most of the other presenters have focused their evidence on the current and future uses of the watercourses and the current water quality problems and the 1988 Manitoba Water Quality Objectives.

The Commission were also requested to recommend a specific mechanism for the development and coordination of water quality basin management to achieve the Water Quality Objectives. As a first stage towards such a goal, a number of studies have been identified on un-ionized ammonia and combined sewer overflows. The recommendations that deal with these studies, includes a requirement to put in place a steering or advisory committee to both assist in the definition of the study and advise on the conduct of the study. The need for any further coordinating committee could be examined during subsequent hearings.

General Overview

In general, most presenters indicated their agreement with Manitoba Environment's proposed water quality objectives. In some cases, presenters called for higher quality designations, specifically for sections of the Assiniboine and La Salle Rivers. There was general consensus that the quality of our rivers and streams has a direct impact on aquatic life, wildlife, and human life, especially for communities in close association with the water environment. There was also a general consensus that the body of site specific knowledge surrounding water quality issues in the classification area was lacking in a number of areas. However, most presenters did not see the lack of knowledge as a

significant reason to postpone the improvement of water quality which had been advocated throughout the hearings.

The costs to implement various treatment options were presented to the hearings as rough estimates only. Estimates ranged from \$20 million to over \$1 billion depending on the level of treatment required. The effectiveness of various options was questioned as were certain negative side effects. Regardless of the costs estimates, many presenters considered that *now* was the time to begin a clean-up of the rivers and that costs would only increase in the future. The City of Winnipeg delegation and several witnesses questioned the benefits that would accrue from the expending of large amounts of capital. It was noted that increased operating costs would also be significant.

Another concern identified at the hearing was that the water quality objectives respecting un-ionized ammonia had been in place for some time and communities such as Brandon, which were close to the functional design stage of a new wastewater treatment system, were being required under their licences to meet un-ionized ammonia limits.

Individual Presenters and Interest Groups

In addition to Manitoba Environment, The City of Winnipeg, and the Town of Selkirk, there were over 50 individual presenters or interest groups providing evidence to the Commission. Many of these presenters stressed the value of the watercourses to their personal interests, livelihood, or group activities. This had been exemplified by the personal involvement of local volunteers groups and individuals in river and stream clean-up programs. Many viewed river and stream management from an ecosystem approach and stressed the need to implement improvements from this perspective. Several speakers reminded the Commission of the requirements of the concept of sustainable development. Many presenters recognized the need to set reasonable time-frames for improvements. Water conservation, utilization, and pricing were raised as approaches to consider in conjunction with the application of water quality objectives.

There was concern expressed that application of water quality objectives to sections of rivers and tributaries was not appropriate and that a water basin approach, including upstream areas and Lake Winnipeg, was required. Further, the need to consider watercourse sediments and riverbanks in conjunction with surface water quality was noted. A number of presenters discussed problems of floating debris, noting the dangers to users and the aesthetic degradation of the

waterways. The method of clearing debris collected at the St. Andrews Locks was of particular concern.

Under the Green Plan, Environment Canada is believed to be planning a thorough water quality study of the entire Canadian section of the Red River basin. The original plan was timed to coincide with a study in the U.S. reach of the Red River being undertaken by the United States Geological Survey. The completion of these studies should significantly improve knowledge of the basin.

Other concerns noted by various presenters included the discharge of sewage from holding tanks of boats; the need to remove various stream obstructions; the need to ensure adequate inspection and enforcement capabilities; and finally, the desire of some to disallow recreational power boating, jet-skiing, and water-skiing within the designated area of the rivers, noting safety concerns, noise, and riverbank degradation.

PREVIOUS CEC RECOMMENDATIONS

It was noteworthy that several of the recommendations from the 1981 Red River Watershed Classification, as applied to the Winnipeg region, had not been implemented. Other than a study involving ultraviolet irradiation of waste water, action had not been taken to meet a fecal coliform limit set at 400 organisms per 100 mL. A study - Disinfection Evaluation: City of Winnipeg Wastewater Treatment Plant Effluent was jointly authorized by Manitoba Environment and the City. No decision was reached to disinfect wastewater effluents at the City of Winnipeg Wastewater Treatment Plants.

SPECIFIC MANITOBA SURFACE WATER QUALITY OBJECTIVES

Class 1 - Domestic Consumption

Manitoba Environment has proposed that the Red and Assiniboine Rivers be protected for domestic consumption. The Department has agreed that the current impact of the City of Winnipeg on the Red River does not impair the use of river water for downstream users, specifically, the Town of Selkirk. The Town of Selkirk has approval from Manitoba Health to produce drinking water from the Red River as needed. The City of Winnipeg has shown that complete treatment of raw river water is required because of natural and upstream exceedences of drinking water objectives. The City agrees with the classification and has recommended that the Assiniboine River also be so classified since it is used as a source of drinking water for the Headingley Jail. The City does not agree with the

classification of the La Salle River for domestic consumption as there are no current nor anticipated uses within the City of Winnipeg.

There was general consensus from the Town of Selkirk and other presenters that the proposed classifications should be implemented. A concern remained that treated water from the Red River would always be perceived by some as unacceptable for domestic use.

Class 2 - Category B - Cool Water Aquatic Life and Wildlife

There was complete agreement from all parties that watercourses within the classification area should be protected for aquatic life and wildlife. The major area of disagreement was the application of MSWQO for un-ionized ammonia concentrations. The City contends that un-ionized ammonia levels have been relatively stable from 1965 to 1991 and that there is no evidence of lethal or sub-lethal effects on the fishery. The City of Winnipeg identified uncertainties in the un-ionized ammonia objectives. While Manitoba Environment agreed that site-specific research had not been used to establish the MSWQO for un-ionized ammonia, the Department was confident that the objectives (based on U.S. EPA research) are relevant and have scientific credibility. Fish biologists reported differing views regarding the river's current ability to support a strong and diverse fish population. One biologist reported that fingernail clams were found only upstream of the City of Winnipeg. A biologist from Fish Futures Inc. drew attention to the detriment to fish passage from barriers on both the mainstem rivers and tributaries. Another biologist asserted that the entire watershed should be investigated in terms of its fishery and fish habitat. There was some disagreement on the merits of various low-flow conditions which have been used to test for compliance with MSWQO.

There appeared to be uncertainty with respect to the level of un-ionized ammonia control required for sustainable aquatic life. Site-specific research would reveal the nature and extent of effluent plumes and the chronic-exposure sensitivity of local species. The determination of requirements for effective control options for un-ionized ammonia, in conjunction with site specific research, would allow the refinement of water quality objectives for cool water aquatic life and habitat. In the interim, best available information faces the City and the Province with costly remediation requirements which may, in the long run, not represent money well spent.

Class 3 - Industrial Consumption

Manitoba Environment has proposed that the Red, Assiniboine, Seine and La Salle Rivers, and Cook's, Netley and Devil's Creeks, be classified for industrial consumption. The City of

Winnipeg has agreed with these classifications with the exception of the Seine and La Salle Rivers because of the low-flow character of these rivers. There was general agreement with the proposed classifications from other presenters.

Class 4 - Irrigation, Categories A, B and D, Greenhouse Irrigation, Field Crop Irrigation, & Livestock Watering

There was significant disagreement as to the interpretation of the MSWQO for irrigation. Manitoba Environment has included lawn watering, park and golf course watering, and cereal crops in their definition of agricultural consumption although these uses are not specifically designated as such under the MSWQO. The City of Winnipeg believes that these new inclusions should be scrutinized and subject to public review. Further, the City observes that irrigation uses are limited by factors such as conductivity, pH, and chlorides and that the fecal coliform objective is questionable (1,000 organisms per 100 mL for irrigating water and 200 organisms per 100 mL for waters which may come in contact with field workers, children, golfers, etc.).

The Commission notes that little irrigation takes place during wet-weather flows when CSO effluents have a substantial impact by raising fecal coliform levels.

Class 5 - Categories A & B - Primary & Secondary Recreation

Manitoba Environment has proposed that only the Red River be classified for primary recreation and that all rivers and streams within the classification area be classified for secondary recreation. The Department provided evidence to show significant use for both categories of recreation and has indicated that use numbers would increase if river quality was improved. Numerous individual presenters and interest groups stressed their agreement with the proposed classification.

The key specific requirement for recreational use is the fecal coliform objective. Primary recreation advocates a 200 organisms per 100 mL and secondary recreation a 1,000 organisms per 100 mL level. The City of Winnipeg considers that natural river conditions make the Red River unsafe as well as unsuitable for primary recreation and the most prominent use - water-skiing - is so limited that benefits do not justify the costs of disinfection. Disinfection of wastewater treatment plant effluent would likely bring the City of Winnipeg into full compliance with the primary and secondary recreation objectives during dry-weather flows. During wet-weather flows, objectives would not be met because of the impact of combined sewer overflows. Land drainage also contributes to the coliform load. This

would also require that discharges of raw sewage to storm or combined sewers during dry weather would have to be limited to emergency situations only.

The Commission feels there is insufficient site-specific information on the composition and impact of CSOs to advocate a blanket requirement for all CSOs to be regulated and treated or to separate combined sewers. It is known from Winnipeg's estimates and from experience elsewhere that the costs are high. It may be that, even with complete regulation and treatment of CSOs, fecal coliform objectives could not be met at all times.

RECOMMENDATIONS

The Clean Environment Commission recommends that the Manitoba Department of Environment classify the Red and Assiniboine Rivers and tributaries, within and downstream of the City of Winnipeg, according to the following Manitoba Surface Water Quality Objectives:

Recommendation 1 (Class 1 - Domestic Consumption)

The Red and Assiniboine Rivers should be protected for domestic consumption use according to the MSWQO.

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 related objective's specified un-ionized ammonia parameters. The Commission recommends that the 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 3 (Class 3 - Industrial Consumption)

The Red, Assiniboine, Seine, and La Salle Rivers, within the classification area, should be classified for industrial consumption according to the MSWQO.

Recommendation 4 (Class 4 - Categories A, B and D, Greenhouse and Field Crop Irrigation and Livestock Watering)

The following watercourses and uses should be protected according to the MSWQO, during dry-weather flows:

- The Red and Assiniboine Rivers should be protected for greenhouse irrigation;
- all rivers and streams, specified within the classification area, should be protected for field crop irrigation;
- all rivers and streams, specified within the classification area, with the exception of Omand's and Bunn's Creeks, should be protected for livestock watering.

Classification of these uses during wet-weather flows should be postponed until site-specific research can provide adequate information for informed decision-making. Research requirements have been specified in Recommendation 7.

Recommendation 5 (Class 5 - Categories A & B, Primary and Secondary Recreation)

The Red River should be protected for primary recreation, and all watercourses specified within the classification area be classified for secondary recreation, according to the MSWQO, during dry-weather flows.

Classification for these uses during wet-weather flows should be postponed until site-specific research can provide adequate information for informed decision-making. Research requirements have been specified in Recommendation 7. Until this information is available, the rivers within the prescribed area should be posted with cautionary notices regarding the risks of primary and secondary recreation following rainfall events of sufficient volume to cause combined sewer overflow impact to the rivers.

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.

Recommendation 7 (Fecal Coliform Study)

Site specific studies should be undertaken to determine water quality impacts of the combined sewer system on the rivers with the study including but not limited to:

- a physical inventory of the combined sewer system and the reaches of the rivers affected
- a project schedule in order to ensure that a sufficient number of flow events are monitored to understand the impacts of the combined sewer overflow on water quality in the river particularly during low river flows
- an understanding of routing through the sewer system during dry and wet weather flow events
- flow monitoring of the sewers and the rivers
- rainfall monitoring network
- water quality monitoring during overflow events at the overflows and in the receiving stream
- the establishment of parameters concerning storm frequency and the duration that fecal coliform levels must be met.

The data should be used to establish the cause of water quality violations in the river and subsequently result in the formulation of remedial measures to reduce the impact.

Members of the scientific community in Manitoba should be invited to collaborate in the study design and an advisory or steering committee should be established during implementation of the study. Recommendations should be available before July, 1997 regarding changes to the design and operation of the combined sewer overflows in The City of Winnipeg. Hearings should be held within six months of the completion of the study to determine the implementation schedule for fecal coliform objectives.

In the interim, following rainfall events of sufficient volume to cause combined sewer overflows to the rivers, the rivers in the prescribed area should be posted with health related cautionary notices regarding the safety of primary recreation.

Recommendation 8 (Warning System for High Coliform Levels)

The Minister of Environment, in conjunction with other Departments and the City of Winnipeg, should research and develop an appropriate high fecal coliform level *public warning system* for operation during the recreation season. The warning system should alert river and tributary users within the classification area of fecal coliform standard exceedances. It should be operational in the recreation season following attainment of dry-weather flow compliance with fecal coliform objectives.

Recommendation 9 (Floating Debris Procedures - St. Andrews Locks)

The Minister of Environment should encourage and facilitate improved operations by Public Works Canada to minimize the release of floating debris passing over the St. Andrews Locks.

Recommendation 10 (Wastewater Discharge From Boats)

As soon as possible, legislation should be developed to prohibit the discharge of wastewater from boats into the rivers and streams of Manitoba.

Recommendation 11 (Upgrading of 1981 Red River Classification)

The watershed classification program for the Red River, undertaken in 1981, should be upgraded to reflect the revisions made to the "Manitoba Surface Water Quality Objectives" document of 1988.

Recommendation 12 (Barriers and Flow Interruptions on The Seine River)

Manitoba Environment should refer concerns raised at the hearings regarding barriers and interruptions to flow, particularly on the Seine River, to the appropriate authorities for investigation.

Recommendation 13 (Review of Manitoba Surface Water Quality Objectives)

Manitoba Environment should consider a number of recommendations made respecting the need to re-examine the Manitoba Surface Water Quality Objectives. If, following such an examination, substantive changes are contemplated, a public review of any proposed revisions should be undertaken.

Recommendation 14 (Riverbank and Riverbottom Clean-up)

Manitoba Environment should continue to assist initiatives of volunteer groups designed to clean-up river banks and riverbottoms, particularly in the Winnipeg area.

GLOSSARY OF TERMS

- Aerosol** - Colloidal particles dispersed in a gas, smoke, or fog.
- Ammonia** - A pungent, colorless, gaseous, alkaline compound of nitrogen and hydrogen that is highly soluble in water. Normally present in most waters as a biological degradation product. Some of the ammonia (NH_3) reacts in water to form ammonium ions (NH_4^+). The toxicity of aqueous solutions of ammonia is attributed to the NH_3 (un-ionized ammonia).
- Chlorination** - The application of chlorine or chlorine compounds to water or wastewater, generally for the purpose of disinfection, but frequently for chemical oxidation and odor control.
- Combined Sewer** - A sewer intended to receive both wastewater and storm or surface water.
- CSO** - Combined Sewer Overflows carries both sewage and storm water run-off.
- Dechlorination** - The partial or complete reduction of residual chlorine by any chemical or physical process.
- Disinfection** - (1) The killing of waterborne fecal and pathogenic bacteria and viruses in potable water supplies or wastewater effluents with a disinfectant; an operational term that must be defined within limits, such as achieving an effluent with no more than 200 colonies fecal coliform per 100 ml. (2) The killing of the larger portion of microorganisms, excluding bacterial spores, in or on a substance with the probability that all pathogenic forms are killed, inactivated, or otherwise rendered non-virulent.
- Dissolved Oxygen (DO)** - The oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per litre (mg/L), or percent saturation.
- Dry Weather Flow** - (1) The flow of wastewater in a combined sewer during dry weather. Such flow consists mainly of wastewater, with no storm water included. (2) The flow of water in a stream during dry weather, usually contributed entirely by groundwater.
- Fecal Coliform** - Aerobic and facultative, gram-negative, nonspore-forming, rod-shaped bacteria capable of growth at 44.5°C , and associated with fecal matter of warm-blooded animals. Fecal coliforms are used as an indicator of disease producing bacteria.
- Gastrointestinal Illness (GI)** - A mild illness resulting in an inflammation of the stomach and intestines that may cause stomach cramps, headaches, vomiting and diarrhea.
- MSWQO** - Manitoba Surface Water Quality Objectives.
- NEWPCC** - North End Water Pollution Control Centre.
- Nitrification** - The oxidation of ammonia nitrogen to nitrate nitrogen in wastewater by biological or chemical reactions.

- Outfall Sewer** - A sewer that receives wastewater from a collecting system or from a treatment plant and carries it to a point of final discharge.
- Oxygen Saturation** - The maximum quantity of dissolved oxygen that liquid of given chemical characteristics, in equilibrium with the atmosphere, can contain at a given temperature and pressure.
- Ozonation** - The process of contacting water, wastewater, or air with ozone for purposes of disinfection, oxidation, or odor control.
- Primary Recreation Period** - Between May 1 to September 30 as defined by Environmental Management Division.
- 7-Q¹⁰** - Average minimum flow over a 7-day period which has a probability of occurring once in 10 years.
- 4-Q³** - Average minimum flow over a 4-day period which has a probability of occurring once in 3 years.
- Sanitary Sewer** - A sewer that carries liquid and waterborne wastes from residences, commercial buildings, industrial plants, and institutions, together with minor quantities of ground, storm, and surface waters that are not admitted intentionally.
- Sanitary Wastewater** - Wastewater discharging from the sanitary conveniences of dwellings (including apartment houses and hotels), office buildings, industrial, plants, or institutions.
- Saturation** - The condition of a liquid when it has taken into solution the maximum possible quantity of a given substance at a given temperature and pressure.
- Secondary Treatment** - The second step in most wastewater treatment systems in which bacteria consumes the organic parts of the wastes. It is accomplished by bringing the sewage and bacteria together in a trickling filter or activated sludge process.
- Separate Sewer** - A sewer intended to receive only wastewater or storm water or surface water.
- SEWPCC** - South End Water Pollution Control Centre.
- Storm Sewer** - A sewer that carries storm water and surface water, street wash and other wash waters, or drainage, but excludes domestic waste water and industrial wastes.
- Storm Water** - Surface water from rain, snow, or ice melting and running off from the surface of a drainage area. It is normally collected in sewers separate from the sanitary sewer, and receives minimal, if any, treatment prior to discharge to a receiving water. When collected in a combined sewer system, the resulting mixture of sewage and stormwater is called combined wastewater.
- Tertiary Treatment** - The treatment of wastewater beyond the secondary or biological stage often implying the removal of nutrients, such as phosphorous and nitrogen, and of a high percentage of suspended solids.

Ultraviolet Radiation - Light waves shorter than visible blue-violet waves of the spectrum, having wave lengths of less than 390 nanometres. Has application in the disinfection of water and wastewater.

USEPA - United States Environmental Protection Agency. The Federal Environmental Regulatory Agency in the U.S.A.

VSS - Vortex Solids Separator.

Wastewater - The spent or used water of a community or industry which contains dissolved and suspended matter.

Water Quality Criteria - Scientific standards on which a decision or judgement may be based concerning the suitability of water of a specific quality to support a designated use.

WEWPCC - West End Water Pollution Control Centre.

WWF - Wet Weather Flows, increased flows to the WPCC resulting from rainfall or snowmelt.

APPENDIX A: CITIZEN AND GROUP PRESENTATIONS

Ms. Karen Jodoin of the Save Our Seine, Lorette Chapter

Mr. Robert Hudson of Roseisle, Manitoba, on behalf of concerned citizens in the region of Stephenfield, Manitoba

Dr. I. Reid

Ms Peg Venables, of the Save Our Seine Residents Committee

Mr. Edwin Yee, representing the Manitoba Hazardous Waste Management Corporation (MHWMC)

Mr. Max Morelli, Canadian Member of the International Joint Commission Red River Pollution Board

Mr. William Gummer, Chief of the Water Quality Branch, Conservation and Protection, Environment Canada

Mr. Brian Osborne, Canadian Coordinator for the International Coalition for Land and Water Stewardship in the Red River Basin

Dr. Pete Sarsfield, Director Health Promotion, Protection and Disease Prevention, Manitoba Health

Mr. Dennis Windsor, presenting on behalf of the Water and Wetlands Research Group of the Canadian Plains Research Center

Mr. Jerry Moskalyk

Ms Mary Davies, representing the Selkirk and District Chamber of Commerce

Mr. Weins, representing the Selkirk Rotary Club

Mr. Alvin Merinuk, Reeve of the Rural Municipality of St. Clements

Mundeep Kaur, Susan Peters, and Jackie Lussier, students representing Lord Selkirk High School students

Mr. Russell Skalesky, representative of the Triple S Community Development Corporation, based in Selkirk

Mr. Joe Smolinski, representing the Selkirk and District Hospital Board

Mr. Harvey Benson, Councillor with the Town of Gimli

Mr. Wayne Faires, Chairman of the Red River Advisory Group and Vice-President of the Lockport Merchants Association

Mr. Ron Dalmyn

Mr. Clyde Rennie

Mr. Jean-Paul Boily and Mr. Robin Wiens of the Saint Boniface Residents Association and the Saint Boniface Riverbank Preservation Committee

Dr. Allan Lansdown, Dr. Diane Malley and Dr. Derek Muir presented on behalf of the Manitoba Environment Council

Ms. Deborah Smith on behalf of CHOICES - A Coalition for Social Justice

Mr. William Kocay and Mr. Doug Symington, representing the Manitoba Recreational Canoeing Association

Dr. Alan Ronald

Mr. Dennis Breed

Mr. Gerard Lecuyer of the Enviraaction Group

Mr. Lyle Ross of the National Farmer's Union

Dr. Gerry McKenny representing Manitobans Against the Assiniboine Diversion

Mr. Michael Tokarz

Mr. Ronald Basarab of the Winnipeg Rowing Club and the Manitoba Rowing Association

Mr. David Blicq, a member of the Save Our Seine River Committee

Dr. Jim Ross, President of the Manitoba Medical Association

Mr. Jim Duncan

Mr. Arthur Turner

Mr. Ron Ellis of the Manitoba Paddling Association Inc.

Ms. Kathy Palsson

Selkirk and District Planning Area Board

Village of Dunnotta

Rural Municipality of Victoria Beach

Rural Municipality of St. Andrews

Selkirk Army, Navy & Air Force Veterans in Canada

Selkirk Kinsmen and Kinette Clubs

Maritime Museum of Manitoba

Dr. William Paton, Associate Professor, Department of Botany/Biology, Brandon University

Dr. Gordon Goldsborough of Brandon University

Mr. Rick Hnatiuk of the Selkirk and Area Weed Control District

Miss Jessica Schafer representing Ms Marianne Cerilli

Paula Harding, Regional Manager, Federal Facilities Accommodation, Public Works Canada

APPENDIX B: LIST OF EXHIBITS

1. Letter, dated July 10, 1991 from **Hon. J. Glen Cummings**, Minister of Environment, Province of Manitoba, to Stan Eagleton, Chairman, Manitoba Clean Environment Commission, with attachment (Terms of Reference: CEC Hearings to Recommend Water Quality Objectives for the Red River, Assiniboine River and Their Tributaries, Within and Downstream of the City of Winnipeg).
2. Letter, dated October 7, 1991 from **Hon. J. Glen Cummings**, Minister of Environment, Province of Manitoba, to Mayor William Norrie, Q.C., Mayor, City of Winnipeg.
3. Letter, dated November 20, 1991 from **Hon. J. Glen Cummings**, Minister of Environment, Province of Manitoba, to Mayor William Norrie, Q.C., Mayor, City of Winnipeg.
4. CEC Presentation - Rivers: Introductory and Closing Remarks, November 25, 1991. Submitted by Manitoba Environment.
5. Clean Environment Commission Presentation. Submitted by Manitoba Environment.
6. Overhead Transparencies, presented November 25, 1991 by Dennis Brown, Manitoba Environment. Submitted by Manitoba Environment.
7. Red and Assiniboine Rivers and Their Tributaries Within and Downstream of the City of Winnipeg: Technical Document. Sharon Gurney, Water Quality Management Section, Environmental Management Division, Manitoba Environment. Submitted by Manitoba Environment.
8. Slides, presented November 25, 1991 by Sharon Gurney, Manitoba Environment. Submitted by Manitoba Environment.
9. Red River Fisheries. Joe O'Connor, Manitoba Natural Resources. Submitted by Manitoba Environment.
10. Slides, presented November 25, 1991 by Joe O'Connor, Manitoba Natural Resources. Submitted by Manitoba Environment.
11. Red and Assiniboine Basin - Public Hearing: Water Quality Management Plan. Submitted by Manitoba Environment.
12. Overhead Transparencies, presented November 25, 1991 by Doug Peterson, Manitoba Environment. Submitted by Manitoba Environment.
13. Curriculum Vitae, for Michael A. Shkolny, P. Eng., Arnold H. Permut, M.Sc., P. Eng., George Rempel, P. Eng., McKernan, J. Michael, Ruth Marr, Gladding, Robert J. and Barry D. MacBride, M.Sc., M.B.A., P. Eng. Submitted by the City of Winnipeg.

14. The Red and Assiniboine Rivers Surface Water Quality Objectives: Summary Report. Report to: City of Winnipeg Waterworks, Waste and Disposal Department. Wardrop/TetrES, August, 1991. Submitted by the City of Winnipeg.
15. The Red and Assiniboine Rivers Surface Water Quality Objectives: Technical Report. Report to: City of Winnipeg Waterworks, Waste and Disposal Department. Wardrop/TetrES, September, 1991. Submitted by the City of Winnipeg.
16. The Red and Assiniboine Rivers Surface Water Quality Objectives: Appendices. Report to: City of Winnipeg Waterworks, Waste and Disposal Department. Wardrop/TetrES, September, 1991. Submitted by the City of Winnipeg.
17. The Red and Assiniboine Rivers Surface Water Quality Objectives: Biophysical Survey. Report to: City of Winnipeg Waterworks, Waste and Disposal Department. Wardrop/TetrES, November, 1991. Submitted by the City of Winnipeg.
18. Water Quality and Uses for Winnipeg's Rivers: A Review of Options and Priorities For the Future, October, 1991. Submitted by the City of Winnipeg.
19. City of Winnipeg Presentation Outline, November 26 and 27, 1991. (Including *Introductory Statements* from William Norrie Q.C., Mayor, City of Winnipeg and R.J. McRae, Commissioner, City of Winnipeg.) Submitted by the City of Winnipeg [(a) & (b)].
20. Letter, dated August 19, 1991 from M.A. Shkolny, P. Eng., Water Pollution Control Planning Engineer, Waterworks, Waste, and Disposal Department, City of Winnipeg to C. Conyette, P. Eng., Manitoba Environment.
21. Brief, untitled, submitted by Robert H. Hudson.
22. Curriculum Vitae, for Linda A. Poffenroth and Richard Stephen Stanwick. Submitted by the City of Winnipeg.
23. Technical Presentation Schedule and Panel, Wednesday, November 27, 1991. Submitted by the City of Winnipeg.
24. Comments Re: Provincial Proposal on Steering Committee. Submitted by the City of Winnipeg.
25. Ambient Water Quality Criteria for Ammonia - 1984. United States Environmental Protection Agency. Submitted by the City of Winnipeg.
26. Brief, "Clean Environment Commission Hearings, November, 1991", submitted by Ian L. Reid, CM; MD; FRCS.
27. Brief, "Presentation to the Clean Environment Commission Re: Water Quality of the Red and Assiniboine Rivers and Tributaries", submitted by Dave Taylor, Concerned Citizens of Manitoba.
28. Brief, untitled, submitted by Save Our Seine (Lorette Chapter).

29. Brief, "Brief to the Clean Environment Commission on the Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers", submitted by Dr. Eva Pip, University of Winnipeg.
30. Brief, "Save our Seine Residents Committee Brief Submission to the Manitoba Clean Environment Commission, November, 1991", submitted by the Save our Seine Coordinating Committee.
31. Brief, "Brief to Manitoba Clean Environment Commission Regarding Red and Assiniboine Water Quality Within and Downstream of Winnipeg", submitted by Ducks Unlimited Canada.
32. Brief, "Clean Environment Commission Water Quality Objectives Hearings Red and Assiniboine Rivers, November, 1991", submitted by the Manitoba Hazardous Waste Management Corporation.
33. Attitudes and Perceptions Toward The Construction of a Hazardous Waste Facility in Winnipeg. Results Group. July 10, 1990. Submitted by the Manitoba Hazardous Waste Management Corporation.
34. Letter, dated November 26, 1991 from Max H. Dodson, U.S. Co-Chairman, Red River Pollution Board, International Joint Commission, to Manitoba Clean Environment Commission, with attachment (Thirtieth Progress Report to the International Joint Commission - Red River. International Red River Pollution Board, October, 1990).
35. Brief, "Manitoba Clean Environment Commission Hearings November 28, 1991 Red and Assiniboine Rivers Surface Water Quality Objectives", submitted by Environment Canada, with attachments (Federal Water Policy, Environment Canada; and, Souris River Basin International Water Quality Objectives for the Saskatchewan/North Dakota and North Dakota/Manitoba Boundary Crossings, Souris River Bilateral Water Quality Monitoring Group).
36. Brief, "Manitoba Clean Environment Commission Public Hearings Regarding Manitoba Environment's Proposed Water Quality Objectives for the Red and Assiniboine Rivers and their Tributaries Within and Downstream of the City of Winnipeg (November 28, 1991)", submitted by the International Coalition.
37. Brief, "Presentation to: Clean Environment Commission, Re: Application of Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers and Tributaries (File # 3012.00)", submitted by Manitoba Health.
38. CEC Presentation - Rivers Introductory and Closing Remarks Selkirk, Manitoba December 2, 1991. Submitted by Manitoba Environment.
39. (a) Rationale Document Supporting Revisions to Manitoba Surface Water Quality Objectives. D.A. Williamson, Manitoba Department of Environment and Workplace Safety and Health, July 15, 1988. (b) Manitoba Surface Water Quality Objectives. D.A. Williamson, Manitoba Department of Environment and Workplace Safety and Health, July 15, 1988. (c) The Development and Use of Water Quality Objectives in Manitoba. D.A. Williamson, Manitoba Environment. (d) Report on a Proposal for the Classification of Manitoba's Surface Water: Red River Principal Watershed Division. The Clean Environment Commission, November, 1981. Submitted by Manitoba Environment.

40. Graph/Chart, "Control/Jurisdiction", submitted by **Manitoba Environment**.
41. Red River Toxic Profile Study. United States Environmental Protection Agency, Environment Canada, North Dakota Dept. of Health, Minnesota Pollution Control Agency and Manitoba Department of Environment and Workplace Safety and Health. Submitted by **Manitoba Environment**.
42. "Pollution Control: Bathing water quality - its status in EC countries" World Water, July /August, 1989. Submitted by **Manitoba Environment**.
43. Brief, "The Town of Selkirk Presentation to the Clean Environment Commission December 3, 1991". Submitted by Bud Oliver, Mayor, **Town of Selkirk**, with attachments.
44. Brief, "Presentation to the Clean Environment Commission on the Proposed Classification of the Red & Assiniboine Rivers and their Tributaries - Manitoba Hydro, December 1991", submitted by **Manitoba Hydro**.
45. Letter, undated, from **Dennis C. Windsor** to D. Stewart, Chairman, Manitoba Clean Environment Commission, with attachment (Proceedings of the Great Plains Aquatic Research Workshop - Technologies and Strategies Used to Develop or Access Water Supplies in the Great Plains, November 4, 1991. Dennis C Windsor, Manager of Environmental Protection and Codes, Manitoba Hydro).
46. Brief, "Presentation to the Clean Environment Commission Public Hearing held December 3, 1991, Selkirk, Manitoba", submitted by the **Selkirk and District Chamber of Commerce**.
47. Brief, "Rotary Club of Selkirk Presentation to the Clean Environment Commission Public Hearing Held December 3, 1991, Selkirk, Manitoba", submitted by the Rotary Club of Selkirk.
48. Resolution, dated November 25, 1991 from the **Rural Municipality of St. Clements**.
49. Letter, dated December 3, 1991 from R. S. "Bud" Oliver, Mayor, Town of Selkirk, to Dale Stewart, Chairman, Manitoba Clean Environment Commission.
50. Letter, dated November 27, 1991 from **Francis J. Schwindt**, Chief, Environmental Health Section, North Dakota State Department of Health and Consolidated Laboratories, to the Manitoba Clean Environment Commission.
51. Letter, dated December 2, 1991 from **Kathy Svanda**, Manager, Non-point Source Section, Water Quality Division, Minnesota Pollution Control Agency, to the Manitoba Clean Environment Commission.
52. (a) A Review of Wastewater Treatment Systems, Processes and Water Quality Management Plans: Their Potential Application to the Red and Assiniboine Rivers: Executive Summary. Charles S. Conyette, P.Eng., Environmental Management Division, Manitoba Environment, October, 1991.(b) A Review of Wastewater Treatment Systems, Processes and Water Quality Management Plans: Their Potential Application to the Red and Assiniboine Rivers: Technical Report. Charles S. Conyette, P.Eng., Environmental Management Division, Manitoba Environment, October, 1991 Submitted by **Manitoba Environment**.

53. **Brief**, "Submission of the Triple S Community Development Corporation to the Clean Environment Commission, November, 1991", submitted by Triple S Community Development Corporation.
54. **Red & Assiniboine Rivers Surface Water Quality Objectives Presentation to the Clean Environment Commission - Selkirk, December 3, 1991.** Submitted by the City of Winnipeg
55. Resolution, dated November 28, 1991, from the Selkirk & District General Hospital.
56. **Brief**, "Brief to the Clean Environment Commission Public Hearings on Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers Within and Downstream of the City of Winnipeg", submitted by Dr. Kenneth W. Stewart and Fish Futures Inc..
57. **Brief**, "Brief to Clean Environment Commission, December 2, 1991", submitted by Harvey Benson, Councillor, Town of Gimli, with attachments.
58. **Letter**, dated November 29, 1991, from D. Hall, Asst. Secretary - Treasurer, the Town of Gimli, to Bud Oliver, Mayor, Town of Selkirk.
59. **Brief**, untitled, submitted by Red River Advisory Group, with attachment (Manitoba Fishing & Hunting Adventures, 1991. Travel Manitoba).
60. **Brief**, untitled, submitted by Rick Epp, Realtor, HomeLife Properties Inc.
61. **Letter**, dated December 2, 1991, from Eva Pip, Professor, Department of Biology, University of Winnipeg, to the Manitoba Clean Environment Commission.
62. **Separating Combined Sewers to Improve and Protect Mississippi River Quality: A Ten Year Commitment - Annual Progress Report.** Cities of Minneapolis, Saint Paul, South Saint Paul and the Metropolitan Waste Control Commission, March 1991. Submitted by Bryan Osborne, Canadian Coordinator, International Coalition for Land and Water Stewardship in the Red River Basin.
63. **Letter**, dated December 12, 1991 from Hon. J. Glen Cummings, Minister of Environment, Province of Manitoba, to Dale Stewart, Chairman, Manitoba Clean Environment Commission, with attachments.
64. **Letter**, dated December 16, 1991 from Francis J. Schwindt, Chief, Environmental Health Section, North Dakota State Department of Health and Consolidated Laboratories, to Manitoba Clean Environment Commission, with attachment (Standards of Water Quality for State of North Dakota).
65. **Letter**, dated December 20, 1991 from Ron Dalmyrn to Manitoba Clean Environment Commission, with attachment (**Brief**, untitled, submitted by Ron Dalmyrn).
66. **Letter**, dated December 31, 1991 from Greg Michie, Managing Director, Triple S Business Development Corporation, to Chairman, Manitoba Clean Environment Commission, with attachment.

67. Review of Ammonia Criteria for Surface Waters. Environmental Applications Group Ltd. June, 1987. Submitted by **Manitoba Environment**.
68. Ammonia Toxicity and Red River Fish: Report to City of Winnipeg Waterworks, Waste and Disposal Department. MacLaren Plansearch Inc. Lavalin. June, 1987. Submitted by **Manitoba Environment**.
69. Overhead Transparencies, various, presented January 13, 1992 by Dwight Williamson, Manitoba Environment. Submitted by **Manitoba Environment**.
70. Overhead Transparencies, various, presented January 13, 1992 by Mike McKernan, Wardrop/TetrES. Submitted by the **City of Winnipeg**.
71. Presentation Notes, Wardrop TetrES, January 13, 1992. Submitted by the **City of Winnipeg**.
72. Letter, dated December 13, 1991 from D. C. Windsor, Manger, Environmental Protection and Codes Department, Manitoba Hydro, to Dale Stewart, Chairman, Manitoba Clean Environment Commission.
73. Brief, "The Saint-Boniface Riverbank Preservation Committee Presentation to Manitoba Clean Environment Commission Re: Water Quality Objectives for Winnipeg's Rivers, November 28, 1991". Submitted by the **Saint-Boniface Residents Association**.
74. (a) Disinfection Evaluation: City of Winnipeg Wastewater Treatment Plant Effluents - Report to City of Winnipeg, Province of Manitoba: Technical Report. October, 1986. MacLaren Engineers, Lavalin. (b) Disinfection Evaluation: City of Winnipeg Wastewater Treatment Plant Effluents - Report to City of Winnipeg, Province of Manitoba: Appendices. October, 1986. MacLaren Engineers, Lavalin. (c) Disinfection Evaluation: City of Winnipeg Wastewater Treatment Plant Effluents - Report to City of Winnipeg, Province of Manitoba: Executive Summary. October, 1986. MacLaren Engineers, Lavalin. Submitted by the **City of Winnipeg**.
75. Letter, dated March 11, 1991 from Margaret Fast, M.D. FRCPC, Director, CDC & Pete Sarsfield, M.D. FRCPC, Director, **Environmental Health**, to Sharon Gurney, Environment Officer, Manitoba Environment, with attachment. (Submitted by Manitoba Environment)
76. Brief, "Brief to the Clean Environment Commission from the Manitoba Environmental Council on the Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers and Tributaries, Public Hearings, 25-28 November and 2 December 1991, Winnipeg and Selkirk", submitted by the **Manitoba Environmental Council**.
77. Overhead Transparency, "PCBs and organochlorine pesticides in a single Red River Sediment sample from Lockport - below the dam and comparison with N.W. Ontario remote lake sediments", presented January 13, 1992 by Derek Muir, Manitoba Environmental Council. Submitted by the **Manitoba Environmental Council**.
78. Brief, untitled, submitted by **CHOICES**, A Coalition for social justice.
79. Brief, "Report for the Winnipeg Water Quality Hearings", submitted by the **Manitoba Recreational Canoeing Association**.

80. Brief, "Application of water quality objectives for the watershed classification of the Red and Assiniboine Rivers and their tributaries", submitted by Gerard Lecuyer for ENVIRACTON.
81. Brief, "Presentation to the Manitoba Clean Environment Commission Water Quality Objectives Hearings, November, 1991", submitted by Manitobans Against the Assiniboine Diversion.
82. Overhead Transparencies, "Ammonia: Monthly Mass Loads (Tonne)", presented January 14 1992 by Mike McKernan, Wardrop/TetrES. Submitted by the City of Winnipeg.
83. Overhead Transparencies, "Components of the nitrogen cycle at the North Perimeter, Lockport and Selkirk", presented January 14, 1992 by Dwight Williamson, Manitoba Environment. Submitted by Manitoba Environment.
84. Brief, "Classification of the Red and Assiniboine Rivers", submitted by Michael B. Tokarz, with attachments.
85. Brief, "Winnipeg Rowing Club/Manitoba Rowing Association Position Paper to the Manitoba Clean Environment Commission, submitted by the Manitoba Rowing Association.
86. Overhead Transparencies, various, presented January 14, 1992 by George Rempel, Wardrop/TetrES. Submitted by the City of Winnipeg.
87. Overhead Transparencies, "City of Winnipeg Pollution Control Initiatives", presented January 14, 1992 by Mike Shkolny, City of Winnipeg. Submitted by the City of Winnipeg.
88. Order in Council, # 152, dated February 2, 1972. Submitted by Manitoba Environment.
89. Letter, dated November 12, 1991, from David M. Blicq to the Manitoba Clean Environment Commission.
90. Letter, dated November 15, 1991, from Jim Ross, President, Manitoba Medical Association to Rory A. Grewar, Secretary, Manitoba Clean Environment Commission, with attachment (Submission to the Clean Environment Commission Re: Water Quality of Red and Assiniboine Rivers).
91. Letter, dated October 25, 1991, from Jim Duncan to Manitoba Clean Environment Commission.
92. Letter, dated November 26, 1991, from Arthur Reid Turner to Rory A. Grewar, Secretary, Manitoba Clean Environment Commission.
93. Letter, dated November 27, 1991, from Ron Ellis, President, Manitoba Paddling Association Inc. to Rory A. Grewar, Secretary Manitoba Clean Environment Commission.
94. Letter, dated December 20, 1991, from Kathy Paulson to Manitoba Clean Environment Commission.
95. Resolution, dated December 3, 1991 from the Selkirk and District Planning Area Board.

96. Resolution, dated November 20, 1991 from the **Village of Dunnottar**.
97. Resolution, dated November 19, 1991 from the **Rural Municipality of Victoria Beach**.
98. Resolution, dated November 26, 1991 from the **Rural Municipality of St. Andrews**.
99. Letter, dated November 25, 1991, from **Rick Hnatiuk**, Weed Supervisor, **Selkirk and Area Weed Control District**, to Gloria Vinnie, Secretary Treasurer, Town of Selkirk. (Submitted by the Town of Selkirk.)
100. Letter, dated November 25, 1991, from **Mary Myall**, Secretary Unit 151, **Army, Navy and Air Force Veterans in Canada**, to His Worship The Mayor, Town of Selkirk. (Submitted by the Town of Selkirk.)
101. Letter, dated December 2, 1991, from **Sandy Huff**, Secretary, **Kinette Club of Selkirk**, to R. S. "Bud" Oliver, Mayor, Town of Selkirk. (Submitted by the Town of Selkirk.)
102. Letter, dated November 21, 1991, from **Ted Francis**, Chairman, **Marine Museum of Manitoba**, to the Manitoba Clean Environment Commission.
103. Brief, "Submission to the Clean Environment Commission on Water Quality Objectives", submitted by **Dr. William H. N. Paton**, Associate Professor, Department of Botany/Biology, Faculty of Science, **Brandon University**.
104. Letter, dated January 10, 1992 from **Dr. L.G. Goldsborough**, Assistant Professor, Department of Botany, **Brandon University**, to **Rory A. Grewar**, Secretary, **Manitoba Clean Environment Commission**, with attachment (Review: "Water quality monitoring and modelling of the Red and Assiniboine Rivers". Appendix A of a Report to the City of Winnipeg, Waterworks, Waste and Disposal Department by **Wardrop/TetrES** consultants. September, 1991.)
105. Letter, dated January 13, 1992, from **R. S. "Bud" Oliver**, Mayor, Town of Selkirk, to **Rory A. Grewar**, Secretary, **Manitoba Clean Environment Commission**.
106. Brief, "Brief to the Clean Environment Commission Public Hearings on Water Quality Objectives for the Watershed Classification of the Red and Assiniboine Rivers Within and Downstream of The City of Winnipeg", submitted by **The Mid-Canada Chapter, American Fisheries Society and The Fishery Resources of the Red - Assiniboine River System**, with attachment (AFS Overview Policy on Man-Induced Ecological Problems: Human Population Growth and Technology. **W. R. Carter III**).
107. Letter, dated January 17, 1992 from **Larry Strachan**, Director, **Environmental Approvals, Manitoba Environment**, to **Dale Stewart**, Chairman, **Manitoba Clean Environment Commission**, with attachment (letter, dated December 27, 1991 from **Paula V. Harding**, A/Regional Manager, **Federal Facilities Accommodations, Public Works Canada**, to **Larry Strachan**, Director, **Environmental Approvals, Manitoba Environment**).
108. Letter, dated January 24, 1992 from **G. Rempel**, **TetrES Consultants Inc.**, to **Dale Stewart**, Chairman, **Manitoba Clean Environment Commission**.

109. Overhead Transparency. "Aquatic Life Protection Present Approaches", presented January 24, 1992 by Dwight Williamson, Manitoba Environment. Submitted by the Manitoba Environment.
110. Survey of Winnipeg Resident Perceptions of River Water Quality. Prairie Research Associates Inc. November 15, 1990. Submitted by the City of Winnipeg.
111. Excerpt, pages 58-59, from Benefit Cost Analysis Guide. Treasury Board Secretariat, Government of Canada. March, 1976. Submitted by the Town of Selkirk.
112. Town of Selkirk Concluding Comments. Submitted by the Town of Selkirk.
113. The Red and Assiniboine Rivers Surface Water Quality Objectives - Closing Statement. City of Winnipeg Waterworks, Waste and Disposal Department. Submitted by the City of Winnipeg.
114. Concluding Statement - Surface Water Quality Objectives for Red and Assiniboine Rivers and Tributary Streams. Larry Strachan, Director, Environmental Approvals, Manitoba Environment. January 24, 1992. Submitted by Manitoba Environment.

APPENDIX C: SUMMARY OF MANITOBA SURFACE WATER QUALITY OBJECTIVES

The surface waters of Manitoba are used for numerous purposes including domestic consumption, industrial uses and agricultural purposes such as irrigation and livestock watering. In addition, many surface waters are used for recreational pursuits such as swimming, water skiing, boating and the enjoyment of pleasant scenery. Most waters are also inhabited by fish life, amphibians (frogs), reptiles (turtles), aquatic insects and algae. Large forms of wildlife, small furbearing mammals, waterfowl and some birds of prey rely upon surface waters for drinking purposes, habitat and sources of food supplies.

The quality of surface water has the potential to become degraded through many other legitimate but sometimes conflicting uses such as the disposal of industrial and municipal effluents, development of hydroelectrical generating sites and land-use practices such as agriculture and forestry.

In order to achieve harmony between the various uses, surface water quality objectives were developed which define minimum levels of quality for each of the uses that requires protection. The objectives, when not exceeded, will protect an organism, a community of organisms, a prescribed water use, or a designated multiple purpose water use with an adequate degree of safety. Specific objectives have been developed for over eighty substances.

These objectives affect all Manitobans, since if they do not offer adequate protection, surface water quality may become degraded. Conversely, if they are too restrictive, an unnecessary burden may be imposed on taxpayers and industry in order to pay for additional waste treatment facilities.

Surface water quality objectives are primarily used by government agencies, such as the Department of Environment and Workplace Safety and Health, in order to assist in developing effluent discharge restrictions for industrial and municipal waste discharges. Similarly, developers can use these objectives in planning processes. With information on downstream water uses, existing water quality characteristics and stream discharge volumes, predictions can be made regarding the treatment costs likely to be associated with any specific location. Although this is the principal role of surface water quality objectives within Manitoba, they may also be used for other purposes. For example, the objectives may be used to assist in developing strategies to control land-use practices that may have effects on water quality, such as cottage development. The objectives may be used in combination with environmental monitoring programs to assist in assessing the quality of our surface water resources. The objectives may also be used to assist in determining if certain waters are suitable for uses such as irrigation.

In cases where the objectives are exceeded, the Department of Environment and Workplace Safety and Health may conduct the necessary studies in order to determine the cause of the pollution. Should the cause be waste effluents, direct regulatory enforcement action could not be taken. Rather, existing discharge licences may be revised to provide the necessary degree of protection.

These objectives are intended to apply to conditions in water that are caused by man's activities. Waters may have natural characteristics outside certain objectives. In such cases, the objectives for those characteristics do not apply. However, if a certain parameter exceeds its objective due to natural conditions, it would be unwise to further increase that parameter by man-made activities, unless such additions would not jeopardize any beneficial use as shown through site-specific investigations.

It is important to realize that scientific information is limited on all the possible effects of a pollutant in the environment. New information, however, is continually being reported. Thus, the objectives must be revised periodically in order to include the most recent scientific knowledge. Based upon the available information, these objectives are designed to afford adequate protection without being unreasonably restrictive yet providing an adequate degree of protection. However, while these objectives are appropriate for most applications within Manitoba, objective modifications may be required at some unique sites. Modifications of objectives could be required for example, to account for the lower or greater sensitivity of resident aquatic species.

Objectives have not been developed for all possible substances that could affect water quality. Manitoba's surface waters could potentially be contaminated with virtually hundreds of substances. These include, for example, agricultural chemicals, or hazardous goods that may be transported through Manitoba. However, given reasonable information that such substances are present, objectives will be developed using the best available scientific information.

Because specific numerical objectives cannot reasonably be developed for every possible chemical, physical or biological parameter, general statements concerning environmental quality are also used to protect water quality. These requirements, although written in general terms, are nevertheless water quality objectives. For example, these may be used to establish effluent limits even though there may be no specific numerical objectives applicable in the receiving water. General statements have been developed for colour, odour, taste, turbidity, deposits, floating materials, flow, litter, nutrients, oil and grease and toxic substances.

Ideally, objectives should be maintained at all times. It is however, generally accepted that to require objective maintenance at all times is unreasonable. Thus, a specific low flow level has been chosen below which the objectives do not have to be met in most streams. This

flow, for large streams and rivers, is the average minimum flow which, on a statistical basis, would occur for a seven consecutive day period once every ten years. For small intermittent streams this minimum flow is 0.003 m³/s. However, the flows in many streams in southern Manitoba are regulated by control structures. The minimum flows for these streams are often determined based upon the operating policy of the Water Resources Branch, Department of Natural Resources. The objectives should be maintained at all times in lakes.

Mixing zones are areas adjacent to a discharge, where the stream or lake may not meet all the water quality objectives. This is allowed for practical reasons, since for most pollutants, it would be unreasonable to expect the objectives to be met at the end of the discharge pipe. Mixing zones are therefore recognized as areas subject to a loss of value. Nevertheless, certain guidelines should be followed to ensure that the loss is kept as small as possible. These include, for example, ensuring that the entire width of rivers are not completely influenced by a discharge in such a manner that fish movement is prohibited or that bathing areas are not included in mixing zones.

Certain pristine waters support important major uses, such as recreation on surface waters within Provincial Parks. These waters may be given a "High Quality" designation. It is the intent that discharges or other activities that may affect the water quality of these areas should be very strictly controlled. Thus, development within "High Quality" surface water areas will likely be more costly than in other areas of the Province, since all available measures should be used to control environmental disturbances.

Some pristine waters of the Province may be preserved in their natural state for the future. These waters may be given an "Exceptional Value" designation. Development of any type that may affect water quality should be discouraged from these areas.

Objectives have been developed for each of the general surface water uses within Manitoba that requires protection. These are designated as classes and include domestic consumption, aquatic life and wildlife, industrial consumption, agricultural consumption, recreation and other uses. Where possible, these general classes are further divided into categories to provide protection, for example, to the different types of recreation.

CLASS 1: DOMESTIC CONSUMPTION defines objectives that will ensure the protection of waters that are used for human consumption after treatment. All surface waters of Manitoba are susceptible to uncontrolled microbiological contamination, for example, by wildlife. Consequently, minimum treatment consisting of disinfection is required for all surface waters prior to consumption. Objectives are included for substances that may have

harmful health effects, such as pesticides, toxic metals and radioactive materials and for substances that may present a nuisance to the consumer, such as excessive hardness and iron.

CLASS 2: AQUATIC LIFE AND WILDLIFE will ensure the protection of waters that are inhabited by aquatic life such as fish, amphibians (frogs), reptiles (turtles) and other forms of life including aquatic insects and algae. By ensuring protection of the aquatic communities, protection is indirectly offered to those forms of wildlife that rely upon surface waters for habitat and for food supplies. These include ducks, geese, furbearing mammals such as the muskrat and birds of prey such as the eagle and osprey. Protection is also provided to those animals that use these waters for drinking purposes.

Objectives are included for numerous parameters including dissolved oxygen, toxic metals and pesticides. The presence of dissolved oxygen in water is essential for aquatic life, and the type of aquatic community is dependent to a large extent on the amount of dissolved oxygen present. Toxic metals, such as zinc and cadmium, in small concentrations, can have harmful effects on growth and reproduction, and in large concentrations, can be lethal. Others, such as mercury and PCB's, even though present in small quantities, can slowly bio-accumulate in the tissue of organisms, until higher harmful levels are reached such that the fisheries resource becomes unsuitable for human consumption.

Some metals, such as cadmium, are more or less toxic depending upon the hardness of the water. For this reason, a mathematical equation is used to establish an objective based upon the relationship between toxicity and hardness.

The existence and composition of an aquatic community also depends upon temperature characteristics. An excessive increase in temperature can be harmful by interfering with fish spawning cycles, causing changes in growth and respiration, and causing more heat tolerant species to replace heat sensitive ones. Heat related winter fish kills can occur when a heated discharge is suddenly stopped. Fish that have been attracted to a heated area are suddenly exposed to the cold ambient temperature.

Developing site-specific temperature objectives is complex and time consuming. Therefore, a method is included by which temperature objectives will be developed for specific discharges.

CLASS 2: AQUATIC LIFE AND WILDLIFE is subdivided into two categories in order to provide specific protection to different general groups of aquatic life in Manitoba.

CATEGORY A: COLD WATER AQUATIC LIFE, COOL WATER AQUATIC LIFE AND WILDLIFE defines objectives that will provide protection to all types of aquatic life inhabiting the surface waters of Manitoba, including the protection of wildlife.

CATEGORY B: COOL WATER AQUATIC LIFE AND WILDLIFE defines objectives that will provide protection to cool water aquatic life such as walleye, sauger and pike, including the protection of wildlife. This category, however, will not provide adequate protection to cold water aquatic organisms such as trout and whitefish.

CLASS 3: INDUSTRIAL CONSUMPTION defines objectives that will ensure the protection of waters that are used for industrial purposes. However, objectives will not be developed at present due to the large number of present and potential industrial users, each with different quality requirements for water.

CLASS 4: AGRICULTURAL CONSUMPTION defines objectives that will provide protection to waters used by the market garden and farming industries for irrigation and livestock watering purposes. Objectives are included for parameters, such as sodium, that will protect variously textured soils. Other objectives, such as boron, will protect sensitive plants. In addition, others, for example, fecal coliform bacteria, are included that are intended to protect humans following consumption of raw vegetables irrigated with waters of this class.

This class is subdivided into four categories in order to provide protection to three different general irrigation practices plus to provide protection for livestock watering.

CATEGORY A: GREENHOUSE IRRIGATION defines objectives that will provide protection to waters that are used by the greenhouse industry where such water is the only source of moisture for the greenhouse plants.

CATEGORY B: FIELD CROP IRRIGATION defines objectives that will provide protection to waters that are used to irrigate field crops, where such water is used to supplement natural rainfall.

CATEGORY C: FIELD CROP IRRIGATION defines objectives that will provide protection to waters that are used to irrigate field crops, where such water is used to supplement natural rainfall. These waters, however, may damage certain soil types if used for long periods of time.

CATEGORY D: LIVESTOCK defines objectives that will provide protection to waters that are used by livestock for drinking purposes.

CLASS 5: RECREATION defines objectives that will ensure that surface waters may be safely used for swimming and boating purposes and also may provide for the enjoyment of pleasant scenery. These waters provide outdoor recreational opportunities for both Manitoba residents and for tourists.

This class is further subdivided into two categories in order to provide protection to the different types of water related recreation depending upon the extent of contact with the water.

CATEGORY A: PRIMARY RECREATION defines objectives that will ensure the protection of waters that may be used for purposes such as swimming and water skiing, where contact with the water is an important aspect of the activity.

CATEGORY B: SECONDARY RECREATION defines objectives that will ensure the protection of waters that may be used for purposes such as fishing and boating, where contact with the water is only incidental to the activity.

CLASS 6: OTHER USES: Manitoba's surface waters may be used for other purposes that do not require protection through the establishment of objectives. These include, for example, the disposal of wastes or the generation of hydroelectrical power. Because of social or economic reasons, certain waters may be used only for these uses.